MULTIPLE METHODS OF QUANTIFYING RIVERBED SEEPAGE RATES TO SUPPORT MANAGED RECHARGE NEAR SOMAVIA ROAD, LOWER SALINAS VALLEY, MONTEREY COUNTY, CALIFORNIA

Report prepared for:
Salinas Valley Basin Groundwater Sustainability Agency

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Multiple Methods of Quantifying Riverbed Seepage Rates to Support Managed Recharge Near Somavia Road, Lower Salinas Valley, Monterey County, California

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EXECUTIVE SUMMARY

The Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) directed a field study to access riverbed seepage within the Somavia Reach of the Salinas River, a 6-mile meandering reach from Chualar Bridge to Jensen's Bluff, overlying an inland portion of the Salinas Valley Aquitard (SVA). The river forms broad meanders in the Somavia Reach and the SVA is potentially thin and discontinuous. The reach is situated within a downstream transition of decreasing river seepage rates identified by Monterey County Water Resources Agency's Salinas River Discharge Measurement Series measurements.

To assist the SVBGSA, Balance Hydrologics (Balance) performed an analysis of historical streamflow records and reservoir release data to evaluate seasonal and year-to-year streamflow reach losses, providing context for our 2024-2025 field measurements. A variety of field methods were then implemented to evaluate river seepage rates within the Somavia Reach: a) high-precision synoptic-flow surveys to detail flow losses through the reach; b) streamflow gaging to assess seasonal sub-reach losses; c) shallow piezometer clusters to assess seasonal changes to vertical head gradients; d) riverbed temperature profiler time-series data to calibrate the USGS 1DTempPro model to estimate infiltration; and d) ring-infiltrometer measurements to estimate infiltration and hydraulic conductivity of riverbed, overbank and alternate channel alluvium.

Results of the historical records analysis and field program confirm that the highest riverbed seepage rates of the Chualar reach are within the sub-reach from Chualar bridge through the first meander bend (to the Downstream Bend 1 gage), and notably higher riverbed seepage rates than upstream reaches from Soledad to Chualar. Riverbed seepage rates fluctuated throughout the year mainly related to flow (i.e., riverbed wetted area). Downstream from the Chualar bridge to Downstream Bend 1 sub-reach, river loss rates were measurably lower and more variable throughout the year, presumably due to near-surface clay patches and seasonal constrains from hyporheic flow and saturation of the river alluvium.

Three distinct types (or 'facies') of alluvial deposits were found at a distance from the main channel and within the overbank and alternate channels: a) fine to coarse loose alluvial sand with (5 to 10%) rounded gravel primarily in the main channel area with fine to medium sand at distance from the main channel flow; b) stiff silt-clay in overbank areas and commonly overlying alluvial sand, and c) soft silt-clay in alternate channels that exhibited 6- to 8-inch-deep desiccation cracks. Furthermore, while the stream

gages were dry, standing water was regularly observed on clayey silt in the alternate channel of Bend 1.

The Groundwater Sustainability Plans (GSPs) propose project concepts to increase aquifer recharge from the Salinas River, including extraction wells to induce surface water recharge or multi-benefit stream channel improvements including flood plain restoration and recharge basins. The Chualar bridge to Downstream Bend 1 sub-reach would be a preferred area within the Somavia Reach but not without managing silt-clay deposits.

1. INTRODUCTION

1.1 Purpose

The Salinas River drains one of the major watersheds of California. The hydrology and geomorphology of the watershed are summarized in California State University Monterey Bay's (CSUMB) landmark Watershed Institute document (Watson and others, 1999). Runoff, sediment, salts, and biota move through the watershed along the mainstem, from major tributaries such as the Nacimiento, San Antonio, and the Estrella River basins, and from the Arroyo Seco subwatershed which enters the mainstem Salinas River near Soledad. Long-term stream gages on the Salinas River are near Bradley, Soledad, Chualar, and at Spreckels, all operated by the U.S. Geological Survey (USGS) Water Resources Division (**Table 1**). The USGS has also recently installed a new stream gage near King City, and the Arroyo Seco is gaged at the point it exits the mountains (USGS, near Greenfield) and near its mouth (USGS, near Soledad).

The Nacimiento and San Antonio watersheds are dammed near their confluences with the Salinas River, and operated for combined goals of water conservation, flood protection, groundwater recharge, environmental habitat, dam safety and recreation. Releases from the two reservoirs recharge downstream aquifers. Monterey County Water Resources Agency (MCWRA) owns the dams, reservoirs, and a related downstream diversion facility. To assess the recharge rates and recharge potential of the reach between Chualar and Spreckels, data were analyzed from USGS gages and from MCWRA manual streamflow measurements. Our study further characterizes the reach downstream of USGS gage at Chualar Bridge. The Chualar Bridge is where Chualar River Road crosses the Salinas River near the community of Chualar.

The Eastside Aquifer Subbasin and 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plans (GSPs) (Montgomery and Associates, 2022, 2020) propose using extraction wells to increase aquifer recharge from the Salinas River and to supply irrigation water. The locations of the extraction wells are proposed at the Somavia Road area, within the reach of river between the Chualar Bridge and Jensen's Bluff (**Figure 1**). This reach is within a longer and well-studied reach from the U.S. Geological Survey (USGS) gage at Chualar Bridge to the MCWRA Tanimura and Antle (T&A) measurement site, located 3.8 miles upstream from the USGS gage at Spreckels. In this area, the Salinas Valley Aquitard is noted to be less continuous. Based on the results of the MCWRA Salinas River Discharge Measurement Series, an annual synoptic flow survey conducted during the dry season, the estimated streamflow loss from Chualar to T&A is approximately 4.0 cubic feet per second (cfs) per river mile (**Table 2**), though varying annually and seasonally with watershed conditions and flow. As part of a Department of Water Resources SGMA Implementation Grant, the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) has directed a field study to add more context to this estimate and further refine this streamflow loss estimate within this reach.

To assist the SVBGSA with this study, Balance Hydrologics has performed the following tasks:

- An analysis of historical streamflow records and reservoir release data to evaluate seasonal and year-to-year streamflow reach losses, and to put in context our field measurements during 2024 and 2025.
- High-precision synoptic-flow surveys of the Somavia study reach during the 2024 dry season to detail flow losses within subsections of the Somavia Reach.
- Based on the results of the synoptic-flow surveys, the project team[1] selected two sites to install near-continuous monitoring instrumentation. At each site, we installed:
    - a temporary stream gage to assess seasonal changes to sub-reach losses (i.e., Chualar Bridge to temporary station #1, temporary station #1 to temporary station #2, and temporary station #2 to Spreckels),
    - a piezometer cluster comprising a shallow and deep piezometer to assess seasonal changes to vertical head gradients at each site, and
    - two riverbed temperature profilers (each having three vertically hung temperature loggers) to measure the temperature time series within the saturated riverbed sediments. We used the temperature time series data to calibrate the USGS 1DTempPro model (a coupled numerical heat-transport and groundwater flow model) to estimate infiltration.[2]

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[1] Biweekly project team meetings regularly included Emily Gardner (SVBGSA), and Abby Ostovar, Staffan Schorr, and Colin Kikuchi (Montgomery & Associates).

[2] Temperature monitoring piezometers were designed in consultation with UCSC professor Andrew Fisher who has coauthored several papers and has had experience in the region using this method. Vertical temperature profile data was analyzed using USGS software 1DTempPro that was designed for this purpose. *https://code.usgs.gov/water/espd/hgb/1dtemppro*

- We also performed ring-infiltrometer measurements to estimate infiltration and hydraulic conductivity of riverbed, overbank and alternate channel alluvium.

1.2 Description of Somavia Reach

At the upstream boundary of the Somavia Reach, the Salinas River is gaged by the USGS at Chualar (ID No.11152300), located at Chualar River Road, two miles southwest of the community of Chualar and State Highway 101 (**Figure 2**). With a drainage area of 4,042 square miles and a period of record from 1977 to present (**Table 1**), daily mean discharge at this station has ranged from no flow to 68,000 cfs, with a maximum recorded peak flow of 92,000 cfs on March 11, 1995. Flow is regulated by releases from Nacimiento Reservoir (377,900 ac-ft capacity) and San Antonio Reservoir (335,000 ac-ft capacity), and managed for dam safety, flood protection, groundwater recharge, the operation of the Salinas River Diversion Facility, water supply, fish migration, fish-habitat requirements, agriculture, and recreation. In most years, reservoir releases are ramped up in early Spring and sustained to maintain flow during the dry season. MCWRA is required to provide bypass flow to the Salinas River Lagoon any time there are releases to recharge the groundwater basin. Releases are typically ramped down in late summer or fall, depending on demand or other operational considerations, such as when releases are needed to maintain empty space in the reservoirs to accommodate winter inflows. Though large withdrawals from groundwater pumping and small surface-water diversions are upstream from the Chualar station, flow is maintained through and beyond the Somavia Reach during the dry season and dries down when reservoir releases stop. However, during extended drought years, the reach generally has little to no flow (e.g., 2022, 2014-16, 1990-91, etc.).

Downstream from Chualar, the Salinas River flows within a 6-mile broad meandering reach from Chualar bridge to Jensen's Bluff, with two large bends before turning down-valley at Jensen's Bluff. A third more elongated meander extends another 5 miles from Jensen's Bluff to MCWRA's T&A measurement site. The series of three meanders is progressively longer as the river disperses its energy. The meandering reach overlies the upstream end of the Salinas Valley Aquitard, a Pleistocene shallow clay unit deposited in a shallow sea extending from Monterey Bay inland, where it meets continentally derived shallow clays (based on Hydrogeologic Conceptual Model updates, Montgomery & Associates, 2025). Through the Somavia Reach, the aquitard is potentially thin and/or discontinuous and is likely interbedded with alluvial sands and beach deposits.[3]

The USGS also gages flow at Spreckels (ID No.11152500), located fourteen miles downstream from the USGS Chualar gage at Salinas-Monterey Highway 68 (drainage area 4,156 sq. mi.). In the reach between the Chualar gage and the Spreckels gage, the river flows in a single-thread channel at baseflow and occupies alternate channels, braids, and abandoned channels at high flows. The river bends appear particularly dynamic during flood flows. The reach is predominantly agricultural with little urban development. The farms within this segment of the Salinas Valley, including those adjoining this reach of the river, actively pump groundwater.

The reach between the Chualar Road bridge and Spreckels has historically shown resilience to episodic change, such as the massive delivery of sand and other sediment from (and along) the river. The river pattern and its cross section ('hydraulic geometry') have historically remained more stable than reaches just a little further upstream and downstream during such events. For example, when the Arroyo Seco and lower Salinas Rivers were flooded with sediment following runoff from the 1977 Marble-Cone fire[4], this reach did not significantly erode its banks or aggrade despite increases in coarse sediment load greater than 30 times the mean annual average (Hecht, 1981 from the burned watersheds). In contrast, the reaches upstream of Chualar uniformly widened and laterally eroded (Roberts and Hecht, 1985). More recent observations by MCWRA

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[3] The general change in the alluvial aquifer from river deposits to tidal or deltaic deposits in this reach has been recognized since the 1930s and 1940s, when this segment of the valley was known as the Spence Road transition' or 'Spence transition'. It was intensively studied originally as part of the sea-water control efforts which culminated in DWR Bulletin 46, which summarized regional management concepts for 40 years beginning in mid-century.

[4] Sediment transport following 1977 Marble-Cone fire was an episode that has proven to be a major test of channel stability in the Salinas River over the past 70 years since the construction of San Antonio and Nacimiento Reservoirs. The magnitude of the excess sediment pulse resulted in 9 feet of aggradation at the Green Bridge in Arroyo Seco, the type of episodic response that might be expected following major fires, seismic events, or large landslide failures, which can reasonably be expected to affect facilities placed in or near the river bed anywhere in the river between King City and the mouth.

and local growers from the water year 2023 floods indicated considerable sediment aggradation in the lower Salinas River, including areas near the Spreckels Bridge.[5]

The channel within the Somavia Reach is predominantly fine to coarse sand with patches of poorly sorted sands and gravel. Sand within the active channel is regularly mobile. The USGS stage-discharge rating curve (since 1981) shows that about 3 feet of fill or scour is possible at the Chualar gage. From water year 2023 to 2025, the rating curve has aggraded approximately 0.5 feet. The rating curve at the USGS Spreckels gage shows similar variability through its period of record (since WY1942). In overbank areas and alternate channels, substantial amounts of fine sediment often settle, resulting in a clay and/or silt deposit that develops deep cracks when it dries.

The MCWRA, the Resource Conservation District of Monterey County (RCDMC), and the River Management Unit Association have developed a Stream Maintenance Program (SMP), a coordinated approach to vegetation and sediment management to minimize risk of flooding to landowners along the Salinas River and improve riparian habitat for wildlife. In 2014, a demonstration project of the SMP was initiated on two reaches of the river near Chualar and Gonzales; then in 2016, the SMP expanded to include most of the river's length (92 miles) in Monterey County and has since been operating annually. The SMP includes Arundo control in the flood plain/overbank areas throughout the study reach and other reaches of the Salinas River. Commonly called giant reed, Arundo is a tall, stout, perennial, bamboo-like invasive grass species that forms dense stands up to 30 feet tall in riparian areas and wetlands and generally outcompetes native species. Arundo removal requires cutting and digging up the rhizomes, followed by subsequent herbicide applications.[6] During water year 2025, the overbank area throughout the study reach was scrapped.

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[5] Most hydrologic and geomorphic monitoring occurs for a period defined as a water year, which begins on October 1 and ends on September 30 of the named year. For example, water year 2025 (WY2025) began on October 1, 2024, and concluded on September 30, 2025.

[6] https://www.rcdmonterey.org/salinas-river-stream-maintenance-program

https://www.countyofmonterey.gov/government/government-links/water-resources-agency/programs/salinas-river-stream-maintenance-program-smp

1.3 Acknowledgments

Emily Gardner at SVBGSA assisted us with coordinating landowners to gain access to our gaging and measurement sites. Working with her and team members Staffan Schorr, Colin Kikuchi, and Abby Ostovar of Montgomery & Associates was a wonderful collegial experience. We appreciate the farmers who allowed us access through their property to enter the river. Prof. Andrew Fisher at the University of California Santa Cruz also kindly shared his expertise on the construction of the temperature profilers, site selection, and interpretation of the data. Amy Woodrow at MCWRA provided flow measurements upstream of the Spreckels reach, and the USGS regularly maintained their gages upstream and downstream of the reach during the study.

2. ANALYSIS OF HISTORICAL DATA

The rainfall and streamflow stations with available data to present are listed in **Table 1**. In addition to the Chualar and Spreckels gages, the USGS operates a gage at Soledad, 18.8 miles upstream from the Chualar gage, and about 1 mile upstream of Arroyo Seco confluence, at the Highway 101 bridge. Further upstream, the USGS operates the Bradley gage, 69.4 miles upstream from Chualar and 6.8 miles downstream from the San Antonio River confluence, where releases from the San Antonio reservoir enter the Salinas River with flow from upstream Nacimiento Reservoir releases. In addition, Nacimiento and San Antonio reservoir water elevations are gaged by the USGS.
Of these stations, the Chualar gage has the shortest period of record, from water year 1977 to present.

The California Irrigation Management Information System (CIMIS) Salinas South II station, located about two miles northeast of Jensen's Bluff, has a period of record only from 2013 to present and has similar (or marginally less) monthly precipitation amounts as at the NOAA Salinas Airport station, which has a period of record from 1930 to present (**Appendix A**). MCWRA's Salinas River near Chualar rain station has a period of record only from 2021 and is for real-time storm and flood monitoring and alert and thus not a verified record.

2.1 Analysis of USGS Chualar and Spreckels Station Records

The flow analysis of the Chualar to Spreckels reach was carried out using USGS daily mean flow data from WY1977 through WY2024, the period of record for the Chualar gage. The monthly mean daily flow chart (**Figure 3**) shows generally more flow at Chualar than at Spreckels during most months, particularly during the dry season and into December and January. Winter storms, however, can produce higher flows at Spreckels, as shown by the higher February mean flows at the site. Dry season reservoir releases are (on average) highest in July and August.

Box and whisker plots (in **Figure 3**) of the reach daily mean flow-difference data (i.e., Chualar minus Spreckels) show the data quartiles (or percentiles), median, skewness, and outliers for each month.[7] In these plots, positive values indicate

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[7] Box and whisker plots divide the data into quartiles containing approximately 25% of the data in each quartile. The box plot shows the middle 50% of data, or the range between the 25th and 75th percentile. The upper and lower whiskers represent data outside the middle 50% (i.e., the lower 25% of data and the upper 25% of data) The median marks the mid-point of the data. Skewness is shown as a positive or negative shift in the symmetry of the plot.

a losing reach, and negative values indicate a gaining reach. Based on these results, the dry season for the reach may be defined from June through November, when flows are primarily sourced from reservoir releases and the reach is generally losing flow. During this time, no outliers were observed, and flow loss (mainly from riverbed infiltration) remained within a consistent range month to month, with August showing marginally higher infiltration. The wet season data show considerably more variability.

To illustrate the seasonal occurrence of gaining and losing reach conditions (**Figure 4**), we plotted the Spreckels versus Chualar daily mean flow data for:

a) December through April wet season,

b) June through November dry season, and

c) July and August only (mid dry season).

Flow losses are well correlated during July and August, a period when dry-season reservoir releases are largest and storm flows are absent. At flows higher than 800 cfs during the dry season (from the addition of storm flow), the reach is shown to shift to a gaining reach.

To further concentrate our analysis on baseflows for each of the three seasonal conditions (shown in **Figure 4**), we filtered out the upper quartile (i.e., the upper 25% of data) by plotting only values below 113 cfs at Chualar (which is the 75th percentile shown in the table below). The results (in **Figure 4**) show a losing reach for nearly all baseflows, especially during July and August.

USGS Gage	**Daily Mean Discharge Percentile** (WY1977-2024)						
	5%	10%	25%	50%	75%	90%	95%
Spreckels (cfs)	0	0	0	1.93	49.5	545.8	1670
Chualar (cfs)	0	0	0	47	**113**	609	1640
Soledad (cfs)	0	0	3.4	130	224	370	896
Bradley (cfs)	22.5	34	74.4	278	503	662.9	1060
Nacimiento (cfs)	4.2	13	29	81	370	449	549
San Antonio (cfs)	3	3	3	10	90	245	350

Notes:

A percentile indicates the percent of a distribution that is equal to or below it.

For example, 75% of the daily mean flows at Chualar are at or below 113 cfs and 25% are greater.

A streamflow greater than the 75th percentile is considered above normal.

A streamflow between 25th and 75th percentiles is considered normal.

A streamflow less than the 25 percentile is considered below normal.

Year-to-year data for each of the three seasonal conditions are plotted in **Figure 5** for July and August, in **Figure 6** for the June through November dry season, and in **Figure 7** for the December through April wet season. A wide range of reach flow losses and gains is shown. Average Chualar to Spreckels reach flow loss was 3.3 cubic feet per second per river mile (cfs/rm) during the dry season and 2.2 cfs/rm during the wet season (shown in the table below).

Seasonal Daily Mean Discharge, Chualar minus Spreckels (WY1977-2024)

Season =	**July and August** (Figure 5)		**June - November** (Figure 6)		**December - April** (Figure 7)	
Data set =	all data	Chualar < 113 cfs	all data	Chualar < 113 cfs	all data	Chualar < 113 cfs
Maximum (cfs/rm)	14	7.8	78	7.8	--	--
Mean (cfs/rm)	3.7	3.4	3.7	3.3	7.8	2.2

Note: Flows less than 113 cfs at Chualar (75 percentile) were used to filter out high flow data.

Some of the variability can be attributed to gaging accuracy, especially when extrapolating rating curves to high flows. In addition, sediment transport from the Arroyo Seco sub-watershed area was significantly elevated following the 1977 Marble-Cone fire, causing bank distress and instability on the Salinas River (Roberts and others, 1983; 1984), and to a lesser degree following the 2008 Basin Complex/Indians Fire and subsequent fires. Due to post-fire instabilities, establishing normal gaging conditions was challenging until the late 1980's. Variability in the high-flow rating curve may be related to variable bed conditions, as well as USGS funding and changing staff assignments.

2.2 MCWRA Synoptic Flow Survey

Monterey County Water Resources Agency (MCWRA) conducts an annual dry-season synoptic flow survey known locally as the “Salinas River Discharge Measurement Series”. Flow measurement sites include ten locations from the confluence of the San Antonio River (at river mile 104) where reservoir releases combine down to Spreckels (river mile 13.2). In 2024, the Discharge Measurement Series were performed by MCWRA and USGS staff on August 20 and 21, documenting an entirely losing stream from 555 cfs at the San Antonio River confluence to 13.2 cfs at Spreckels. Riverbed infiltration for the entire stream was roughly 6 cfs/rm with reach values ranging from 1 to nearly 10 cfs/rm (**Table 2**). An infiltration of 8 cfs/rm was measured in the reach from Soledad to Chualar, with less infiltration downstream, particularly below the T&A measurement site. Infiltration from Chualar to T&A (which includes the Somavia study reach) was 4 cfs/rm. These results are close to the mean values of previous year surveys (1995 to 2023) except for the Greenfield-to-Soledad reach, in which a new minimum loss rate was measured for a second year in a row, attributed to the influence of surface water flow from Arroyo Seco on the groundwater system within this reach.

Variability in streamflow losses (1995-2023) for a given reach can be attributed to available vadose-zone storage related to precipitation totals, tributary inflows (as noted above at Arroyo Seco), and to groundwater pumping. The presence of shallow clay deposits can also reduce losses, as noted in less variability in the Chualar to Spreckels reach, where the Salinas Valley Aquitard underlies much of the reach.

3. SOMAVIA REACH FIELDWORK

3.1 Dry-season Synoptic Flow Surveys

Following the MCWRA and USGS synoptic flow survey on August 20 and 21, 2024, we performed detailed synoptic flow surveys in the Somavia Reach on August 28 and September 24, 2024 (**Table 3**). Locations were chosen with the overall goal of characterizing flow losses across the river bends and intervening straight reaches, as well as general accessibility and the ability to wade the river, particularly during dry-season reservoir releases when flows are relatively steady. Seven measurement sites were selected (shown in **Figure 2**):

- USGS Chualar gage (river mile 27.8)
- River Ranch Organic (river mile 26.6)
- Bend 1 (river mile 26.2)
- Downstream of Bend 1 (river mile 25.4)
- River Road (river mile 24.3)
- Bend 2 (river mile 23.4)
- Upstream of Jensen Bluff (river mile 21.9)

High-precision flow measurements were performed by Balance Hydrologics' field hydrologists. Flow survey calculations are shown in **Appendix B**.

The highest infiltration was measured in the upstream portion of the reach (highlighted yellow in **Table 3**). From Chualar Bridge through Bend #1, flow losses were 10 to 16 cfs/rm, three to five times the broader Chualar-to-Spreckels reach loss of 3.4 cfs/rm. Flow losses decreased downstream from Bend #1 to Jenson Bluff, from one to two times the Chualar-to-Spreckels reach loss. Infiltration variability is noted throughout the reach.

3.2 Infiltrometer Measurements of Overbank and Alternate Channels

We found three distinct types (or ‘facies’) of alluvial deposits at a distance from the main channel (thalweg) and within the overbank and alternate channels:

- Fine to coarse loose alluvial sand with (5 to 10%) rounded gravel mainly in the main channel area with fine to medium sand at distance from the main channel flow (**Figure 8**),
- Stiff silt-clay in overbank areas and commonly overlying alluvial sand (**Figure 9**), and
- Soft silt-clay in alternate channels that exhibited 6- to 8-inch-deep desiccation cracks (**Figure 9**).

We performed infiltrometer measurements near our downstream Bend 1 gage a) in an overbank area in well-sorted fine to medium alluvial sand, and b) in overbank stiff silt-clay (**Figure 10**).

3.2.1 Test Procedure

We conducted 2 single-ring infiltrometer tests (1S and 2S) and 2 double-ring infiltrometer tests (1D and 2D). Tests 1S and 1D were performed on fine sand, and 2S and 2D were performed on a silt-clay deposit, which did not have desiccation cracks. The double-ring infiltrometer comprised a 12-inch diameter ring within a 20-inch diameter ring, while the single-ring infiltrometer was 16 inches in diameter. All rings were 1-foot deep and pounded into the soil to a depth of 0.3 feet, leaving 0.7 feet above ground to hold water. To limit leakage, a bentonite slurry was used to seal the rig where needed.
For the tests, we used water from a privately owned well near River Road.

We followed a modified ASTM D3385 technical standard, developed to assess and model existing grass swales by Wisconsin Department of Natural Resources Runoff Management Section (2008). Both the ASTM Standard D3385 method and the modified technical standard recommend the use of a double-ring infiltrometer. The outer ring serves as a buffer to help minimize lateral spreading. The modified procedure differs from the standard ASTM D3385 field procedure by measuring the infiltration rate during a 2-hour minimum time frame instead of 24 hours, and allows the water level within both rings to vary somewhat over the duration of the test – an important consideration when working with sandy soils of moderately high permeability. During the test, the observer maintains a constant head of water, and the infiltration rate is measured over time.

It is well established that infiltration capacity tends to be rapid when soil is initially wetted and then decays towards an equilibrium (long-term) rate. We fit our 2-hour data to a logarithmic decay function and extrapolated to 24 hours to estimate a standard ASTM D3385 infiltration capacity.

The main advantages of a ring or cylinder infiltrometer, whether double-ring or single-ring, are a) only a small area is needed for measurements (as compared to sprinkler infiltration tests), b) it uses fewer resources and hours to construct and is simple to run, and c) it does not have a high-water requirement. The modified ASTM D3385 infiltration capacity method is also more cost-effective, allowing more sites to be measured and thus increasing the sample size. Infiltration capacity measurements with ring or cylinder infiltrometers provide only indices of variation between sites, generally yielding values that are 2-10 times greater than soil infiltration capacity measured during natural rainfall under the same conditions (Dunne and Leopold, 1978). Ring infiltrometer tests are best suited to estimate infiltration from shallow surface water (e.g., ponds and streams) because the method utilizes a head of water on the surface of the soil, which marginally increases the measured infiltration rate.

3.2.2 Conditions During Testing

The infiltration capacity tests were conducted on January 15, 2025, during a mid-winter dry spell following 4.71 inches of cumulative rainfall for the water year through January 3, 2025 (measured at Salinas Airport). Weather conditions were clear and sunny with mild temperatures and no wind. Although there was no streamflow past our nearby "downstream of Bend 1" gage, water was ponded from the gage to about 2,000 feet upstream in the alternate channel along the outside of the bend. We estimated about 20 gallons per minute of surface flow infiltrating into alluvial sand as it reached the gage. Shallow and deep piezometers at the gage showed a vertical gradient of 1, on January 15, 2025, indicating that shallow groundwater flow was vertically driven by elevation head and not affected by pressure head within the aquifer.

3.2.3 Results

A summary of the infiltration capacity test results is presented in **Table 4**, and the data for each test are attached in **Appendix A**. The two tests in fine sand (1S and 1D) showed infiltration rates that were markedly higher than the two tests in the silt-clay deposit (2S and 2D). In the sand, the 24-hour extrapolated infiltration capacity was 13 feet per day (ft/day) with the double-ring infiltrometer and 43 ft/day with the single-ring infiltrometer. The double-ring infiltrometer result minimizes lateral spreading, which would be included to some extent in the single-ring infiltrometer result. In the silt-clay, infiltration was 0, representing “perched” conditions and a deposit that would behave as a barrier to infiltration.

Given the measured vertical gradient of 1 measured at the Downstream Bend 1 gage (see **Section 3.4)**, the hydraulic conductivity of the alluvial sand bed can be estimated with the infiltrometer capacity results. The double-ring infiltrometer result of 13 ft/day (or $5x10^{-3}$ cm/sec) and the single-ring infiltrometer result of 43 ft/day (or $1.5x10^{-2}$ cm/sec) are typical hydraulic conductivity values for clean sand (noted in many textbooks), even considering that infiltrometer test rates are marginally higher than under natural conditions. As with all soils and subsurface analyses, we note that the values presented are estimates based on standard practice, and discontinuities or differences may exist at depth and were not logged. We note the wide difference in infiltration rates between the alluvial sand and the silt-clay deposits. Desiccation cracks observed in recent silt-clay deposits would also contribute to initial higher infiltration until the cracks sealed up when rewetted.

3.3 Streamflow Gaging

3.3.1 Description of Stations

We installed two temporary gaging stations to monitor fluctuations in streamflow and seasonal changes in infiltration during the water year 2025. The locations of the gaging stations (shown in **Figure 2**) were selected based on results from the channel reconnaissance and synoptic flow surveys (see **Section 3.1**), in collaboration with the project team. Photos of the stations are in **Appendix D**.

- Temporary stream gage #1 was installed downstream of Bend 1, about 2.4 miles downstream of the USGS Chualar gage. The site is situated as the river narrows just downstream of the confluence of the Bend 1 main and alternate channels. In its 15-ft-deep banks (approx.), the active riverbed is sandy, with clay/silt overbank and backwater areas where Arundo removal has occurred.
- Temporary stream gage #2 was installed within Bend 2, about 4.4 miles downstream of the USGS Chualar gage. As at Bend 1, the river occupies the inside channel of Bend 2 with multiple, heavily vegetated high-flow channels about 2,000 feet out from the main channel. The active riverbed is also sandy with clay/silt overbank and backwater areas.

Each stream gaging station was set up with a USGS 'Style C' staff plate and duplicate loggers (Solinst Levelogger) installed in a "stilling well" conduit that recorded pressure and temperature at a 15-minute interval. The elevation of 0.00 feet on the staff plate was surveyed to a local benchmark using Real-Time Kinematic (RTK) positioning. The datalogger 15-minute record was calibrated with periodic manual readings of the staff plate.[8]

These two temporary stations divided the Chualar to Spreckels reach into three sub-reaches:

- Chualar to Downstream Bend 1,
- Downstream Bend 1 to Bend 2, and
- Bend 2 to Spreckels.

3.3.2 Method of Creating a Streamflow Record

Developing a flow record starts with field measurements of flow using a current meter and staff plate readings at a range of stages (**Appendix D**). Then these measurements are used to create (and maintain) an empirical stage-to-flow relationship (aka. a rating curve) for each station. The datalogger record of water depth is converted to stage and corrected for pressure and clock drift. The stage record is then converted to a flow record using the rating curve. Stage shifts, usually caused by accumulation of sticks and leaves, fallen limbs, creek-bed scour, sediment deposition, or backwater conditions, are applied to the record of stage, when necessary, to calculate flow. Large bed changes may require a shift, or even a new stage-flow rating curve. Such adjustments are standard when gaging most open-channel streams worldwide and are commonly needed in this system. As with most open-channel gaging of natural streams, some uncertainty remains (especially at high flows) in spite of efforts to be as accurate and precise as possible. After the first year or two of gaging and developing the rating curve, uncertainty generally decreases.

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[8] In addition to measurements of flow and stage, we collected specific conductance and temperature (SCT) measurements with a field meter as an indicator of the variability of water quality (also shown in **Appendix D**) which varies regularly with flow. Specific conductance measures the ability of water to conduct electricity and is a widely used index for salinity or total dissolved solids (TDS). Rainwater, for example, has very low specific conductance. As water passes over and through the ground, minerals are dissolved into the water, thereby increasing the specific conductance of groundwater. Higher specific conductance indicates transmittal through salt-bearing geologic formations or simply longer residence times in the ground.

For the range of flows reported, we utilize standard streamflow wading equipment appropriate for measuring under the conditions encountered in the field, following standard hydrographic practice (c.f., Rantz and others, 1982). This includes bucket-wheel current-meter methods, the Hach FH950 Velocity Flow Meter, and the SonTek FlowTracker2 handheld Acoustic Doppler Velocimeter.

The gaging records are presented as daily mean flow, which is averaged from data recorded and calculated every 15 minutes. For each water year, the record of mean flow values for each day is listed in a standardized form and plotted on an annual hydrograph.

3.3.3 Gaging Results

The gaging records for WY2025 are presented as daily mean flow for each station. The record is shown in **Form 1** for the "Downstream Bend 1" station and in **Form 2** for the "Bend 2" station. A hydrograph of the gaging results for both stations is shown in **Figure 11** relative to USGS data from the Spreckels, Chualar, Soledad, and Bradley stations and cumulative rainfall at the CIMIS Salinas South II station.

- The Chualar, Soledad, and Bradley station data show upstream reservoir releases and the effects of groundwater withdrawals, diversions, and storms.
- Reservoir releases were ramped down to 70 cfs during October 2024, which ceased flow at Chualar, through the Somavia Reach, and downstream to Spreckels. However, while the streambeds were dry at these gages, we observed standing water on clayey silt in the alternate channel of Bend 1 and evidence of sand deposits from flow pulses (possibly from agricultural runoff?).
- Storms in February 2025 produced seasonal peak flows at all stations, then reservoir releases sustained flow through the remainder of the water year.
- Reservoir releases were again ramped down in October 2025. Flows fluctuated weekly during the dry season, suggesting the effect of weekly irrigation schedules by growers.

Sub-reach flow losses – Chualar to Downstream Bend 1, Downstream Bend 1 to Bend 2, and Bend 2 to Spreckels – are summarized in **Table 5** using our flow measurement data.

Showing some variability through the water year, losses were highest in the upper sub-reach (Chualar to Downstream Bend 1) of 11 cfs per river mile, then lowered to 3.4 cfs/rm from Downstream Bend 1 to Bend 2, and then to 1 cfs/rm in the lower sub-reach, Bend 2 to Spreckels. These findings are consistent with our synoptic flow survey results. The variability of flow loss through the dry season is illustrated in **Figure 12** for the reach from Chualar to Bend 2, with fluctuation around 9 cfs/rm, ranging from 5 to 14 cfs/rm.

3.4 Piezometer Clusters

In addition to streamflow gages, we installed a shallow drive-point piezometer and a deep drive-point piezometer at each gaging station to evaluate vertical hydraulic head gradients. Like at the flow gages, a datalogger (Solinst Levelogger) was installed in each piezometer that recorded pressure and temperature at a 15-minute interval, and the elevation of the top of each piezometer was surveyed to a local benchmark using RTK positioning. The 15-minute record collected at each piezometer was calibrated with periodic manual depth-to-water measurements, taken from the RTK-surveyed reference point (RP). The manual measurements are summarized in **Table 6**, and water year hydrographs are illustrated in **Figure 13** for the Downstream Bend 1 gage and **Figure 14** for the Bend 2 gage.

At the Downstream Bend 1 station, vertical hydraulic head gradients were consistently slightly higher than 1, averaging 1.2, indicating an infiltration potential of mainly elevation head with some surface-water pressure head and potentially some matric suction within the vadose zone. The piezometer responded directly with stage as the river wetted up from storms in February but receded quicker than stage in April, following high flows during February and March; this faster recession in the piezometer suggests possible well pumping induced drawdown and/or lateral groundwater flow during receding river flow.

Conversely, the infiltration conditions recorded at the Downstream Bend 1 station were not recorded at the Bend 2 station where a) we observed local presence of clay underlying mobile sand deposits, b) river flow losses were measurably less, and c) perched surface-water conditions were apparent in the data; the vertical hydraulic head gradient at Bend 2 was 0 as both the shallow and deep piezometers directly correlated with stage. The water level in the deep piezometer was generally above the bed elevation once the alluvium had become saturated, suggesting gaining flow conditions at the site, possible hyporheic flow and limited space in the river alluvium for riverbed seepage to occur. The groundwater level in the deeper piezometer then quickly decreased as river flow receded and the alluvium drained and dried, turning the system into a losing condition. These observations suggest that infiltration along Bend 2 would vary with seasonality and wetted conditions.

In general, the piezometer cluster results generally agree with the gaging and synoptic flow survey results of highest infiltration from Chualar through Bend 1, decreasing infiltration downstream from Bend 1 through Bend 2, and lower infiltration downstream from Bend 2.

3.5 Riverbed Flux Measurements Using Temperature Profilers

Heat is a naturally occurring tracer in stream systems, and solar-driven temperature fluctuations at the land surface provide signals for tracing exchanges between surface water and groundwater. A method for estimating streambed seepage rates using time-series thermal data is based on quantifying changes in phase and amplitude of temperature variations between pairs of subsurface sensors (Hatch and others, 2006). In the Pajaro River, the method has been successfully applied (Hatch and others, 2010; Racz and others, 2011).

The method utilizes a shallow temperature profiler comprising a string of temperature loggers within a 2-inch diameter sealed PVC pipe with a steel drive-point tip (**Figure 15**). The profiler was driven into the riverbed using a steel bar extending to the drive-point and a gasoline-powered t-post driver, then filled with water. The temperature loggers were hung within the profiler at 10 cm, 30 cm, and 70 cm from the bed surface. We used Onset Tidbit v2 water temperature loggers (accuracy ±0.2 °C) set to record temperature every 15 minutes.

3.5.1 Field Setup

Each gaging station - Bend 1, Bend 2, as well as Chualar, had two temperature profilers installed: Temperature profiler '*A*' was situated three (3) feet out from the riverbank and gaging station stilling well, and *Temperature profiler 'B'* was located eight (8) feet from the riverbank and gaging station.

The data used in the groundwater/surface-water flux analysis spanned from February to September, during which the Salinas River maintained continuous flow, and conditions were saturated. At Bend 2B, the time series begins in May due to an instrument malfunction affecting one of the three loggers.

3.5.2 1DTempProV2 Results

To analyze the vertical temperature profiles, we used the USGS 1DTempProV2 model, a coupled numerical heat-transport and groundwater flow model that estimates and visualizes vertical groundwater/surface-water flux, and hydraulic conductivity in cases where hydraulic head is known (Koch and others, 2016). The model uses Root Mean Square (RMS) as a metric for calibrating the simulated temperature against measured data. We focused on adjusting the hydraulic conductivity of different magnitudes to evaluate the best-fit simulation with the lowest RMS for each profiler. All other model parameters are listed in **Table 7**.

An initial visual analysis of the temperature data showed that the best oscillating amplitude and phase signal was observed between the 10 cm and 30 cm loggers. At Bend 2 and Chualar, the deepest temperature logger at 70 cm depth had a much weaker signal, if any. However, this did not necessarily limit the performance of the model.

The RMS results from the sensitivity analysis of varying hydraulic conductivity are shown in **Table 8**. One set of data at each station resulted in an RMS value close to the accuracy of the temperature logger (± 0.2 ˚C): Bend 1A, Bend 2B, and Chualar A. The measured and simulated data for these datasets are illustrated in **Figures 16, 17,** and **18**.

The highest hydraulic conductivity and specific discharge were found at Bend 1A, with a hydraulic conductivity of 1 m/d, which falls within the lower to middle range of sand deposits. At Bend 2B, the best fit was found at 1×10^{-3} m/d, which is at the lower end of silty deposits, typically corresponding to low-permeable material such as silty clay. The hydraulic conductivity at Chualar A was 1×10^{-1} m/d and corresponds to fine sand, silty sand, or loamy soils.

The modeled time-variable specific discharge, presented in **Figures 19**, **20,** and **21** shows continuous vertical seepage that fluctuates near the estimated hydraulic conductivity at each site. The modeled specific discharge values in m/day shown in **Figures 19**, **20,** and **21** were converted to cfs/rm using empirical correlations at each gage of wetted perimeter to gaged flow, presented in **Figures 22, 23,** and **24**. The results align with several other findings from the field:

- The highest flow losses were measured in the sub-reach from Chualar bridge to the Downstream Bend 1 gage;
- The highest vertical head gradient was measured at the Downstream Bend 1 gage;
- Low to negligible vertical head gradients were measured at the Bend 2 gage, indicating little to no infiltration.

3.5.3 Field Limitations

There are some notable misfits in the modeled results to measured data for certain periods - for example, a slightly overestimated amplitude at Bend 1A during June-July, or an underestimated temperature fluctuation at Bend 2B in beginning of May.
This is mainly due to the weak signal from the deepest temperature logger.
However, the simulated data reflects the measured data overall.

Additional errors in the field experiment include exposure to sunlight and heating of the PVC and the enclosed water column containing the temperature loggers when the water surface dropped below the elevation of the conduit. The profilers named ‘A’ were generally more shaded than the profilers named ‘B’, which may have limited the possible sunlight-induced measurement bias in the recorded temperatures.

4. CONCLUSIONS

We assisted the SVBGSA in a reconnaissance field study to add more context to riverbed seepage within the Somavia Reach, a 6-mile meandering reach from Chualar Bridge to Jensen's Bluff, overlying an inland portion of the Salinas Valley Aquitard. In the Somavia Reach, the river forms broad meanders and the aquitard is potentially thin and discontinuous. The reach is situated within a downstream transition of decreasing river seepage rates identified by MCWRA's Salinas River Discharge Measurement Series measurements.

The MCWRA's August 2024 River Discharge Measurement series showed the Salinas River is a losing stream all along the 91-mile length of the main stem, from the San Antonio River confluence to Spreckels, at an average rate of roughly 6 cfs/rm. Flow loss was 8 cfs/rm in the 19 miles from Soledad to Chualar with less infiltration downstream. Flow loss was 4 cfs/rm in the 11 miles from Chualar to T&A (which includes the 6-mile Somavia study reach), and 1.4 cfs/rm from T&A to Spreckels (4 miles). The 2024 River Discharge Measurement series result for the 14.6-mile Chualar to Spreckels reach was less than the mean values of previous surveys, though precipitation during 2024 was above normal. Year-to-year variability in flow loss in the Chualar to Spreckels reach, however, is notably less than reaches upstream, which is attributed to the Salinas Valley Aquitard underlying much of the reach, as the presence of shallow clay deposits restricts impacts from well pumping.

A review of historical USGS gaging data shows generally more flow at Chualar than at Spreckels during most months, particularly during the dry season and into December and January, though winter storms can produce more runoff at Spreckels, and during drought years, the reach generally has little to no flow. Dry-season reservoir releases generally sustain a baseflow through the reach and are (on average) highest in July and August. Based on Spreckels versus Chualar daily mean flow data, seepage seasons were characterized as a) a December through April wet season, b) a June through November dry season, and c) July and August only. A wide range of flow losses and gains is found in the records, but a losing reach was recorded for nearly all baseflows, especially during July and August. For the 14.6-mile Chualar to Spreckels reach, the average flow loss was 3.3 cubic feet per second per river mile (cfs/rm) during the dry season and 2.2 cfs/rm during the wet season.

Our high-precision synoptic flow survey of the 6-mile Somavia Reach on August 28, 2024 and September 24, 2024, identified the highest infiltration in the upstream 2.4-mile portion of the reach, from Chualar Bridge through Bend #1, where flow losses were 10 to 16 cfs/rm, or three to five times the 3.4 cfs/rm loss rate for the longer 14.6-mile Chualar to Spreckels. Flow losses decreased downstream from Bend #1 to Jensen's Bluff, from one to two times the Chualar to Spreckels reach loss with infiltration variability noted throughout the reach.

Our gaging showed similar riverbed seepage results with notable variability through the year. On average, losses were 11 cfs/rm from Chualar to the Downstream Bend 1 gaging station, then lowering to 3.4 cfs/rm from Downstream Bend 1 station to Bend 2 station, and then to 1.0 cfs/rm from Bend 2 to Spreckels. From Chualar to Bend 2, the variability of flow loss through the dry season fluctuated around 9 cfs/rm, ranging from 5 cfs/rm to 14 cfs/rm.

Piezometer cluster results generally agree with the gaging and synoptic flow survey results of highest infiltration from Chualar through Bend 1, decreasing infiltration downstream from Bend 1 through Bend 2, and lower infiltration downstream from Bend 2. At the Downstream Bend 1 station, vertical hydraulic head gradients were consistently slightly higher than 1, indicating an infiltration potential of mainly elevation head. The results also showed possible well-pumping induced drawdown in the records and/or lateral flow. These conditions, however, were not recorded at the Bend 2 station – streambed seepage presumably perched by local underlying clay.

We performed ring-infiltrometer measurements near our Downstream Bend 1 gage in an upper bar area of well-sorted fine to medium alluvial sand and in an overbank area of stiff silt-clay – two infiltrometer tests in each deposit. In the sand, the infiltration capacity result was 13 feet per day (ft/day) and 43 ft/day, while in the silt-clay, infiltration was 0, representing "perched" conditions and a deposit that would behave as an aquitard if continuous. However, desiccation cracks observed in recent silt-clay deposits found in alternate channels would contribute to initial higher infiltration until the cracks sealed up when rewetted. Given the measured vertical gradient of 1 at the gage, the hydraulic conductivity of the alluvial sand bed was estimated from the infiltrometer capacity results, ranging from 5×10^{-3} cm/sec to 1.5×10^{-2} cm/sec, typical values for clean sand.

Using these hydraulic conductivity results of the ring-infiltrometer measurements, we estimated riverbed seepage using the USGS 1DTempProV2 numerical model calibrated with the temperature profiler data. The modeled results of specific discharge fluctuated through the year near the estimated hydraulic conductivity at each site.

When converted to a reach infiltration (in cfs/rm) using an empirical correlation at each gage of wetted perimeter to gaged flow, the rates were clearly highest at the Downstream Bend 1 gage – as high as 17 cfs/rm with a March flow of 160 cfs and as low as 3 to 6 cfs/rm with July and August flows of 25 to 50 cfs. Modeled infiltration rates were less than 1 cfs/rm at Chualar, and less than 0.01 cfs/rm at Bend 2.

Overall, we implemented a variety of independent field methods to confirm that the highest riverbed seepage rates of the Chualar reach are within the sub-reach from Chualar bridge to the Downstream Bend 1 gage, and notably higher than upstream reaches from Soledad to Chualar. Riverbed seepage rates fluctuated throughout the year mainly related to flow (i.e., river-bed wetted area). Downstream from the Chualar bridge to Downstream Bend 1 sub-reach, river loss rates were measurably lower and more variable throughout the year, presumably due to near-surface clay patches and seasonal constrains from hyporheic flow and saturation of the river alluvium.

5. LIMITATIONS

The study primarily focused on investigating recharge from surface water into the river alluvium and does not examine connectivity to the 180-ft aquifer. Therefore, results do not address (a) the mechanisms for connectivity between the river alluvium and the 180-ft aquifer, and (b) the extent to which additional pumping from the 180-ft aquifer would induce additional recharge from the river.

The contents of this report were prepared in general accordance with the accepted standard of practice existing in Northern California at the time the investigation was carried out. No other warranties, expressed or implied, are made.

The gaging work has been performed at the threshold-exceedance level for only one year. The work product is developed at a more limited level of effort than is usually applied to a gage operated for multi-year full-range water-resource objectives and parameters. This is a different standard and for a different purpose than those measurements made by USGS. Balance has not reviewed the measurements or computations made by USGS at the other Salinas River stream gages or the measurements made by other agencies, such as the Monterey County Water Resources Agency.

It should be recognized that streamflow measurements of natural channels and dynamic flows are a difficult and inexact art. Interpretation of field indicators and conversion of streamflow measurements into a gaging record are also complex and usually entail the work of numerous cooperating individuals. More extensive monitoring can reduce some of the uncertainties associated with these gaging results. The findings presented in this report should be noted, per standard, as “provisional and subject to revision” until published in a final document.

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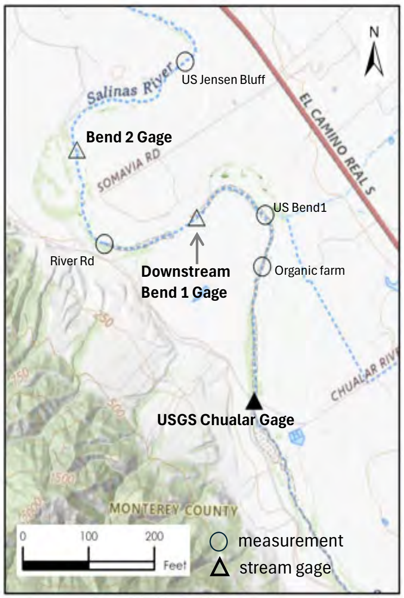
GAGING FORMS

Water Year:	**2025**
Stream:	**Salinas River**
Station:	**Somavia Reach, Downstream Bend 1**
County:	**Monterey, California**

Form 1. Annual Hydrologic Record, Daily Mean Flow, Water Year 2025, Salinas River, Somavia Reach, Downstream Bend 1



Station Location / Watershed Descriptors

Coordinates: 36.5784, -121.55979 (WGS84). Gage is approximately 2.59 miles downstream from the USGS gage at Chualar River Road in Monterey County, California. Drainage are upstream of the gage is 6,263.86 square miles. Land use upstream of this gage is primarily agricultural, with a mixture of industrial and mid-density urban residential uses. Channel at gage is primarily medium/coarse sand. Over-bank flood plain is was scraped of Arundo during WY25 which removed fine silt/clay from the bench and exposed the underlying permeable sand. Rating curve extended above 159 cfs by and below 15 cfs by graphical extension.

Mean Annual Flow

NA

Peak Flows (WY25)

Date	Time (24-hr)	Gage Ht. (feet)	Flow (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Flow (cfs)
NA							

Extremes for period of record: NA

Period of Record

Gaging is sponsored by Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA). Installed 10/24/2024

WY 2025 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1		0.15	0.00	0.00	0.00	135.12	110.28	42.15	71.15	75.69	24.63	
2		0.00	0.00	0.00	0.00	132.13	111.06	37.48	70.71	75.26	27.87	
3		0.37	0.00	0.00	0.00	127.08	109.49	34.92	71.24	71.15	29.17	
4		0.00	0.00	0.00	0.00	118.81	110.35	32.96	72.79	64.00	38.78	
5		0.00	0.00	0.00	0.29	115.97	104.54	37.67	72.00	53.19	49.42	
6		0.00	0.14	0.00	0.21	128.38	99.58	42.26	69.20	55.25	53.25	
7		0.00	0.00	0.00	84.48	105.61	97.40	36.46	57.90	64.15	47.68	
8		0.12	0.00	0.00	179.61	93.79	96.11	30.94	50.53	65.75	43.37	
9		0.04	0.15	0.00	99.48	87.73	93.47	27.77	55.57	58.79	35.23	
10		0.08	0.14	0.00	25.56	84.52	88.71	28.65	62.72	45.69	28.93	
11		0.02	0.00	0.00	1.50	82.05	85.38	28.98	58.65	37.46	36.62	
12		0.11	0.84	0.00	0.00	79.75	82.30	38.47	50.39	31.24	41.30	
13		0.00	0.04	0.00	122.73	85.57	80.01	54.81	45.72	26.15	45.01	
14		0.00	0.62	0.01	438.61	103.24	78.74	61.63	43.51	30.25	35.62	
15		0.00	1.06	0.35	326.13	114.30	78.24	60.65	43.74	36.47	39.08	
16		0.00	0.16	0.40	227.34	119.17	76.74	63.76	54.26	40.28	35.40	
17		0.00	0.40	0.00	216.91	110.56	74.08	60.14	67.76	35.80	27.99	
18		0.00	0.79	0.00	191.59	129.30	70.98	66.10	68.74	28.63	32.98	
19		0.00	0.26	0.00	173.52	152.04	67.83	71.13	66.72	23.23	40.59	72.49
20		0.00	0.00	0.00	166.03	155.11	59.56	75.40	61.49	21.41	37.07	67.16
21		0.00	0.00	0.00	158.17	157.19	59.30	77.84	56.16	29.03	31.36	67.58
22		0.00	0.50	0.00	154.00	158.03	58.59	77.51	55.70	42.79	33.09	71.65
23		0.07	0.11	0.00	150.32	152.26	52.08	74.92	69.38	41.76	31.69	74.38
24	0.73	0.00	0.72	0.00	148.89	144.85	43.70	74.50	74.95	34.76	31.96	73.04
25	0.74	0.40	0.86	0.00	148.95	137.66	42.55	74.33	75.00	29.84	38.54	75.65
26	0.42	1.49	0.70	0.00	146.64	131.48	44.34	78.36	72.98	32.62	56.74	76.19
27	0.24	0.31	9.90	0.21	142.82	126.16	43.79	82.60	73.39	32.53	46.42	66.78
28	0.00	0.00	1.40	0.38	139.22	119.51	47.67	82.57	71.89	36.14	49.62	35.81
29	0.00	0.00	0.01	0.00	-	116.00	51.18	81.99	72.72	38.25	54.58	18.17
30	0.00	0.00	0.00	0.00	-	113.34	48.33	78.26	74.86	36.02		8.10
31	0.00	-	0.00	0.00	-	109.65	-	75.54	-	27.71		-
MEAN DAILY FLOW	-	0.11	0.61	0.04	122.96	120.20	75.55	57.77	63.73	42.62	38.76	58.92
MAX. DAILY FLOW	0.74	1.49	9.90	0.40	438.61	158.03	111.06	82.60	75.00	75.69	56.74	76.19
MIN. DAILY FLOW	0.00	0.00	0.00	0.00	0.00	79.75	42.55	27.77	43.51	21.41	24.63	8.10
VOLUME (cfs-days)	-	3.17	18.8	1.35	3443	3726	2266	1791	1912	1321	1124	707
VOLUME (acre-feet)	-	6.29	37.3	2.67	6829	7391	4495	3552	3792	2621	2229	1402

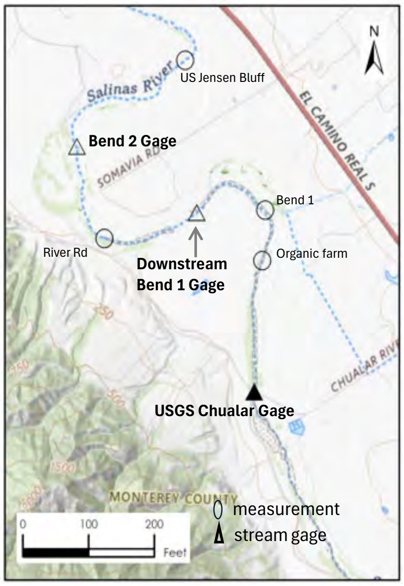
Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations. No additional precision is implied.
2. Mean daily values are based on 15-minute calibrated record of stage. Stage shifts have been applied to the record based on measurements and observations to account for shifting bed conditions.
3. Data are subject to revision. Additional measurements or observer accounts may warrant an adjustment to the rating curve.
4. Temporary gage for Somavia Reach 1-year study.

Water Year 2025 Totals:		
Mean flow	**-**	(cfs)
Max. daily flow	**439**	(cfs)
Min. daily flow	**0.00**	(cfs)
Annual total	**-**	(cfs-days)
Annual total	**-**	(ac-ft)

Water Year:	**2025**
Stream:	**Salinas River**
Station:	**Somavia Reach, Bend 2**
County:	**Monterey, California**

Form 2. Annual Hydrologic Record, Daily Mean Flow, Water Year 2025, Salinas River, Somavia Reach, Bend 2



Station Location / Watershed Descriptors

Coordinates: 36.5864, -121.58077 (WGS84). Gage is approximately 4.5 miles downstream from the USGS gage at Chualar River Road in Monterey County, California. Drainage are upstream of the gage is 6,249.83 square miles. Land use upstream of this gage is primarily agricultural, with a mixture of industrial and mid-density urban residential uses. Channel at gage is primarily medium/coarse sand. Rating curve extended above 140 cfs by and below 11 cfs by graphical extension.

Mean Annual Flow

NA

Peak Flows (WY25)

Date	Time (24-hr)	Gage Ht. (feet)	Flow (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Flow (cfs)
NA							

Extremes for period of record: NA

Period of Record

Gaging is sponsored by Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA). Gage installed 12/20/2024

WY 2025 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1				0.00	0.00	99.85	108.65	37.65	62.66	76.25	41.33	65.78
2				0.00	0.00	94.70	110.59	32.19	62.35	72.11	39.90	72.17
3				0.00	0.00	86.56	108.91	27.63	63.83	62.58	37.93	75.41
4				0.00	0.00	77.25	111.30	22.78	67.49	54.95	50.30	74.99
5				0.00	0.00	75.17	106.58	31.85	66.63	46.73	64.71	75.18
6				0.00	0.00	96.65	100.68	38.20	59.70	49.11	65.48	69.83
7				0.00	30.82	62.06	98.35	31.94	49.58	55.98	59.90	64.63
8				0.00	77.22	44.40	99.44	23.64	43.15	58.57	53.87	67.81
9				0.00	0.00	35.12	96.67	7.42	46.84	48.58	48.69	75.00
10				0.00	0.00	29.69	89.18	1.65	51.80	39.41	45.27	77.01
11				0.00	0.00	24.56	83.92	2.13	49.50	33.22	51.04	76.51
12				0.00	0.00	18.20	77.80	14.00	45.04	28.44	59.05	72.75
13				0.00	32.33	29.41	73.06	31.99	40.80	23.17	58.78	69.78
14				0.00	737.20	55.91	72.35	37.49	37.81	27.83	53.94	67.02
15				0.00	556.40	75.67	71.56	38.92	37.11	43.73	52.24	71.21
16				0.00	332.81	86.83	68.16	41.06	45.75	48.10	47.76	77.16
17				0.00	272.23	73.95	63.29	38.89	56.39	43.32	43.82	69.97
18				0.00	214.00	100.38	56.03	42.22	56.78	34.76	49.53	61.75
19				0.00	166.92	148.51	49.73	51.35	53.97	26.63	54.53	56.16
20			0.00	0.00	147.20	159.10	43.33	63.23	49.14	22.10	51.12	49.85
21			0.00	0.00	139.23	166.29	44.39	71.53	46.26	34.63	46.28	50.08
22			0.00	0.00	131.00	173.54	46.03	71.77	45.22	52.24	41.63	61.44
23			0.00	0.00	126.52	165.80	43.26	69.36	58.42	52.18	40.08	71.54
24			0.00	0.00	123.07	153.58	35.28	69.39	72.85	46.66	41.52	65.82
25			0.00	0.00	123.27	144.11	32.65	70.64	73.58	41.07	52.50	71.21
26			0.00	0.00	118.95	135.47	35.41	79.88	68.63	43.95	64.20	83.99
27			0.00	0.00	112.71	126.88	36.30	87.83	69.13	43.61	65.25	55.94
28			0.00	0.00	106.82	118.12	39.42	91.03	66.45	51.35	60.83	26.22
29			0.00	0.00	-	114.57	42.73	89.17	65.74	55.39	60.64	13.80
30			0.00	0.00	-	111.09	42.63	80.96	71.02	52.68	61.96	0.00
31		-	0.00	0.00	-	106.66	-	73.59	-	46.15	61.95	-
MEAN DAILY FLOW			-	0.00	126.74	96.45	69.59	47.46	56.12	45.66	52.45	63.00
MAX. DAILY FLOW			0.00	0.00	737.20	173.54	111.30	91.03	73.58	76.25	65.48	83.99
MIN. DAILY FLOW			0.00	0.00	0.00	18.20	32.65	1.65	37.11	22.10	37.93	0.00
VOLUME (cfs-days)			-	0.00	3549	2990	2088	1471	1684	1416	1626	1890
VOLUME (acre-feet)			-	0.00	7039	5931	4141	2918	3339	2808	3225	3749

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations. No additional precision is implied.
2. Mean daily values are based on 15-minute calibrated record of stage. Stage shifts have been applied to the record based on measurements and observations to account for shifting bed conditions.
3. Data are subject to revision. Additional measurements or observer accounts may warrant an adjustment to the rating curve.
4. Temporary gage for Somavia Reach 1-year study.

Water Year
2025 Totals:

Mean flow	**-**	(cfs)
Max. daily flow	**737**	(cfs)
Min. daily flow	**0.00**	(cfs)
Annual total	**-**	(cfs-days)
Annual total	**-**	(ac-ft)

TABLES

Table 1. Available rainfall and streamflow data, GSA Somavia Reach study, Monterey County, CA.

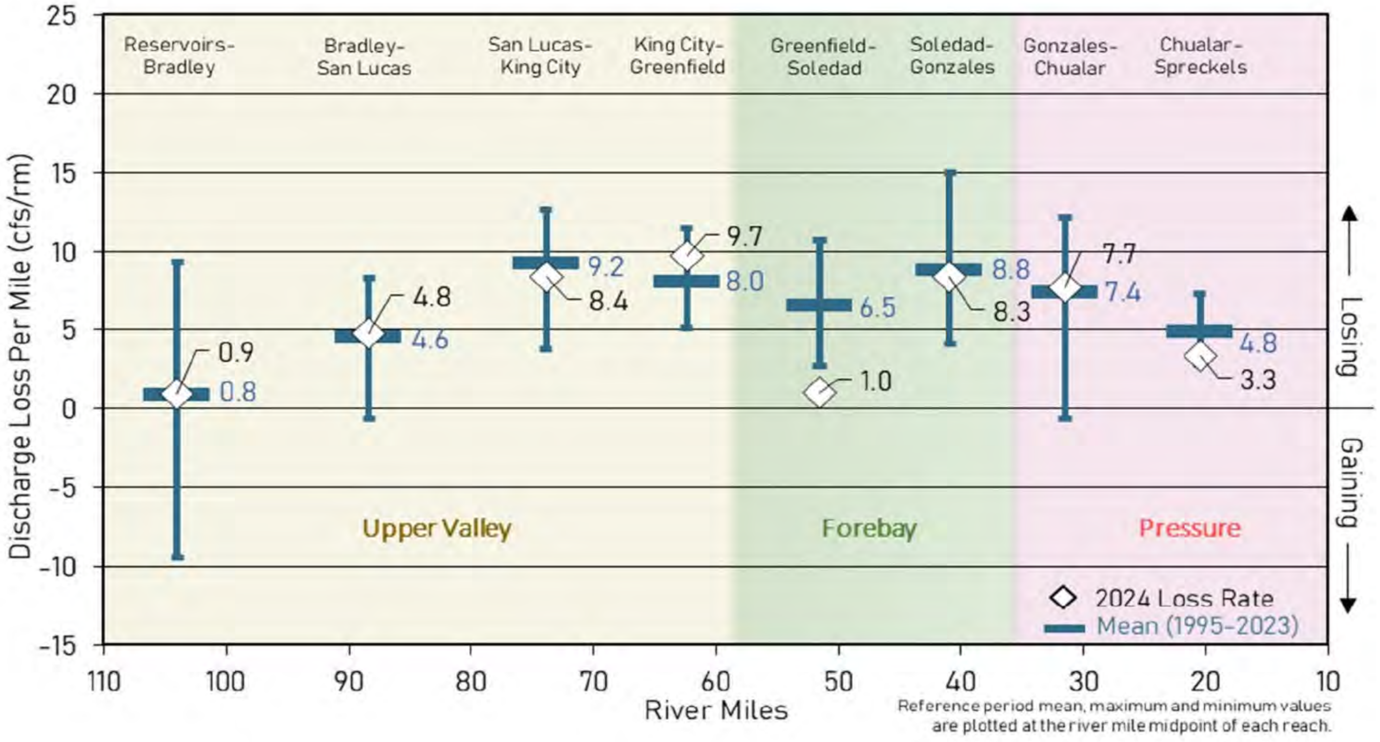
Gage Location	**Data Type**	**Agency**	**Station ID**	**Period of Record**	**Elevation** (ft NAVD88)	**Drainage Area** (sq mi)	**Website**
SALINAS R NR SPRECKELS CA	Streamflow	USGS	11152500	1929-10-01 to present	21.98	4156	https://waterdata.usgs.gov/monitoring-location/USGS-11152500
SALINAS R NR CHUALAR CA	Streamflow	USGS	11152300	1976-10-01 to present	70.54	4042	https://waterdata.usgs.gov/monitoring-location/USGS-11152300
SALINAS R A SOLEDAD CA	Streamflow	USGS	11151700	1968-10-01 to present	155.00	3563	https://waterdata.usgs.gov/monitoring-location/USGS-11151700
SALINAS R NR KING CITY CA	Streamflow	USGS	11151540	2025-12-04 to present	297.00	3685	https://waterdata.usgs.gov/monitoring-location/USGS-11151540
SALINAS R NR BRADLEY CA	Streamflow	USGS	11150500	1948-10-01 to present	445.82	2535	https://waterdata.usgs.gov/monitoring-location/USGS-11151500
NACIMIENTO R BL NACIMIENTO DAM NR BRADLEY CA	Streamflow	USGS	11149400	1957-10-01 to present	591.97	329	https://waterdata.usgs.gov/monitoring-location/USGS-11149400
NACIMIENTO RES NR BRADLEY CA	Reservoir Elevation	USGS	11149300	1957 to 1985; 2020-11-19 to present	825 (crest)	325	https://waterdata.usgs.gov/monitoring-location/USGS-11149300
SAN ANTONIO RES NR BRADLEY CA	Reservoir Elevation	USGS	11150100	1965 to 1985; 2020-12-09 to present	802 (crest)	323	https://waterdata.usgs.gov/monitoring-location/USGS-11150100
NACIMIENTO RESERVOIR	Reservoir Releases	MCWRA	Nacimiento	1958-10-01 to present	800 (inflatable spillway gate)	325	https://www.countyofmonterey.gov/home/showdocument?id=24230
SAN ANTONIO RESERVOIR	Reservoir Releases	MCWRA	San Antonio	1966-10-01 to present	780 (spillway crest)	323	https://www.countyofmonterey.gov/home/showdocument?id=24240
SALINAS AIRPORT	precipitation	NOAA	USW00023233	1930-06-14 to present	73	n/a	https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USW00023233/detail;jsessionid=722FE0992F761B3F54111E0B9CC7EE7E
Salinas South II	precipitation	CIMIS	214	2013-05-17 to present	153	n/a	https://www.cimis.water.ca.gov/Stations.aspx
Salinas River Nr Chualar	precipitation	MCWRA	32112	2021-01-26 to present	92	n/a	https://mcwrarealtimehydrodata.com/site/?site_id=6206&site=02c6b323-4567-4e56-a6a1-a8714cbca5c5

Table 2. Synoptic flow survey results, August 20-21, 2024, San Antonio River confluence to Spreckels, Salinas River, Monterey County Water Resources Agency

Salinas River bed infiltration is roughly 6 cubic feet per second per river mile (cfs/RM) with reach values ranging from 1 to 10 cfs/RM. An infiltration of 8 cfs/RM was measured in the reach from Soledad to Chualar with less infiltration downstream, particularly below T&A. Infiltration from Chualar to T&A (which includes the Somavia study reach) was 4 cfs/RM. These results are similar to mean values of previous year surveys (1995 to 2023). Source: MCWRA, 2024.

	Salinas River Station	River Mile upstream from Monterey Bay *miles*	Flow Measurement *cfs*	Flow loss between stations *cfs per river mile*	Cumulative flow loss from Bradley *cfs per river mile*
Upper Valley	San Antonio R. confluence (combined reservoir releases)	104	555	--	--
	Bradley (USGS 11150500)	97.2	549	-0.9	--
	San Lucas	78.8	459	-4.9	-4.9
	King City	68.3	371	-8.4	-6.2
	Greenfield	56.5	257	-9.7	-7.2
Forebay	Soledad (USGS 11151700)	46.6	247	-1.0	-6.0
	Gonzales	35.2	151	-8.4	-6.4
Pressure	Chualar (USGS 11152300)	27.8	94.0	-7.7	-6.6
	Tanimura and Antle (T&A)	17.0	50.3	-4.0	-6.2
	Spreckels (USGS 11152500)	13.2	45.0	-1.4	-6.0
	Chualar-Spreckels reach	--	--	**-3.4**	--

Somavia Reach →



Reference period mean, maximum and minimum values are plotted at the river mile midpoint of each reach.

224076 synoptic flow survey 2025-12-06.xlsx, MCWRA

Table 3. Synoptic flow survey results, Chualar Bridge to Jensen Bluff, Salinas River, Monterey County, CA.

The highest infiltration was measured in the upstream portion of the Chualar Bridge to Jenson Bluff reach (highlighted yellow). From Chualar Bridge through Bend #1 flow losses were three to five times the broader Chualar to Spreckels reach loss, while downstream from Bend #1 to Jensen Bluff, losses decreased to levels one to two times the Chualar to Spreckels reach. High precision flow measurements were performed by Balance Hydrologics' field hydrologists. Infiltration variability is noted throughout the reach.

Location			**August 28, 2025 Survey**					**September 24, 2025 Survey**				
Station	**River mile upstream from Monterey Bay** *miles*	**River mile downstream from Chualar Bridge** *miles*	**Flow Measurement** *cfs*	**Flow loss from Chualar Bridge** *cfs per river mile*	**Multiple of Chualar to Spreckels flow loss**	**Flow loss between stations** *cfs per river mile*	**Multiple of Chualar to Spreckels flow loss**	**Flow Measurement** *cfs*	**Flow loss from Chualar Bridge** *cfs per river mile*	**Multiple of Chualar to Spreckels flow loss**	**Flow loss between stations** *cfs per river mile*	**Multiple of Chualar to Spreckels flow loss**
Chualar Bridge	27.8	0	91.9	--	--	--	--	114	--		--	
River Ranch Organic	26.6	1.17	77.8	-12.1	3.4	-12.1	3.4	95.0	-16.1	4.8	-16.1	4.8
Bend #1	26.2	1.60	70.5	-13.3	3.8	-16.8	4.8	90.7	-14.5	4.3	-9.93	2.9
d/s Bend #1	25.4	2.43	not measured	--	--	--	--	79.6	-14.1	4.2	-13.4	4.0
River Rd site	24.3	3.46	60.3	-9.13	2.6	-5.51	1.6	76.6	-10.8	3.2	-2.84	0.8
Bend #2	23.4	4.38	not measured	--	--	--	--	72.8	-9.38	2.8	-4.21	1.2
u/s Jensen Bluff	21.9	5.86	55.6	-6.19	1.8	-1.95	0.6	64.3	-8.46	2.5	-5.72	1.7
USGS data at 10:00 (PDT):												
Chualar (11152300)	27.8	0	98.5					111				
Spreckels (11152500)	13.2	14.6	47.2	**Chualar-Spreckels reach loss (cfs/RM) = -3.5**				61.8	**Chualar-Spreckels reach loss (cfs/RM) = -3.4**			

Table 4. Ring-infiltrometer results of overbank and alternate channels conducted downstream of Bend #1 on January 15, 2025, GSA Somavia Reach study, Salinas River, Monterey County, CA.

Site	Surface Material	Method [1]	Infiltration capacity test result (ft/day)	24-hour extrapolated infiltration capacity (ft/day)	Head above soil surface (ft)	Remarks
1S	Sand	Single-ring, constant head	51	43	0.66	highest results
		Single-ring, falling head	35	not applicable	0	
1D	Sand	Double-ring, constant head	27	13	0.63	double ring test minimizes lateral flow
		Double-ring, falling head	22 to 39	not applicable	0.15	varied infiltration rate; possible lateral flow as water in outer ring infiltrated
2S	Silt/Clay	Single-ring, constant head	1.0	0	0.59	low infiltration representing perched conditions
2D	Silt/Clay	Double-ring, constant head	0	0	0.66	perched conditions

Notes:

1. Constant rate infiltration tests were conducted for a minimum of 2 hours (per Wisconsin Department of Natural Resources modified ASTM D3385 method for assessment and modeling existing grass swales). Test results were extrapolated to 24 hours, the standard time recommended in ASTM D3385 (2009), with a best-fit logarithmic decay equation. This equation is based on established observations that infiltration capacity tends to be rapid initially when soil is initially wetted, then decays towards an equilibrium (long-term) value with time. A falling-head test was conducted immediately following completion of the constant-head test.

Table 5. Discharge measurements at Salinas River Bend 1 and Bend 2 temporary gages and sub-reach losses
GSA Somavia Reach Study, Monterey County, CA

Date	USGS Chualar	DS Bend 1		**Chualar-DSBend1**	Bend 2		**DSBend1-Bend2**	USGS Spreckels	**Bend2-Spreckels**
	cfs	Time	cfs	cfs/rm	Time	cfs	cfs/rm	cfs	cfs/rm
River Mile	27.8	25.4		--	23.4		--	13.2	--
9/24/2024	111	14:52	79.6	13.1	12:50	72.8	3.4	61.8	1.1
2/21/2025	192	10:15	158	14.0	12:31	140	9.0	147	-0.6
4/10/2025	115	12:30	89.1	10.8	10:15	87.2	0.9	77.5	1.0
5/6/2025	69.1	13:45	46.9	9.3	11:00	38.1	4.4	23.8	1.4
7/8/2025	91.9	14:40	68.2	9.9	11:45	62.3	3.0	42.7	1.9
9/19/2025	91.7	15:25	61.0	12.8	11:45	58.9	1.1	36.8	2.2
9/29/2025	37.6	15:40	15.8	9.1	14:00	11.9	1.9	10.8	0.1
Average	**--**	**--**		**11.3**	**--**		**3.4**	**--**	**1.0**

Notes: Flow measurements at Downstream Bend 1 gage and Bend 2 gage performed by Balance Hydrologics.
Flow at Chualar and Spreckels gages taken from USGS 15-minute records.

Table 6. Water-surface elevation and vertical hydraulic head gradient measurements

GSA Salinas River Somavia Reach Study, Monterey County, CA

		Stage		Shallow Piezometer		Deep Piezometer		Vertical Gradient	
		Staff Plate (feet)	Elevation (ft NAVD88)	Depth to Water (feet)	Elevation (ft NAVD88)	Depth to Water (feet)	Elevation (ft NAVD88)	(stage - deep piezo)	(shallow piezo - deep piezo)
Downstream Bend 1 Station									
Reference Point =		0.00	62.80	Top of casing	67.98	Top of casing	68.01	--	--
Stick up =		--	--	5	62.98	5	63.01	--	--
Top of screen =		--	--	6.30	61.68	13.41	54.60	--	--
Bottom of screen =		--	--	7.00	60.98	15.91	52.10	--	--
Date	Time								
5/6/2025	13:45	2.00	64.80	dry	--	14.40	53.61	1.16	--
7/8/2025	14:40	2.13	64.93	dry	--	14.28	53.73	1.16	--
9/19/2025	15:25	2.19	64.99	dry	--	14.47	53.54	1.19	--
9/29/2025	15:40	1.62	64.42	dry	--	14.38	53.63	1.12	--
11/11/2025	11:39	dry	--	dry	--	15.82	52.19	--	--
Bend 2 Station									
Reference Point =		0.00	54.82	Top of casing	59.85	Top of casing	62.47	--	--
Stick up =		--	--	5.00	54.85	7.65	54.82	--	--
Top of screen =		--	--	6.29	53.56	13.98	48.49	--	--
Bottom of screen =		--	--	7.05	52.80	16.56	45.91	--	--
Date	Time								
5/6/2025	11:00	0.44	55.26	4.41	55.44	7.32	55.15	0.01	0.05
7/8/2025	11:45	0.91	55.73	4.44	55.41	6.87	55.60	0.02	-0.03
9/19/2025	11:45	0.87	55.69	4.31	55.54	6.92	55.55	0.02	0.00
9/29/2025	14:00	water below gage		dry	--	7.61	54.86	--	--
11/11/2025	13:11	dry	--	dry	--	16.34	46.13	--	--

Table 7. Parameters used in 1DTempProV2 model, GSA Somavia Reach Study, Monterey County, CA.

Porosity (ϕ_s)	0.35
Thermal conductivity (λ_s)	2.00 W/(m °C)
Sediment heat capacity (c_s)	2×10^6 J/(m^3 °C)
Dispersivity (α)	0.01 m
Head difference (Δh)	0.60 m
Sensor distance (Δl)	0.60 m
Vertical hydraulic gradient ($i=\Delta h/\Delta l$)	1.00

Table 8. Root Mean Square (RMS) for temperature and specific discharge simulations using 1DTempProV2 with hydraulic conductivity (K) as the independent variable, GSA Somavia Reach Study, Monterey County, CA.

The yellow highlighted values show the lowest RMS for each temperature profiler data set indicating the best fit of modeled results to the measured data for the corresponding K. Bend 1A, Bend 2B, and Chualar A data sets had the best fit for each station.

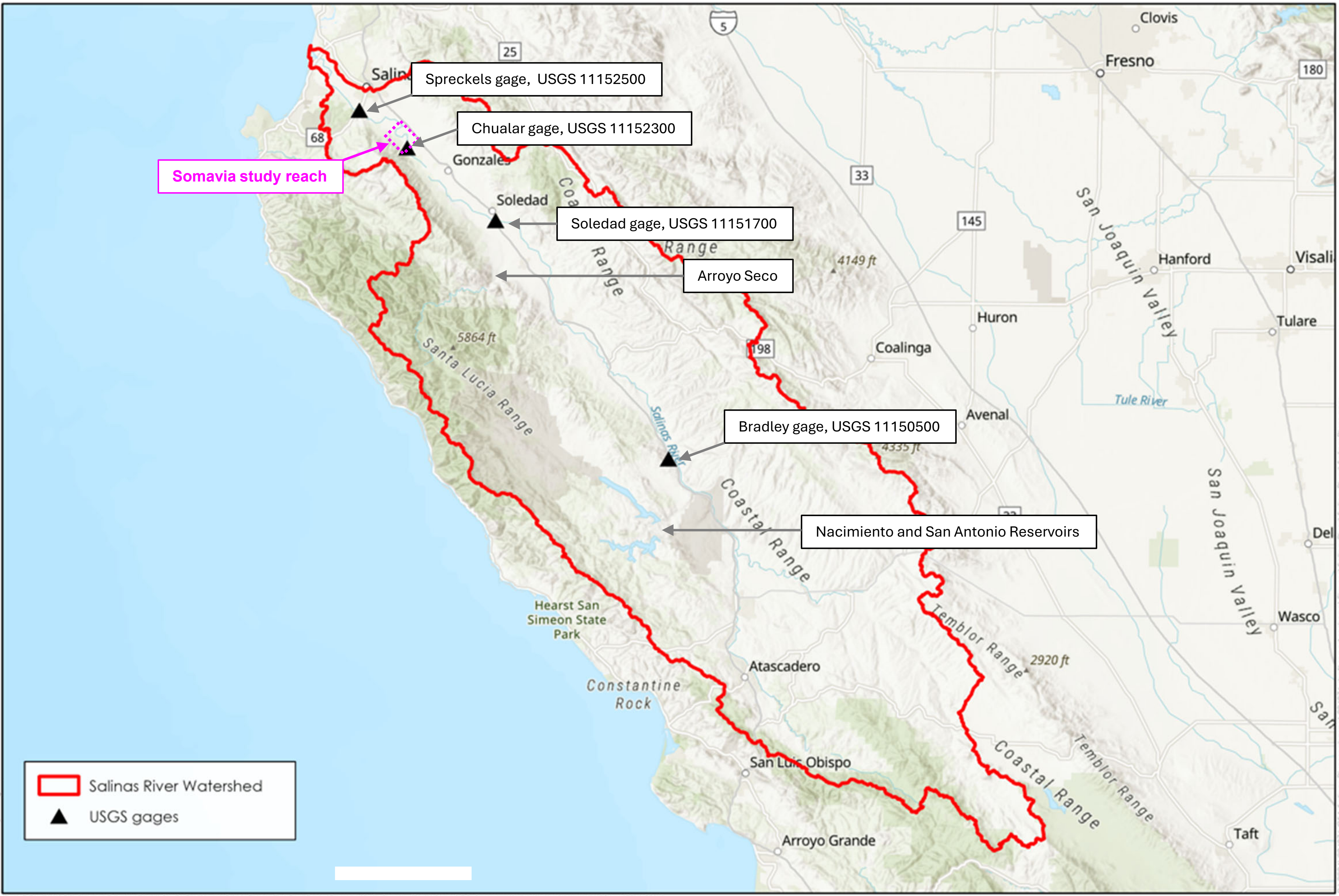
Hydraulic Conductivity (K) (m d^{-1})	**Root Mean Square (RMS)** (C°)					
	Bend 1A	Bend 1B	Bend 2A	Bend 2B [1]	Chualar A	Chualar B
0.001	--	--	0.294	**0.191**	0.227	0.646
0.01	0.501	0.610	0.296	0.534	0.224	0.640
0.1	0.454	0.594	0.334	0.268	**0.214**	0.592
0.5	0.299	0.687	0.512	0.534	0.343	0.545
1.0	**0.232**	0.918	0.616	0.745	0.437	0.717
3.96 *[2]*	0.368	1.236	0.727	0.933	0.529	1.094
13.11 *[2]*	0.428	1.297	0.746	0.961	0.546	1.179

Notes:

[1] No data before May 2025 due to sensor malfunction

[2] Hydraulic conductivity results of infiltrometer tests in river alluvial sands.

FIGURES



Esri, CGIAR, USGS, Fresno County Dept. PWP, California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS

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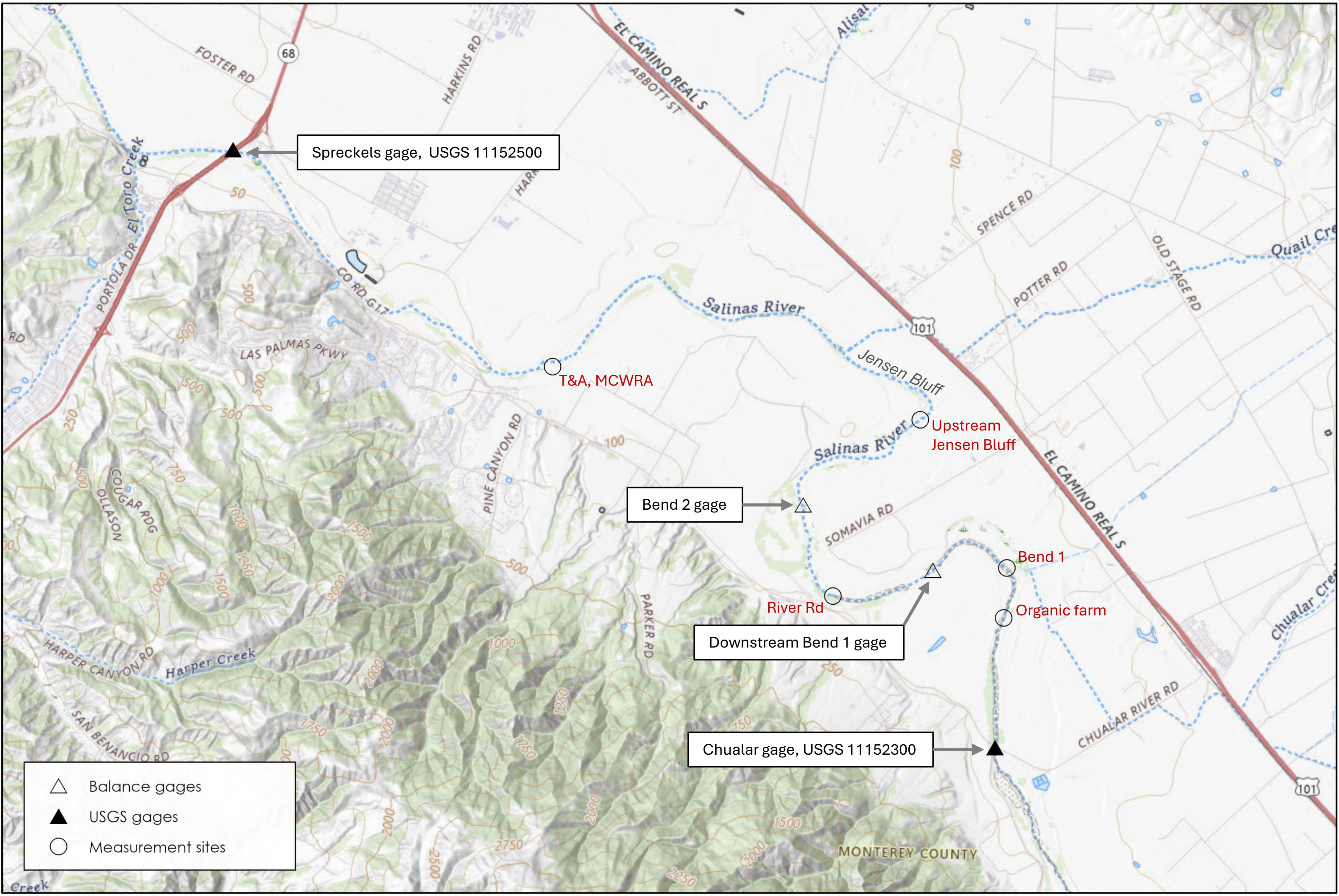
Balance Hydrologics

PN: 224076
DATE: November 25, 2025

N
0 100 200 Feet

FIGURE 1 - SALINAS RIVER WATERSHED

GSA Salinas River Recharge
Monterey County, CA



P:\2024\224076 GSA Salinas River recharge\Map Figure drafts\SalinasRiver\SalinasRiver.aprx

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth

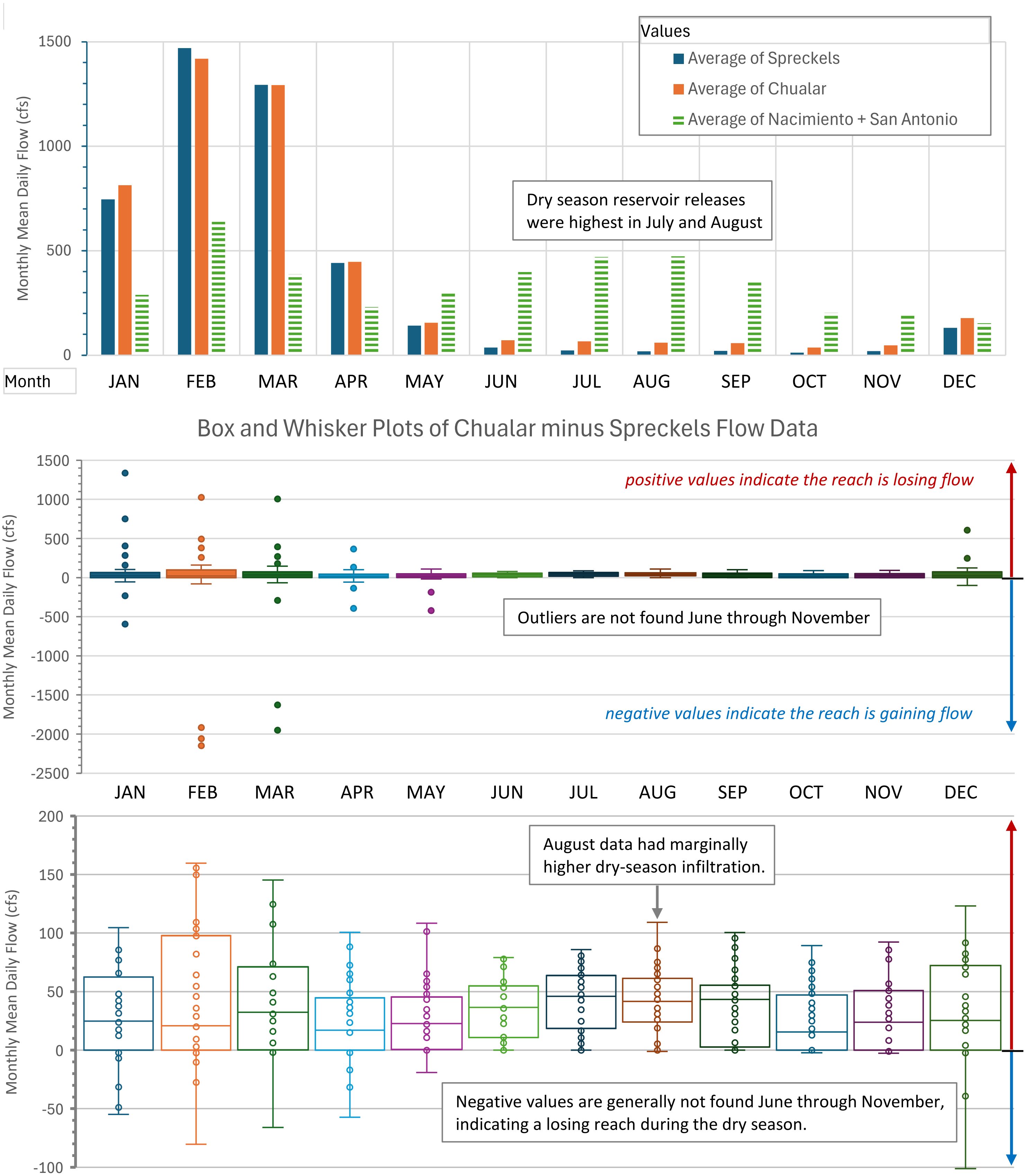
Balance Hydrologics

PN: 224076
DATE: December 03, 2025

N
0 100 200
Feet

FIGURE 2 - SOMAVIA STUDY REACH

GSA Salinas River Recharge
Monterey County, CA



Dry season reservoir releases were highest in July and August

positive values indicate the reach is losing flow

Outliers are not found June through November

negative values indicate the reach is gaining flow

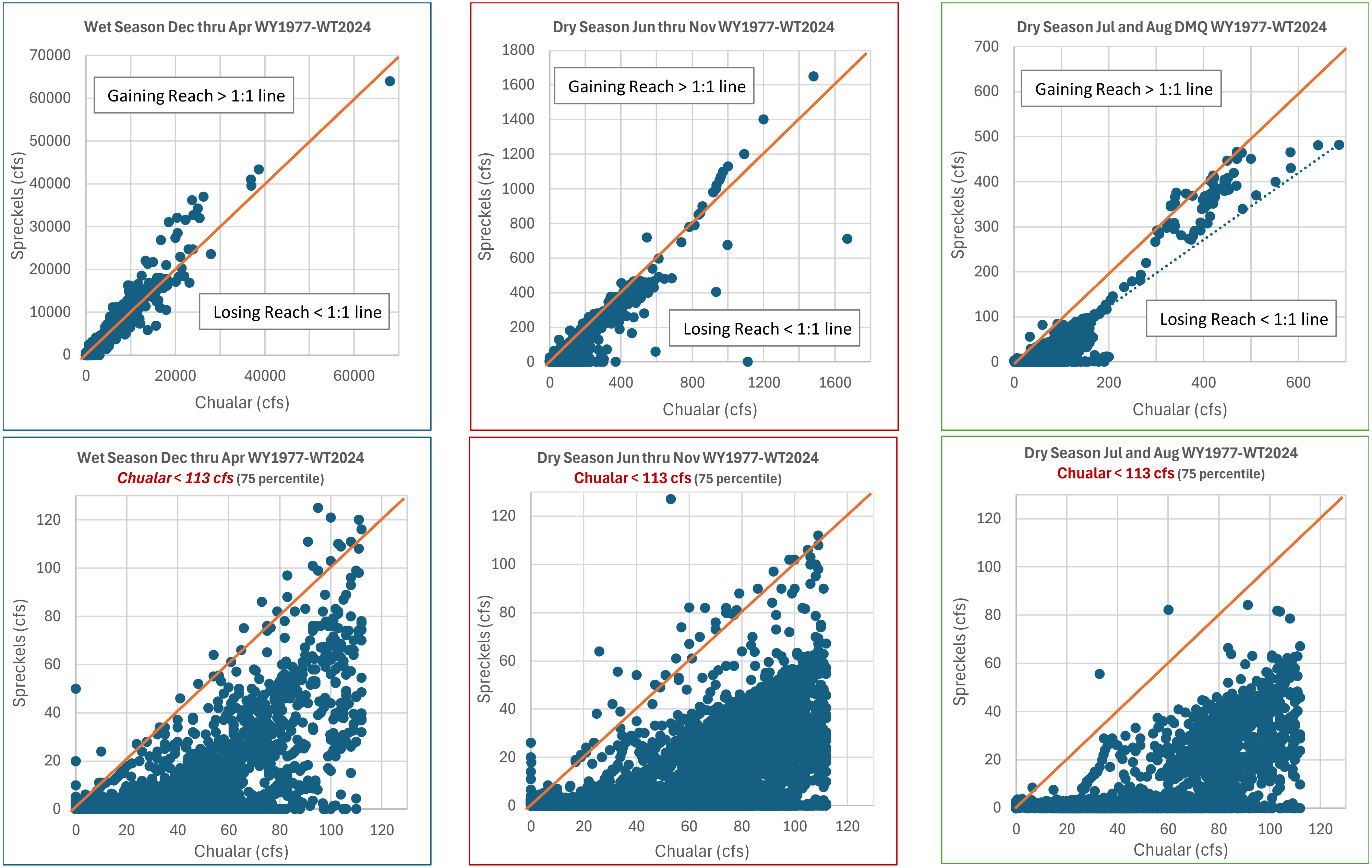
August data had marginally higher dry-season infiltration.

Negative values are generally not found June through November, indicating a losing reach during the dry season.

Balance Hydrologics

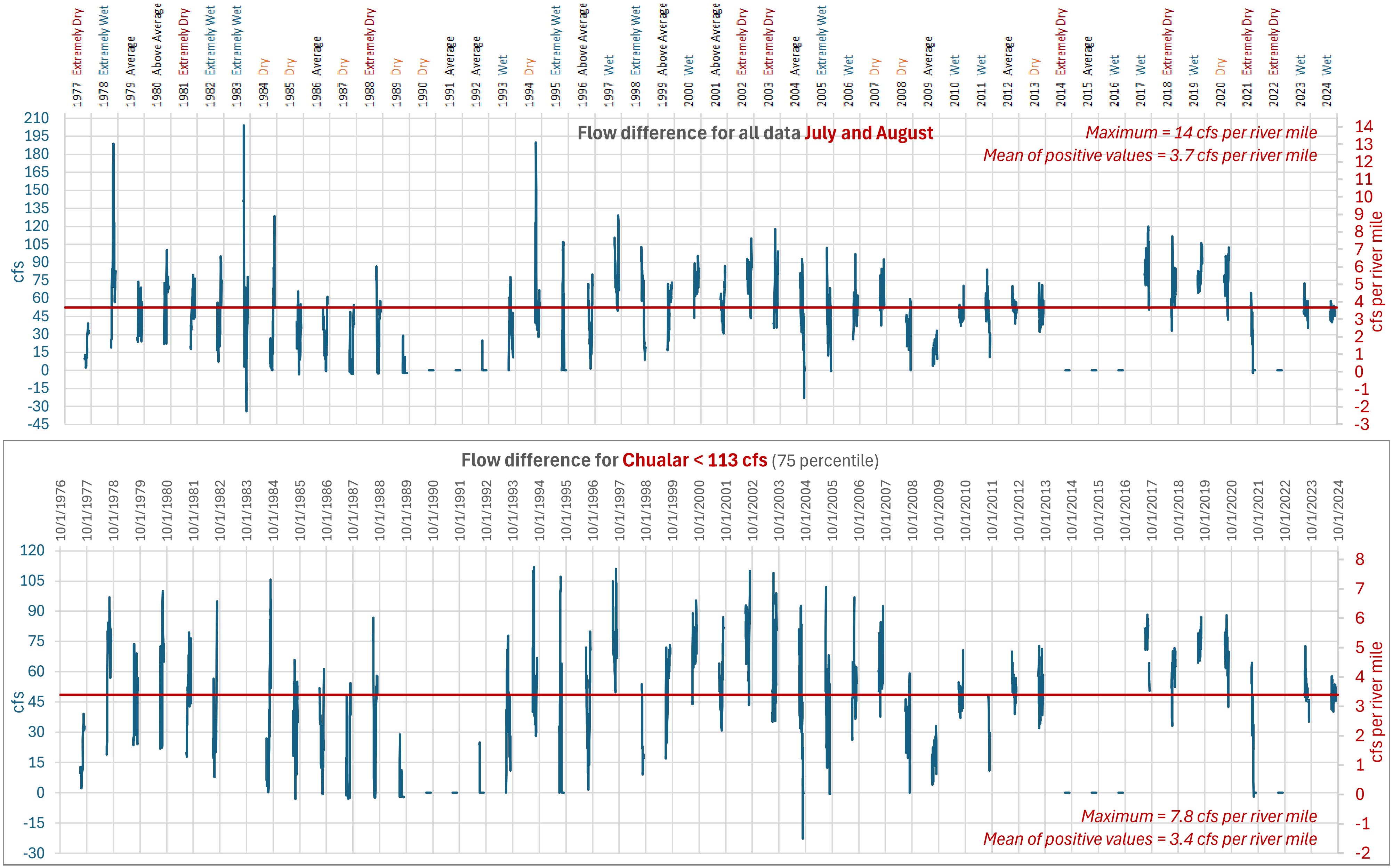
Figure 3. Analysis of mean daily flow data, 1977-2024, USGS Chualar and Spreckels gages and reservoir releases, GSA Somavia Reach study, Monterey County, CA. The box and whisker plots show data quartiles (or percentiles), median, skewness, and outliers in Chualar minus Spreckels flow data. Positive values indicate a losing reach, found constantly during dry-season baseflow reservoir releases. The wet season data show considerably more variability.

224076 USGS Daily Mean 2025-12-05.xlsx, monthly and annually MDQ



Balance Hydrologics

Figure 4. USGS gaged daily mean flow, Chualar station versus Spreckels station for wet-season, dry-season, and dry-season months July and August only. Flow losses are well correlated during July and August, a period when dry-season reservoir releases are largest. The reach is typically losing at baseflows, shown as flows at Chualar less than less than 113 cfs (75th percentile).

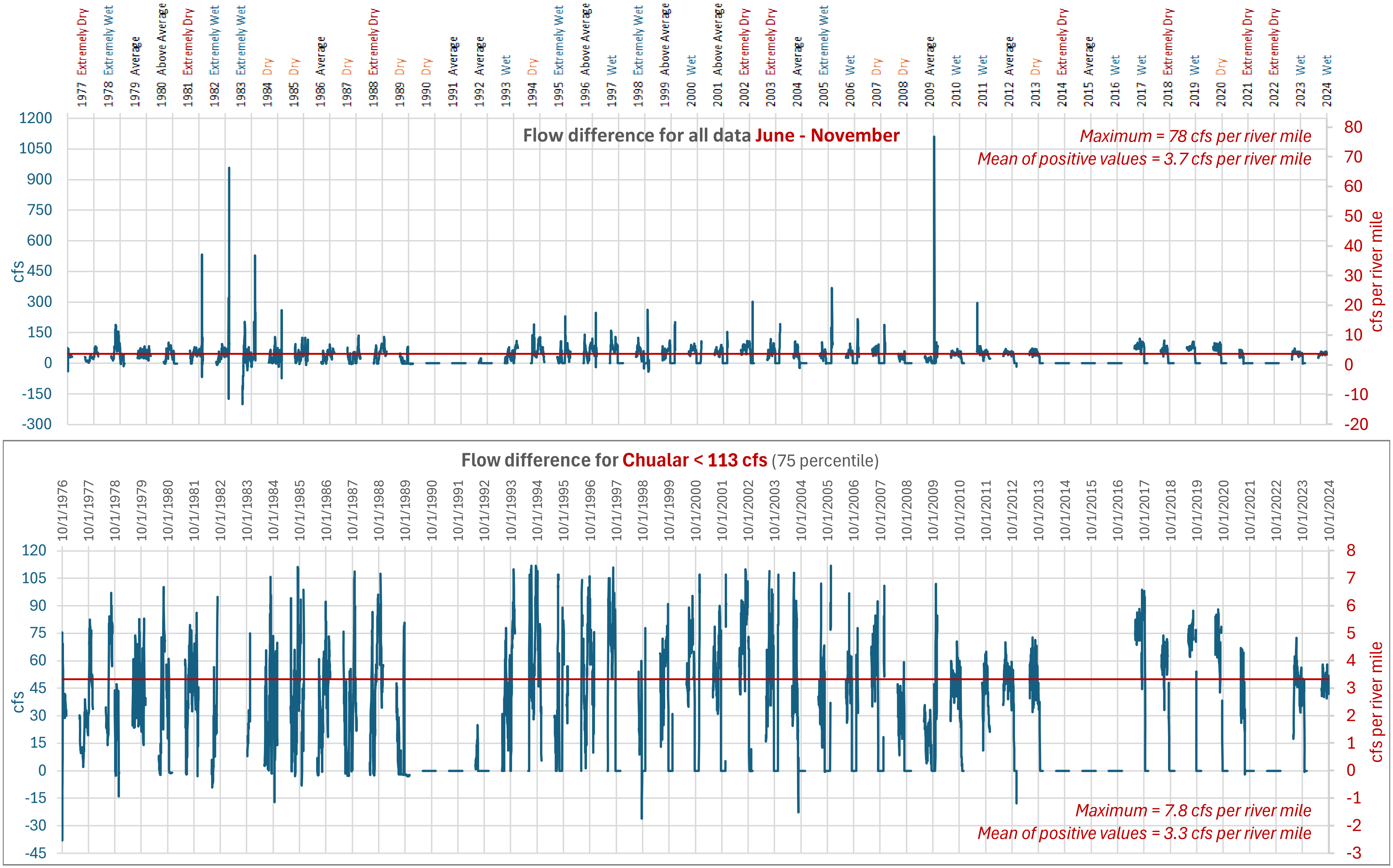


Balance Hydrologics

Figure 5. USGS gaged daily mean flow, Chualar station minus Spreckels station for dry-season months July and August when reservoir releases and river flow differences are largest.

Water year type classification for precipitation: Extremely Dry <70%; Dry 70-90%; Average 90-110%; Above Average 110-125%; Wet 125-160%; Extremely Wet >160%.

224076 USGS Daily Mean 2025-12-10.xlsx, Dry Season Jul-Aug chart, 12/10/2025

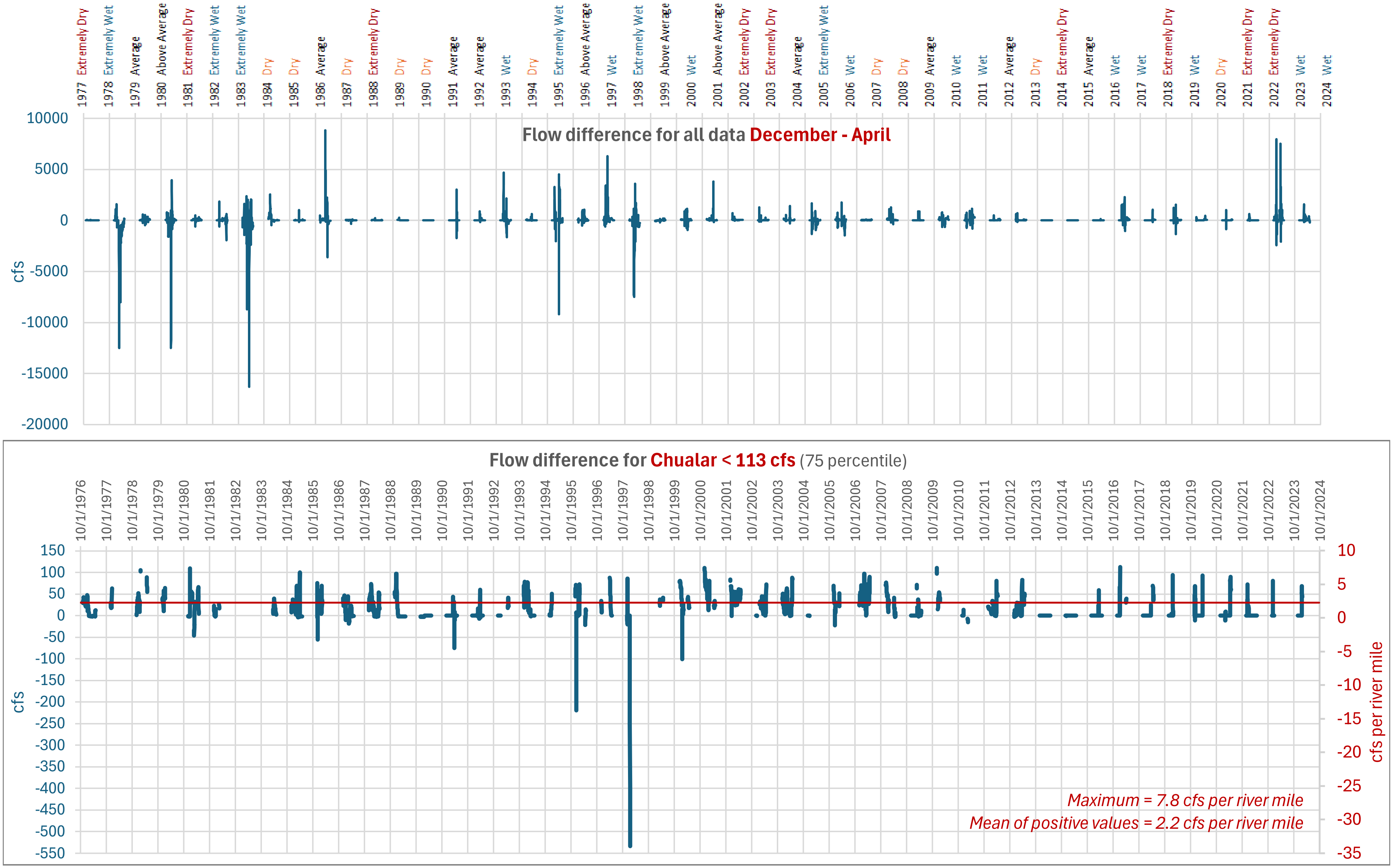


Balance Hydrologics

Figure 6. USGS gaged daily mean flow, Chualar station minus Spreckels station for dry-season months June through November.

Water year type classification for precipitation: Extremely Dry <70%; Dry 70-90%; Average 90-110%; Above Average 110-125%; Wet 125-160%; Extremely Wet >160%.

224076 USGS Daily Mean 2025-12-05.xlsx, Dry Season Jun-Nov chart, 12/5/2025



Maximum = 7.8 cfs per river mile

Mean of positive values = 2.2 cfs per river mile

Balance Hydrologics

Figure 7. USGS gaged daily mean flow, Chualar station minus Spreckels station for wet-season months December through April.

Water year type classification for precipitation: Extremely Dry <70%; Dry 70-90%; Average 90-110%; Above Average 110-125%; Wet 125-160%; Extremely Wet >160%.

224076 USGS Daily Mean 2025-12-05.xlsx, Wet Season Dec-Apr chart, 12/5/2025

Balance Hydrologics

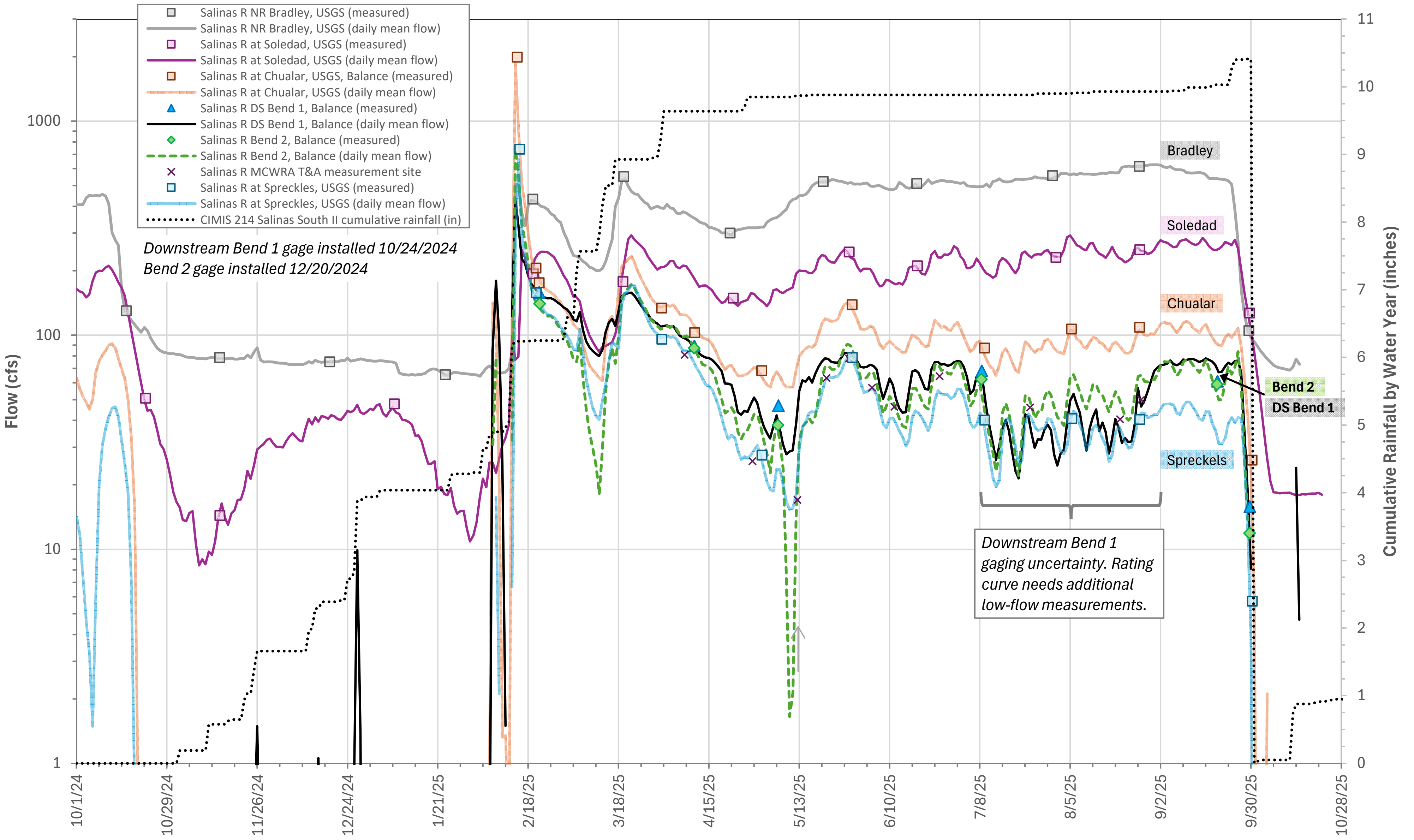
Figure 8. Example alluvial deposits found at the downstream of Bend #1 site, Somavia Reach of Salinas River, Chualar, Monterey County, CA. A silt-clay of about one foot in depth overlying fine to medium alluvial sand.

Figure 9. Soil infiltration test sites conducted downstream of Bend #1 on January 15, 2025, Somavia Reach of Salinas River, Chualar, Monterey County, CA. 6- to 8-inch deep desiccation cracks were found in alternate-channel silt-clay deposits but not on the upper overbank surface.

Balance Hydrologics

Figure 10. Single-ring and double-ring infiltrometer tests downstream of Bend #1 on January 15, 2025, Somavia Reach of Salinas River, Chualar, Monterey County, CA. The single-ring infiltrometer was 16 inches diameter, and the double-ring infiltrometer was 12 inches and 20 inches diameter.

Preliminary data - subject to revision

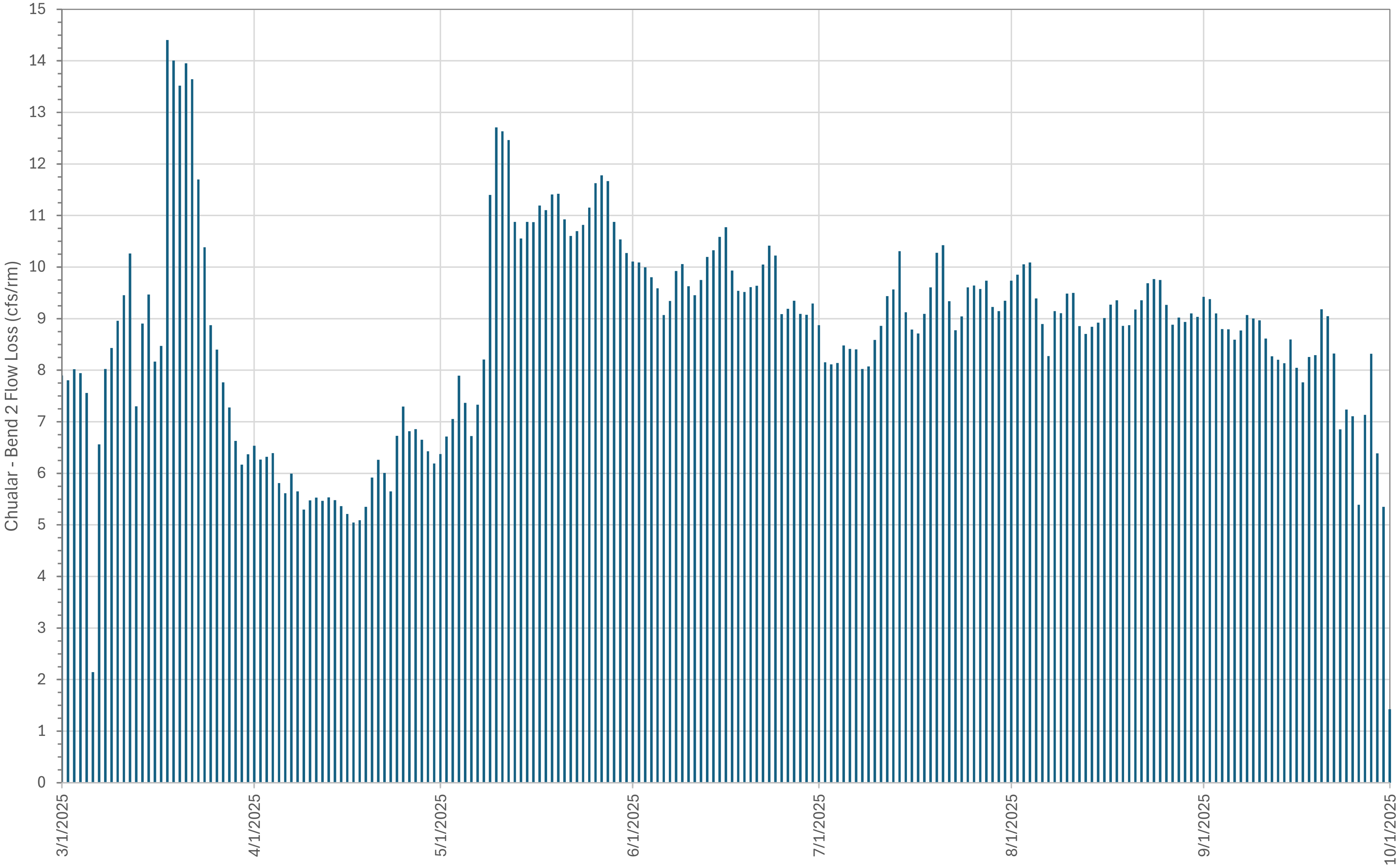


Downstream Bend 1 gage installed 10/24/2024
Bend 2 gage installed 12/20/2024

Downstream Bend 1 gaging uncertainty. Rating curve needs additional low-flow measurements.

Balance Hydrologics

Figure 11. Daily mean flow at Somavia Reach Downstream Bend 1 and Bend 2 temporary stations relative to USGS data, water year 2025, Salinas River, Monterey County, CA Flow at Downstream Bend 1 was extrapolated above 158.4 cfs and below 15.8 cfs. Flow at Bend 2 was extrapolated above 140.4 cfs and below 11.9 cfs. At the Downstream Bend 1 station from 8/30/25 to 9/19/25 mud appears to have muted the sensor response. At the Bend 2 station from 5/9/25 to 5/12/25 the water level was below the sensor.



Balance Hydrologics

Figure 12. Daily mean flow loss per mile from Downstream of USGS Chualar gage to Bend 2 gage, Salinas River Somavia Reach, Monterey County, CA.

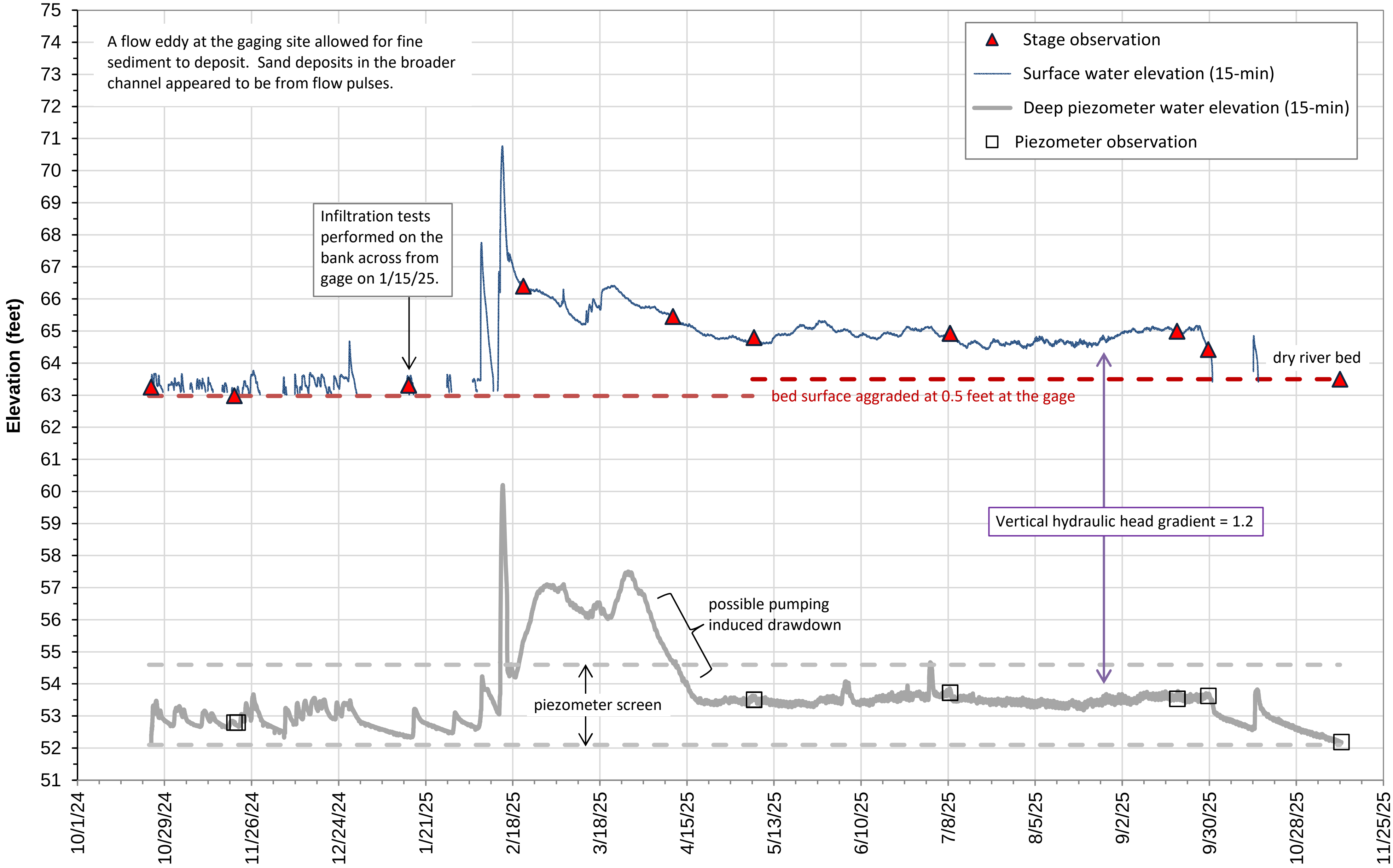


Figure 13. Water surface elevation of the river and in the deep piezometer at Downstream Bend 1 gage during water year 2025, Salinas River GSA Somavia Reach study, Monterey County, CA.
Instrumentation installed 10/24/2024. Drive-point piezometers were driven into the bed without a surface seal. Shallow piezometer did not function correctly; data not shown.

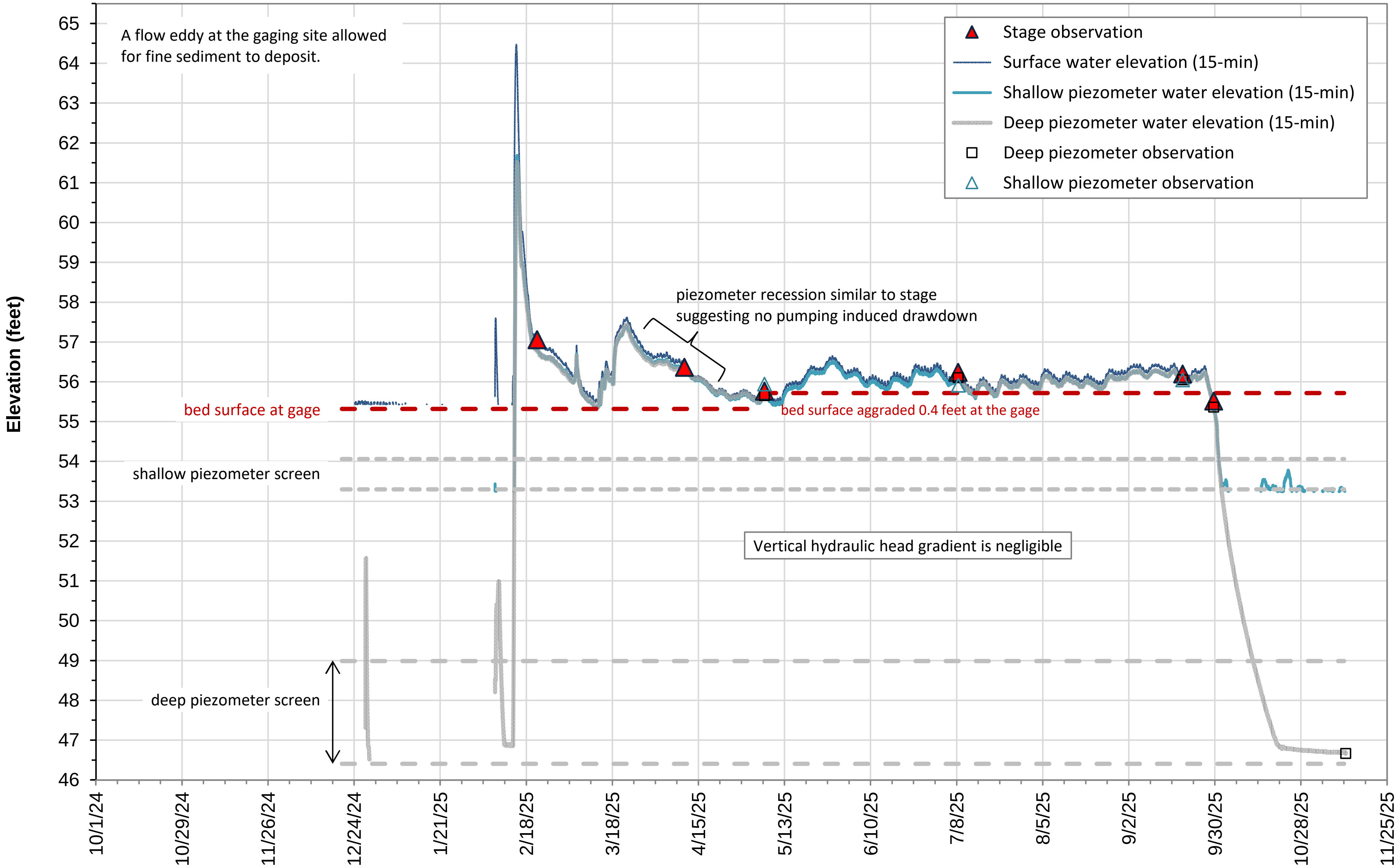
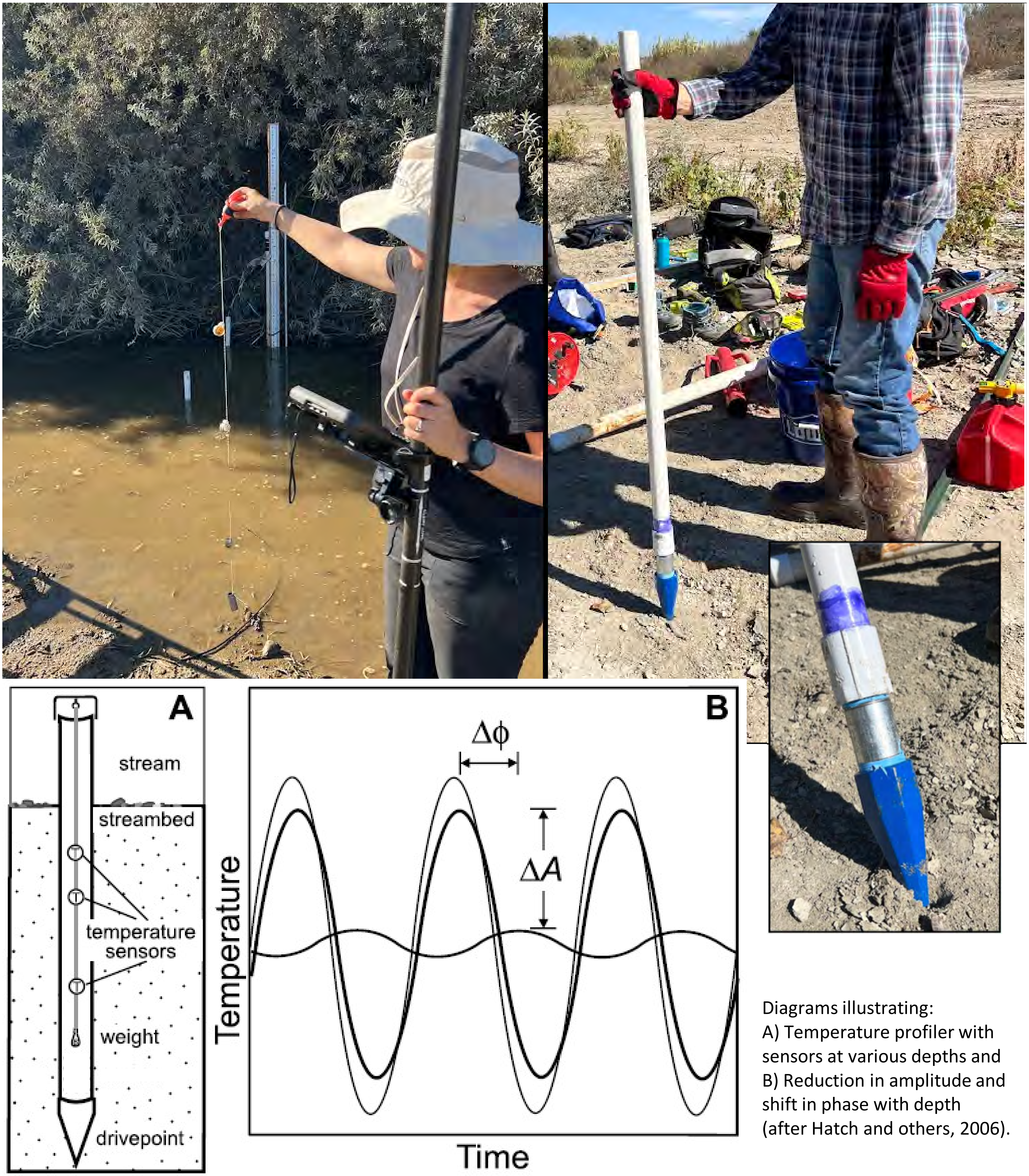


Figure 14. Water surface elevation of the river and in the piezometers at Bend 2 gage during water year 2025, Salinas River GSA Somavia Reach study, Monterey County, CA.
Instrumentation installed 12/20/2024. Drive-point piezometers were driven into the bed without a surface seal.

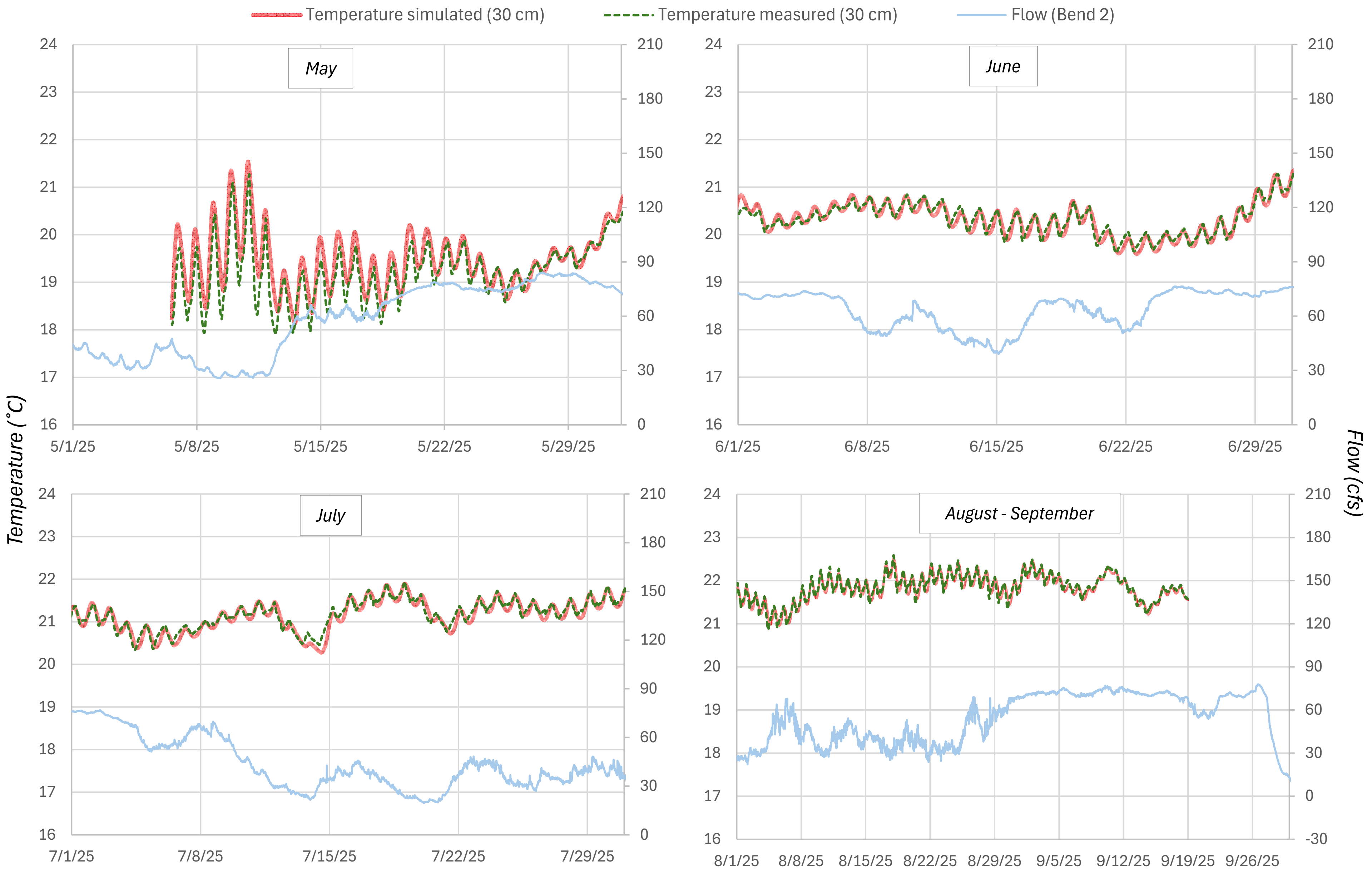


Diagrams illustrating:
A) Temperature profiler with sensors at various depths and
B) Reduction in amplitude and shift in phase with depth
(after Hatch and others, 2006).

Figure 15. Temperature profilers installed to collect riverbed thermal data for analysis to calculate infiltration, GSA Salinas River Somavia Reach study, Monterey County, CA. Onset Tidbit loggers recorded temperature at a 15-minute interval at depths 10, 30, and 70 cm from bed surface.

Balance Hydrologics

Figure 16. 1DTempProV2 simulated temperature at 30 cm depth at Downstream of Bend 1 station Profiler A, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic Conductivity K = 1.0 m/d; Model fit RMS = 0.232 °C



Balance Hydrologics

Figure 17. 1DTempProV2 simulated temperature at 30 cm depth at Bend 2 station Profiler B, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic Conductivity K = 0.001 m/d; Model fit RMS = 0.191 °C

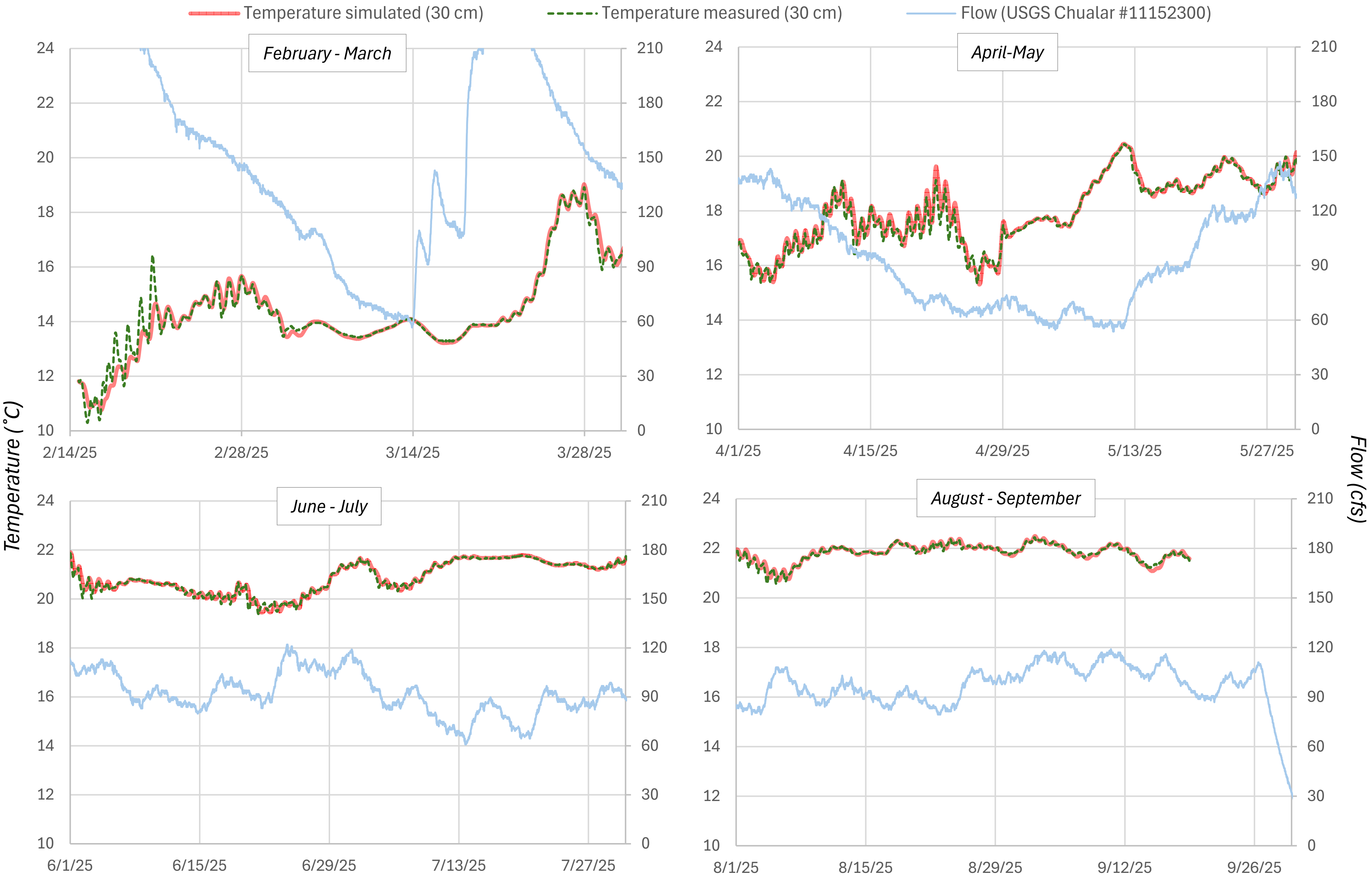
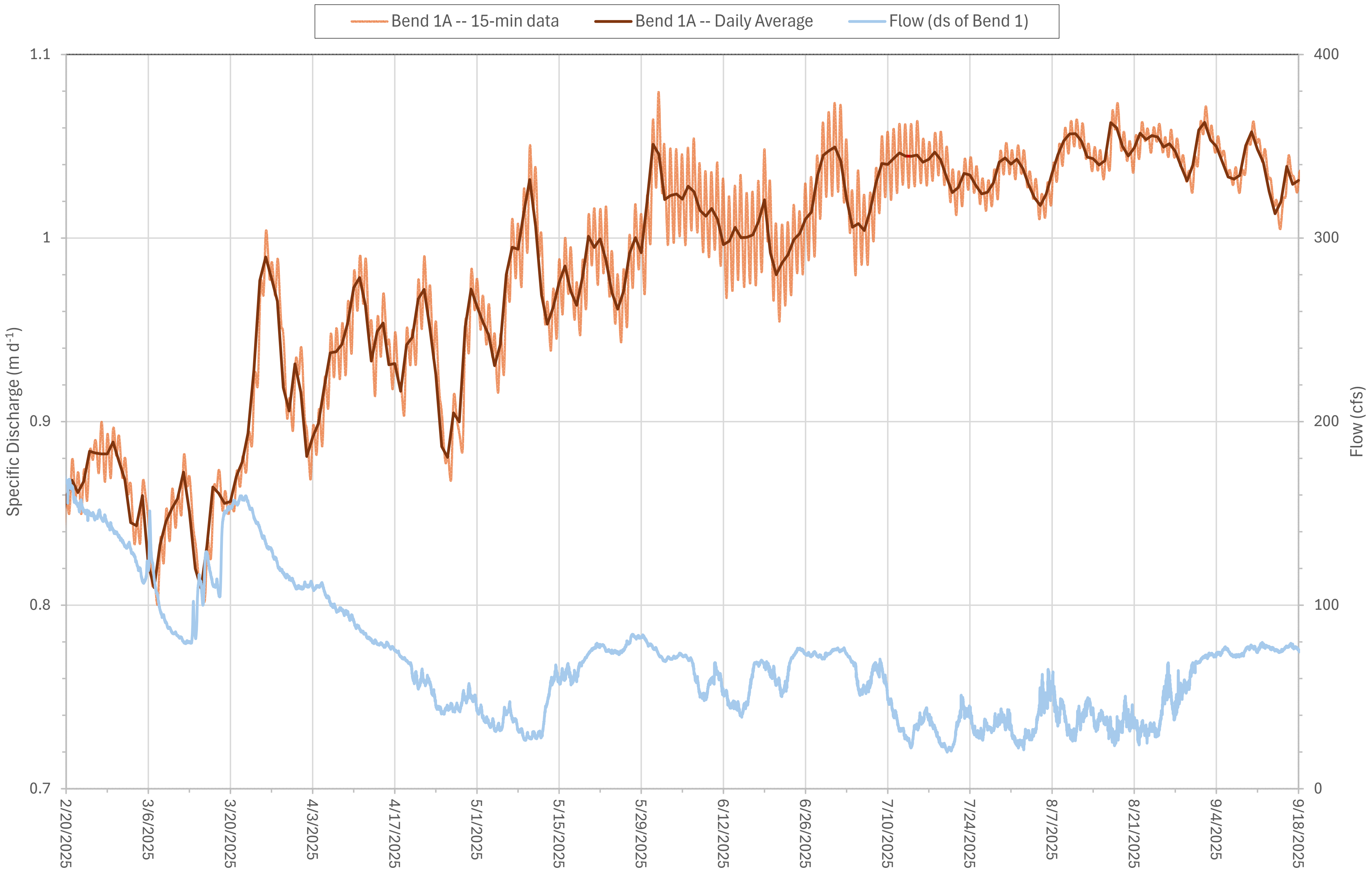


Figure 18. 1DTempProV2 simulated temperature at 30 cm depth at Chualar station Profiler A, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic Conductivity K = 0.1 m/d; Model fit RMS = 0.214 °C



Balance Hydrologics

Figure 19. 1DTempProV2 simulated specific discharge at Downstream of Bend 1 station Profiler A, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic conductivity, K = 1.0 m/d; model fit RMS = 0.232 °C

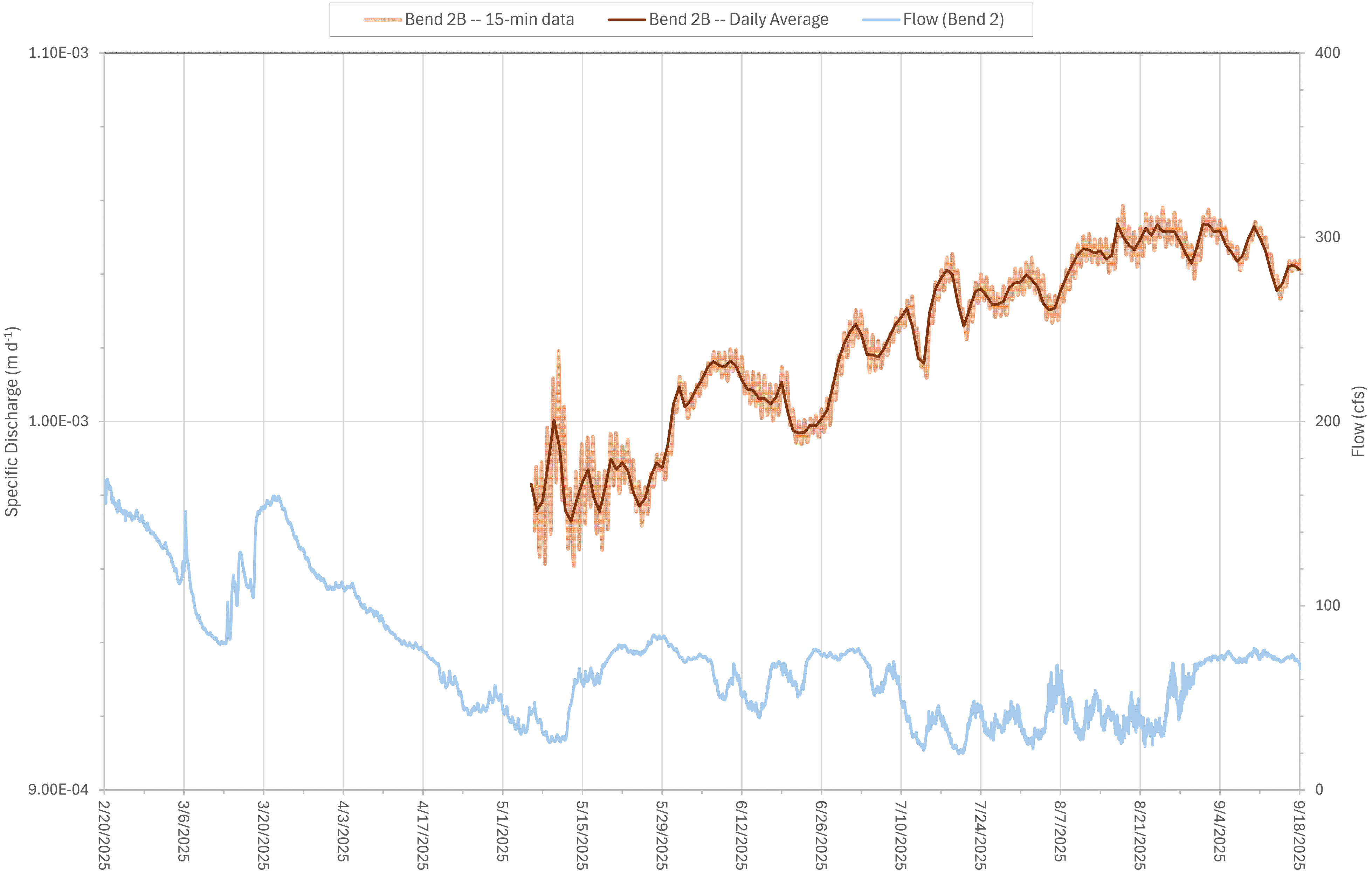
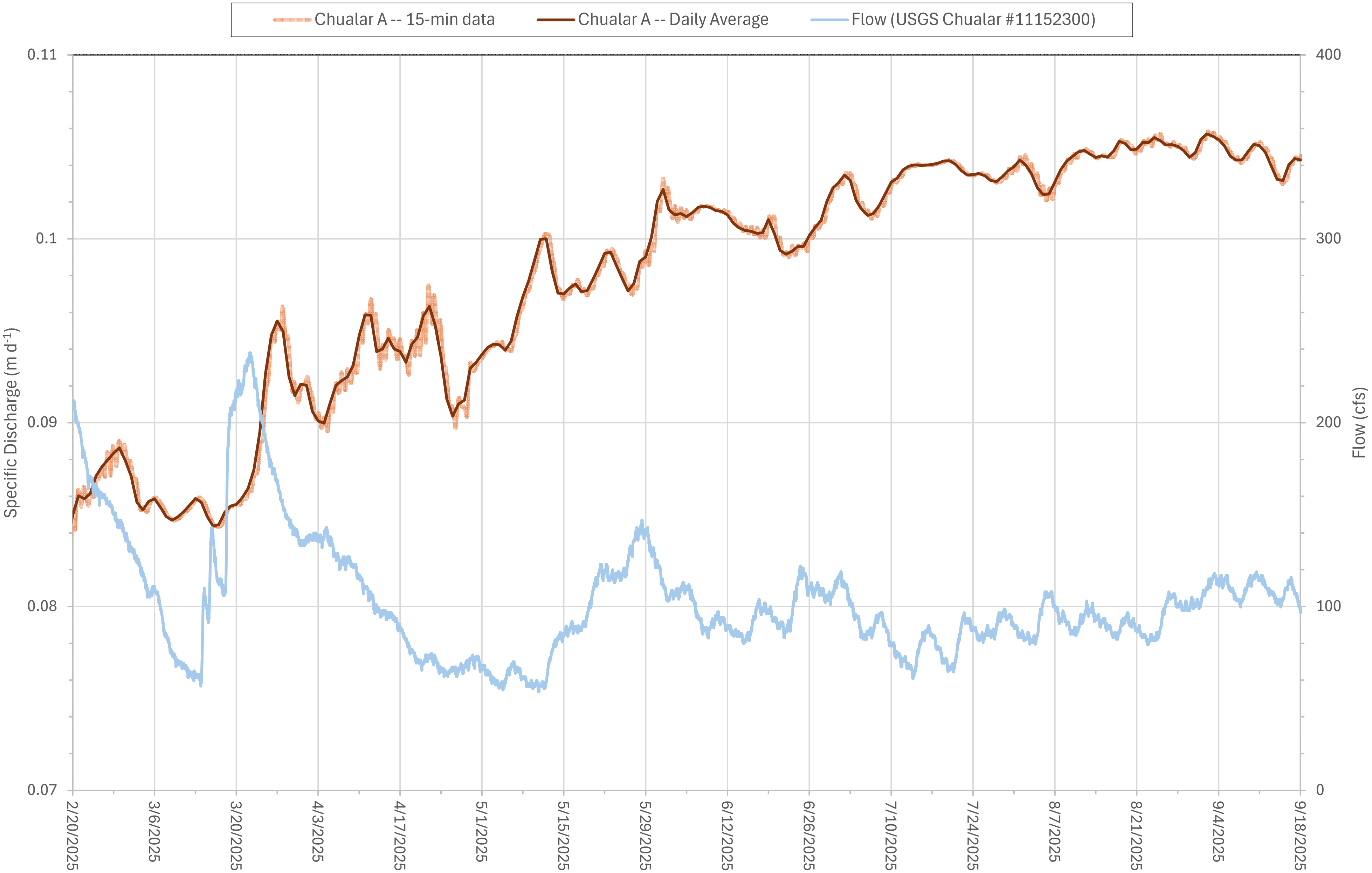
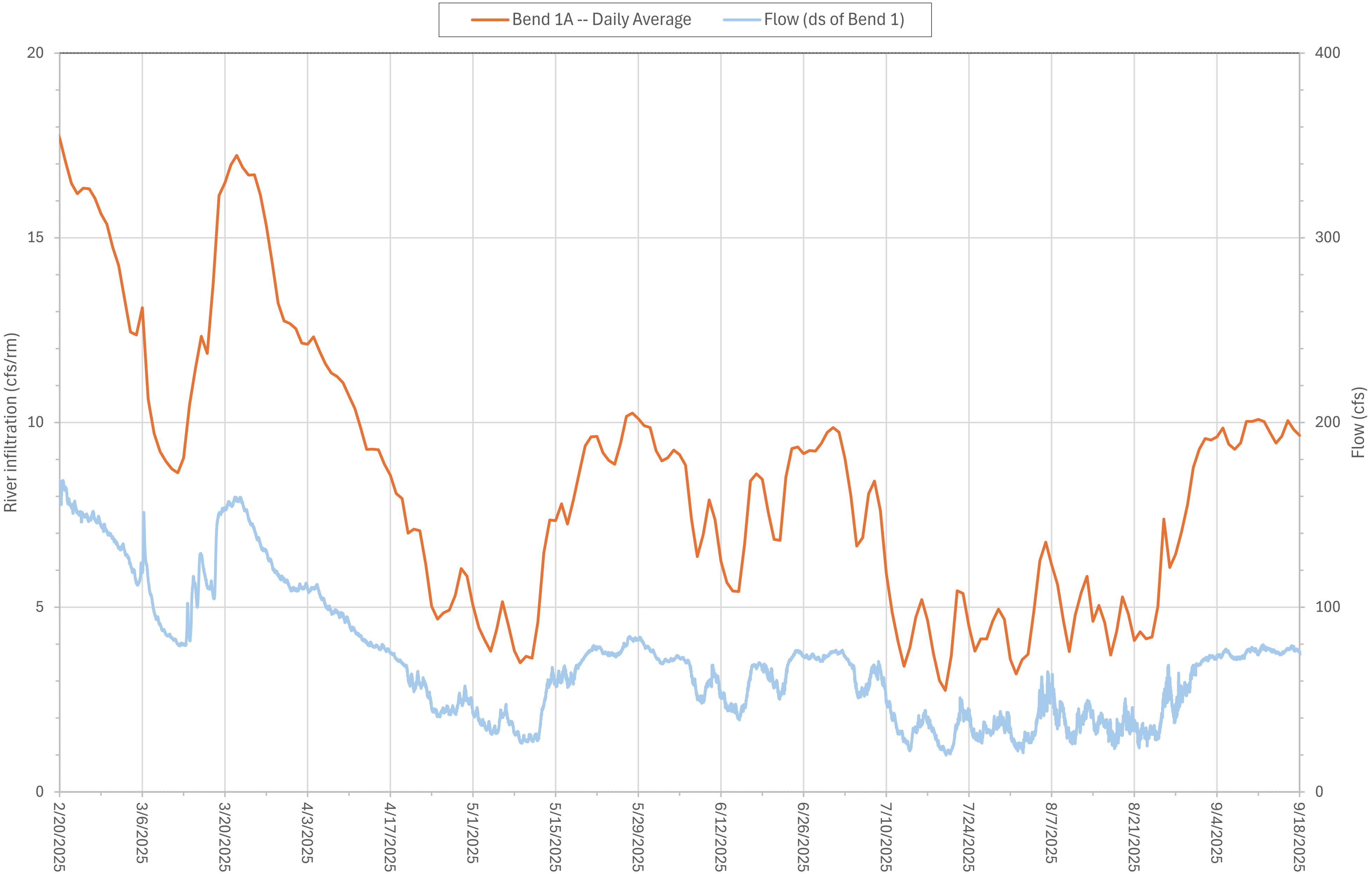


Figure 20. 1DTempProV2 simulated specific discharge at Bend 2 station Profiler B, GSA Somavia Reach Study, Monterey County, CA. The time series begins in May due to a logger malfunction.
Hydraulic conductivity, K = 0.001 m/d; model fit RMS = 0.191 °C



Balance Hydrologics

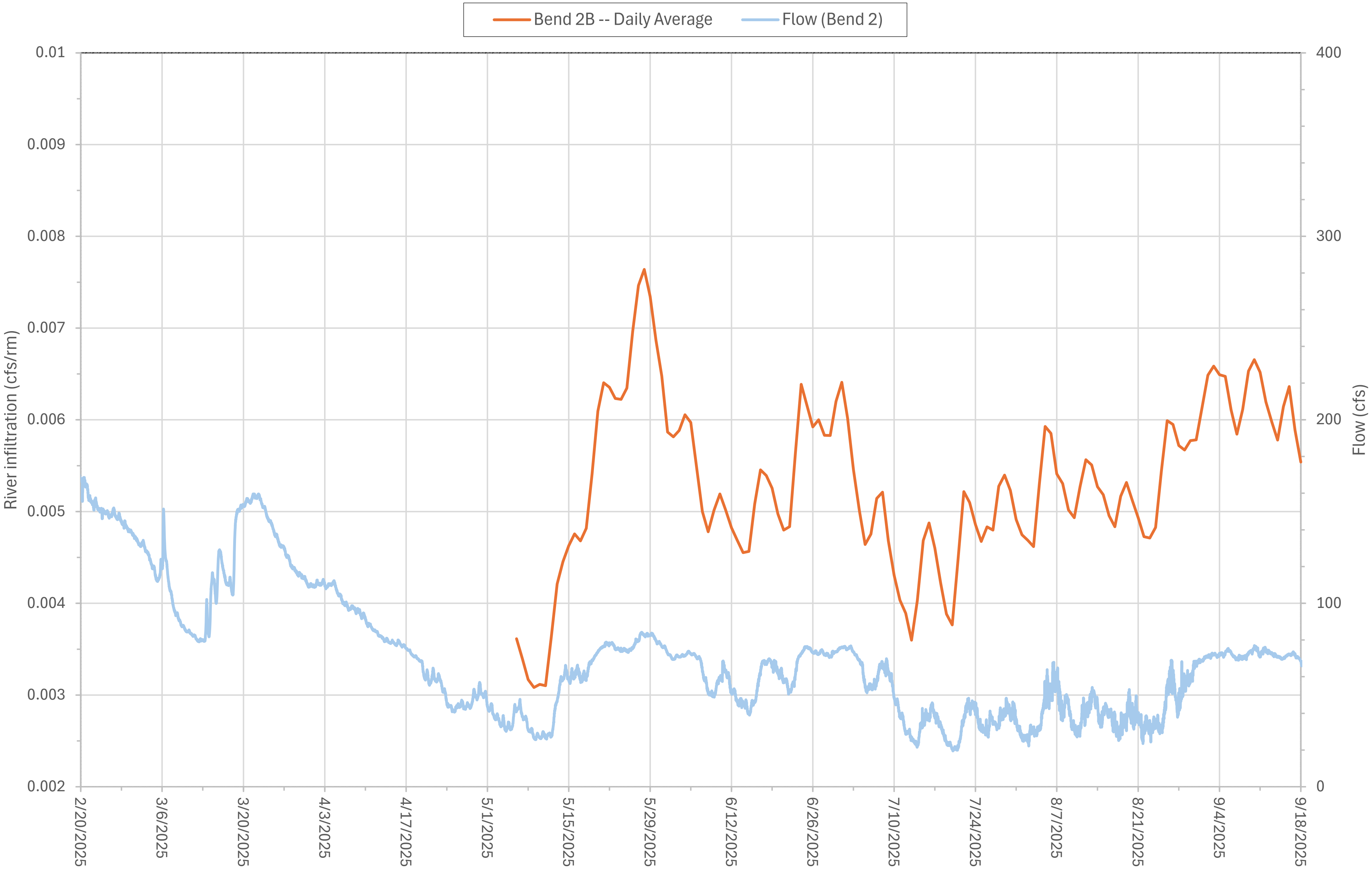
Figure 21. 1DTempProV2 simulated specific discharge at Chualar station Profiler A, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic conductivity, K = 0.1 m/d; model fit RMS = 0.214 °C



Balance Hydrologics

Figure 22. 1DTempProV2 simulated riverbed seepage at Downstream of Bend 1 station Profiler A, GSA Somavia Reach Study, Monterey County, CA.
Hydraulic conductivity, K = 1.0 m/d; model fit RMS = 0.232 °C; modeled specific discharge in m/day was converted to cfs/rm using an empirical correlation at each gage of wetted perimeter to gaged flow.

224076 1DTempPro Vertical flow calcs_2026-03-11.xlsx, Chart q-Bend1A (cfs per rm)



Balance Hydrologics

Figure 23. 1DTempProV2 simulated riverbed seepage at Bend 2 station Profiler B, GSA Somavia Reach Study, Monterey County, CA. The time series begins in May due to a logger malfunction.

Hydraulic conductivity, K = 0.001 m/d; model fit RMS = 0.191 °C; modeled specific discharge in m/day was converted to cfs/rm using an empirical correlation at each gage of wetted perimeter to gaged flow.

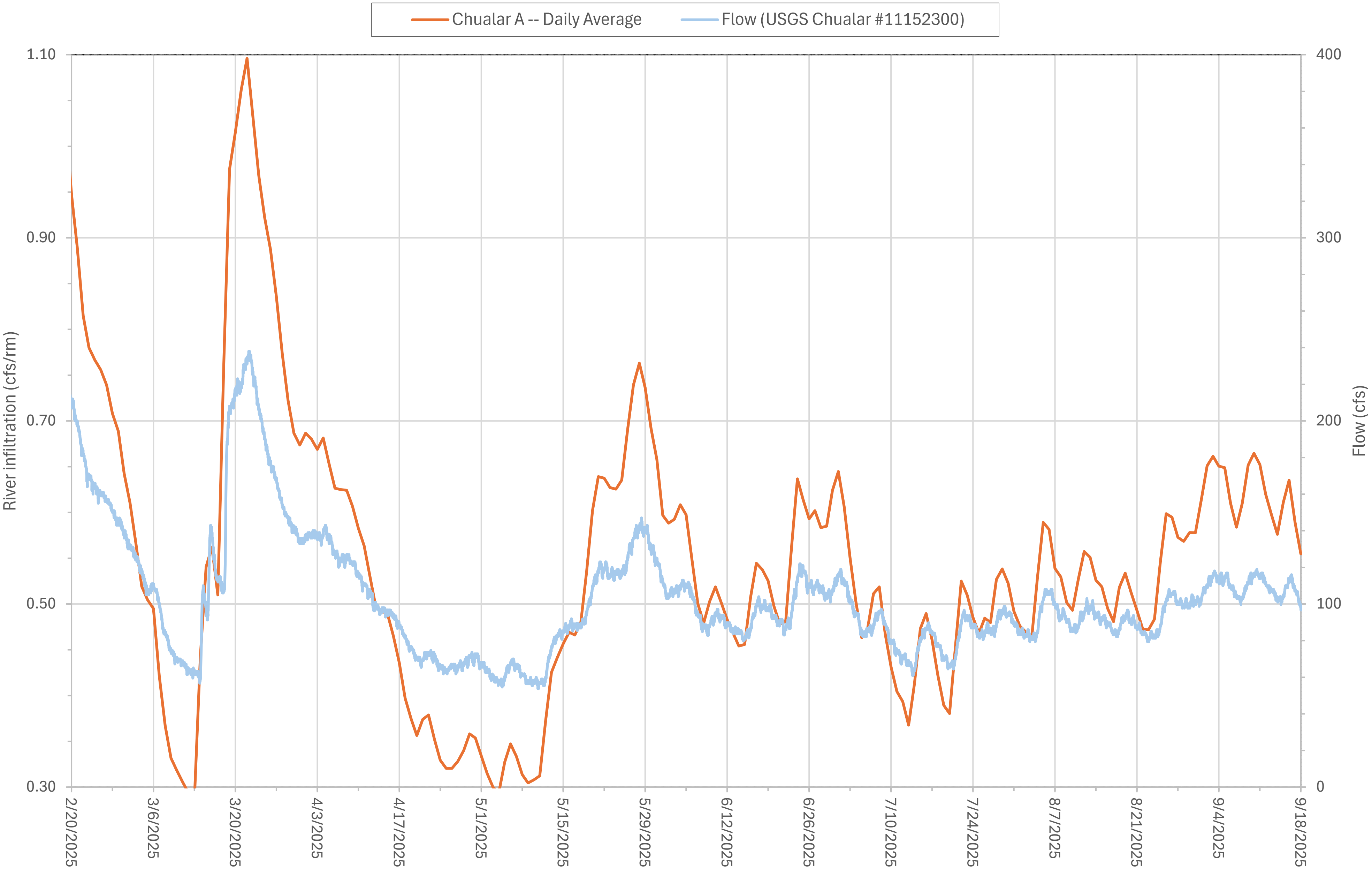


Figure 24. 1DTempProV2 simulated riverbed seepage at Chualar station Profiler A, GSA Somavia Reach Study, Monterey County, CA.

Hydraulic conductivity, K = 0.1 m/d; model fit RMS = 0.214 °C; modeled specific discharge in m/day was converted to cfs/rm using an empirical correlation at each gage of wetted perimeter to gaged flow.

224076 1DTempPro Vertical flow calcs_2026-03-11.xlsx, Chart q-ChualarA (cfs per rm)

APPENDICES

APPENDIX A

Historical monthly rainfall (1977 to 2025)

Appendix A. Monthly Rainfall at Salinas Airport, Monterey County, CA

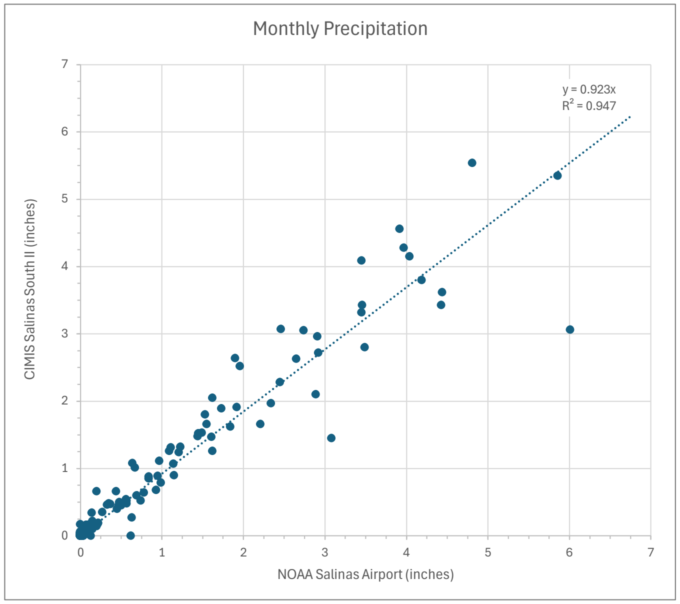
NOAA Station No. USW00023233

WATER YEAR	OCT (inches)	NOV (inches)	DEC (inches)	JAN (inches)	FEB (inches)	MAR (inches)	APR (inches)	MAY (inches)	JUN (inches)	JUL (inches)	AUG (inches)	SEP (inches)	TOTAL (inches)	*% of MEAN*	WATER YEAR TYPE
1977	0.34	0.6	1.81	0.94	0.31	0.97	0.26	0.77	0.1	0	0	0.13	*6.23*	52%	Extremely dry
1978	0.02	0.46	3.92	4.55	3.95	3.5	3.4	0.01	0	0	0	0.22	*20.03*	166%	Extremely Wet
1979	0	1.87	0.81	3.27	2.71	1.51	0.31	0.03	0	0.11	0	0	*10.62*	88%	Dry
1980	1.08	1.22	2.04	2.96	2.75	1.09	0.49	0.09	0.03	0.56	0	0.02	*12.33*	102%	Average
1981	0	0	0.87	0.67	1.34	2.67	0.84	0	0	0	0	0	*6.39*	53%	Extremely dry
1982	0.84	3.33	1.77	3.85	1.64	4.53	1.41	0	0.32	0	0.02	1.15	*18.86*	157%	Wet
1983	1.46	4.77	1.59	3.21	3.95	4.95	1.63	0.06	0.04	0	0.11	1.07	*22.84*	190%	Extremely Wet
1984	0.01	2.96	1.89	0.1	1.57	0.86	0.46	0.02	0.06	0.01	0	0.06	*8*	66%	Extremely dry
1985	1.06	2.42	1.03	0.55	0.89	2.48	0.31	0.1	0.07	0.03	0	0.04	*8.98*	75%	Dry
1986	0.03	1.51	0.41	0.95	2.51	4.39	0.46	0.04	0	0.01	0.02	0.91	*11.24*	93%	Average
1987	0.02	0.09	0.56	2.33	3.48	2.1	0.21	0.02	0	0.01	0	0	*8.82*	73%	Dry
1988	0.65	1.33	2.05	0.6	0.38	0.02	1.16	0.45	0.09	0	0	0	*6.73*	56%	Extremely dry
1989	0	1.25	2.44	0.65	1.02	2.18	0.42	0.08	0	0	0	0.92	*8.96*	74%	Dry
1990	0.85	1.01	0.05	1.6	1.43	1.18	0.52	1.38	0	0	0	0.14	*8.16*	68%	Extremely dry
1991	0.18	0.18	1.45	0.25	1.49	5.99	0.21	0.13	0	0	0.16	0.02	*10.06*	84%	Dry
1992	0.79	0.18	2.08	1.45	4.48	2.46	0.09	0	0.02	0	0	0	*11.55*	96%	Average
1993	0.52	0.03	2.58	6.12	3.45	2.25	0.22	0.78	0.27	0	0	0.01	*16.23*	135%	Wet
1994	0.12	0.74	1.18	1.76	2.5	0.55	1.13	1.23	0.02	0	0	0.05	*9.28*	77%	Dry
1995	0.33	2.58	1.72	7.81	0.69	5.31	1.62	0.26	0.55	0	0	0	*20.87*	173%	Extremely Wet
1996	0	0	2.12	2.69	4.26	2.08	0.73	1	0	0	0	0.02	*12.9*	107%	Average
1997	0.59	3.09	4.96	6.72	0.1	0.07	0.31	0.03	0.05	0	0.01	0	*15.93*	132%	Wet
1998	0.1	4.17	2.52	5.36	9.96	2.89	2.01	1.91	0.11	0	0	0.07	*29.1*	242%	Extremely Wet
1999	0.53	2.33	0.87	2.59	3.05	1.8	1.45	0.03	0.1	0	0.01	0	*12.76*	106%	Average
2000	0.12	1.14	0.07	4.89	4.24	1.74	0.43	0.59	0.01	0.04	0.11	0.09	*13.47*	112%	Above Average
2001	2.54	0.19	0.74	2.85	2.96	1.58	1.82	0	0	0	0	0.06	*12.74*	106%	Average
2002	0.03	0.91	1.62	0.16	0.31	0.4	0.13	0.03	0	0	0	0	*3.59*	30%	Extremely dry
2003	0	0.93	2.79	0.68	0.67	0.58	1.18	0.19	0	0	0.09	0	*7.11*	59%	Extremely dry
2004	0.18	0.79	3.87	1.48	3.14	0.47	0	0.03	0	0.01	0.01	0.01	*9.99*	83%	Dry
2005	2.78	0.36	3.8	2.72	3.37	4.32	1.32	0.75	0.22	0.04	0	0	*19.68*	164%	Extremely Wet
2006	0.11	0.43	3.27	1.97	0.87	5.02	2.93	0.7	0	0	0	0	*15.3*	127%	Wet
2007	0	1.32	2.32	0.73	2.42	0.5	1	0.12	0.02	0	0.01	0.45	*8.89*	74%	Dry
2008	1.09	0.35	1.22	4.84	0.89	0.27	0.21	0	0	0	0	0.01	*8.88*	74%	Dry
2009	0.19	1.31	2.29	1.33	3.52	1.78	0.22	0.28	0.06	0	0.29	0.09	*11.36*	94%	Average
2010	1.68	0.11	1.62	4.01	3.06	2.45	3.36	0.59	0.02	0	0.02	0.01	*16.93*	141%	Wet
2011	0.61	2.02	3.03	1.69	2.91	4.19	0.11	0.68	0.26	0.01	0.01	0.03	*15.55*	129%	Wet
2012	1.46	1.78	0.01	1.6	0.82	2.6	1.85	0.07	0.17	0	0	0	*10.36*	86%	Dry
2013	0.18	3.11	3.32	1.04	0.56	0.41	0.27	0.01	0.04	0	0.02	0.07	*9.03*	75%	Dry
2014	0.15	0.47	0.21	0.12	3.08	1.15	0.56	0	0.02	0.01	0	0.1	*5.87*	49%	Extremely dry
2015	1.14	0.84	6.01	0	0.63	0.19	0.64	0.2	0	0.01	0.06	0.22	*9.94*	83%	Dry
2016	0.2	2.74	1.96	4.04	0.45	3.45	0.5	0.1	0.03	0	0	0	*13.47*	112%	Above Average
2017	1.61	0.95	1.44	5.86	4.43	1.23	0.84	0.02	0.07	0	0	0.04	*16.49*	137%	Wet
2018	0.13	0.62	0.03	1.73	0.13	2.65	1.84	0.02	0	0.01	0	0	*7.16*	59%	Extremely dry
2019	0.67	2.89	1.21	1.53	4.19	1.55	0.27	1.49	0	0	0	0.15	*13.95*	116%	Above Average
2020	0	1.09	3.97	0.93	0	1.9	1.11	0.16	0	0.02	0	0	*9.18*	76%	Dry
2021	0	0.37	0.57	3.46	0.33	0.97	0.04	0.01	0	0.04	0	0	*5.79*	48%	Extremely dry
2022	1.62	0.57	3.92	0	0.07	0.69	0.44	0	0	0	0	0.07	*7.38*	61%	Extremely dry
2023	0.01	1.45	4.81	2.92	1.62	3.45	0.03	0.15	0.07	0	0	0.09	*14.6*	121%	Above Average
2024	0.22	0.48	1.92	2.46	4.44	3.49	0.99	0.74	0	0	0	0.09	*14.83*	123%	Above Average
2025	0	2.21	2.45	0.14	2.34	2.91	0.78	0.09	0	0.03	0	0.35	*11.3*	94%	Average
Mean	0.54	1.34	2.02	2.33	2.23	2.16	0.87	0.32	0.06	0.02	0.02	0.14	12.03		
Cumulative	0.54	1.87	3.90	6.23	8.46	10.62	11.49	11.80	11.86	11.88	11.90	12.03	--		
Maximum	2.78	4.77	6.01	7.81	9.96	5.99	3.4	1.91	0.55	0.56	0.29	1.15	29.1		
Minimum	0	0	0.01	0	0	0.02	0	0	0	0	0	0	3.59		

Notes: *Latitude/Longitude: 36.66352°, -121.60928°. Elevation: 22.3 ft. Source: https://www.ncdc.noaa.gov/cdo-web/*
Water year type classification: Extremely Dry <70% ; Dry 70-90% ; Average 90-110%; Above Average 110-125%; Wet 125-160%; Extremely Wet >160%

Appendix A. Monthly Rainfall at Salinas South II, Monterey County, CA

CIMIS Station No. 214



WATER YEAR	OCT (inches)	NOV (inches)	DEC (inches)	JAN (inches)	FEB (inches)	MAR (inches)	APR (inches)	MAY (inches)	JUN (inches)	JUL (inches)	AUG (inches)	SEP (inches)	TOTAL (inches)	*% of MEAN*	WATER YEAR TYPE
1977															
1978															
1979															
1980															
1981															
1982															
1983															
1984															
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1986															
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2011															
2012															
2013								0.01	0.04	0	0.02	0.16			
2014	0.22	0.45	0.17	0.08	1.45	0.9	0.54	0.02	0	0.01	0	0.09	3.93	38%	Extremely dry
2015	1.07	0.88	3.06	0	0.27	0.15	1.08	0.66	0	0.01	0.11	0.19	7.48	72%	Dry
2016	0.14	3.05	2.52	4.15	0.4	3.32	0.45	0.05	0	0.04	0	0.05	14.17	136%	Wet
2017	1.47	0.89	1.48	5.35	3.43	1.32	0.85	0.03	0.06	0	0	0	14.88	142%	Wet
2018	0	0	0	1.89	0.16	2.63	1.62	0.04	0	0.04	0.02	0	6.4	61%	Extremely dry
2019	1.01	2.1	1.24	1.8	3.8	1.66	0.35	1.53	0	0	0	0.1	13.59	130%	Wet
2020	0	1.26	4.28	0.68	0	2.64	1.31	0.15	0.04	0.02	0.02	0.06	10.46	100%	Average
2021	0.02	0.47	0.48	3.43	0.46	1.11	0.1	0.05	0	0.01	0.04	0	6.17	59%	Extremely dry
2022	1.26	0.52	4.56	0.05	0.09	0.6	0.66	0.01	0.01	0	0.04	0.08	7.88	75%	Dry
2023	0	1.52	5.54	2.72	2.05	4.09	0.02	0.17	0.13	0.17	0	0.16	16.57	158%	Wet
2024	0.19	0.5	1.91	3.07	3.62	2.8	0.79	0.52	0.02	0.02	0.03	0.08	13.55	130%	Wet
2025	0	1.66	2.28	0.34	1.97	2.96	0.64	0.03	0	0.02	0.03	0.48	10.41	100%	Average
Mean	0.45	1.11	2.29	1.96	1.48	2.02	0.70	0.25	0.02	0.03	0.02	0.11	10.46		
Cumulative	0.45	1.56	3.85	5.81	7.29	9.30	10.00	10.26	10.28	10.30	10.33	10.44	--		
Maximum	1.47	3.05	5.54	5.35	3.8	4.09	1.62	1.53	0.13	0.17	0.11	0.48	16.57		
Minimum	0	0	0	0	0	0.15	0.02	0.01	0	0	0	0	3.93		

Notes: *Latitude/Longitude: 36.625619°, -121.537889°. Elevation: 153 ft. Source: https://www.cimis.water.ca.gov/Stations.aspx*
Water year type classification: Extremely Dry <70% ; Dry 70-90% ; Average 90-110%; Above Average 110-125%; Wet 125-160%; Extremely Wet >16

APPENDIX B

Synoptic flow surveys, Chualar Bridge to Jensen Bluff, August 28, 2025 and September 24, 2025

Appendix B. Results of synoptic flow survey on August 28, 2024, Salinas River, Chualar Bridge to Jensen Bluff, Monterey County, CA.

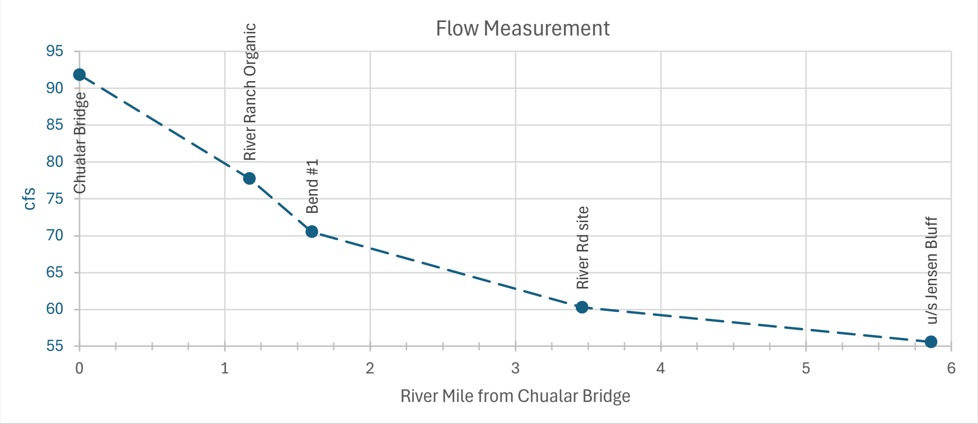
The reach infiltration rate from Chualar Bridge to Jensen Bluff was 6.2 cfs per mile, with a higher rate of 13 cfs per mile from Chualar Bridge to Bend 1, and a highest rate of 17 cfs per mile from River Ranch Organics to Bend 1.

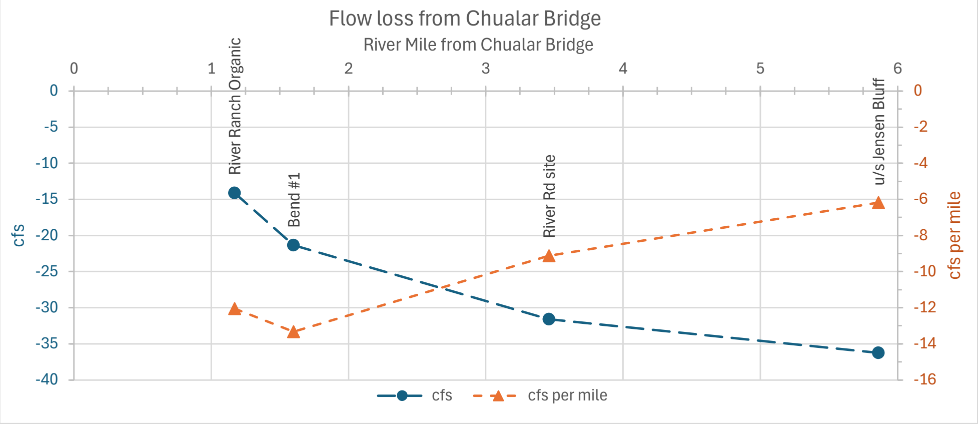
Station	Time of flow measurement (PST)		River mile from Chualar Bridge	Flow Measurement [1] (high precision)	River Width	Average Depth	Water surface area from station to Chualar Bridge	Evaporative loss from station to Chualar Bridge[2]	Flow loss from station to Chualar Bridge				Flow loss between stations		Flow at USGS Chualar Gage 11152300	Flow at USGS Spreckels Gage 11152500
	start	*end*	*miles*	*cfs*	*feet*	*feet*	*acres*	*ac-ft per day*	*cfs*	*ac-ft/day*	*%*	*cfs per mile*	*cfs*	*cfs per mile*	*cfs*	*cfs*
Chualar Bridge	8:00	8:45	0	91.9	87.7	0.80									97.4	47.2
River Ranch Organic	10:00	10:35	1.17	77.8	68.0	0.93	11.0	0.17	-14.10	-28.0	-15%	-12.1	-14.1	-12.1	97.4	47.2
Bend #1	12:20	12:50	1.60	70.5	62.5	1.01	14.4	0.23	-21.33	-42.3	-23%	-13.3	-7.23	-16.8	93.3	46.6
d/s Bend #1	not measured		2.43													
River Rd site	14:00	14:30	3.46	60.3	36.8	1.44	25.6	0.41	-31.58	-62.6	-34%	-9.1	-10.3	-5.5	92.3	46.6
Bend #2	not measured		4.38													
u/s Jensen Bluff	15:45	16:05	5.86	55.6	27.1	1.37	34.9	0.55	-36.25	-71.9	-39%	-6.2	-4.67	-1.9	91.3	46.6

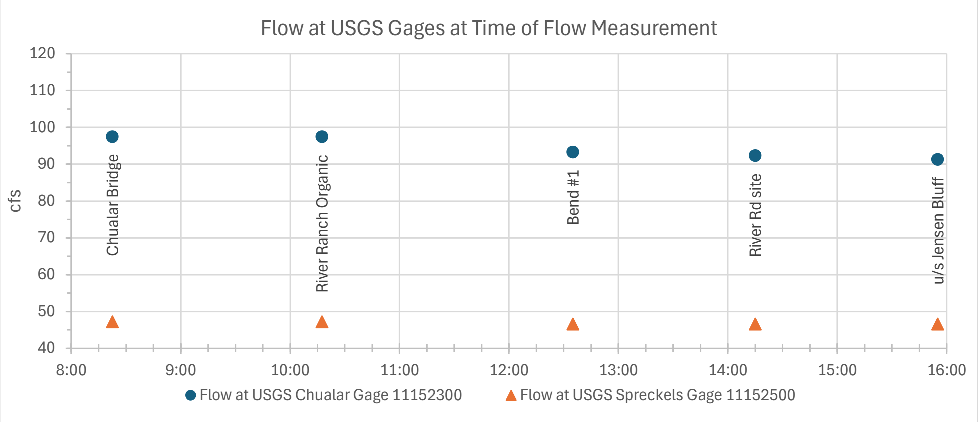
Notes:

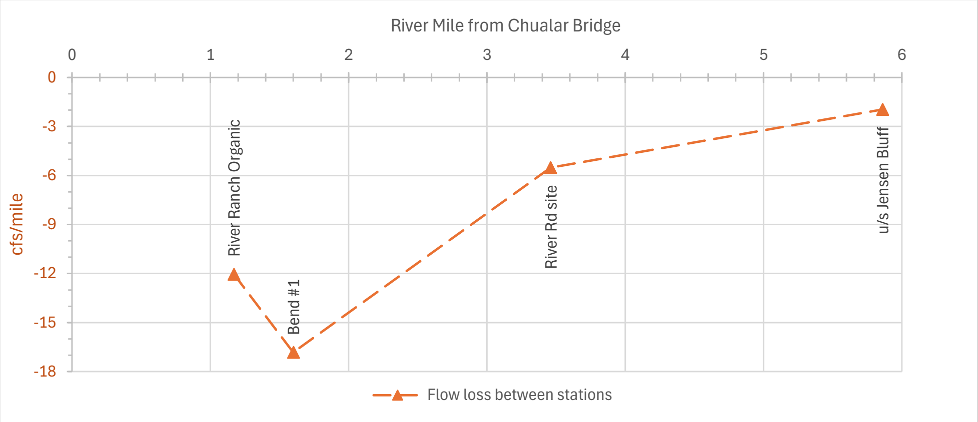
1. At the measured 1.4 feet per second mean flow, flow measurements were taken prior a change of flow recorded at the Chualar gage.

2. California Irrigation Management Information System (CIMIS) Salinas South II Station 214 recorded 0.16 inches of reference evapotranspiration (ETo) on September 24, 2024.









Appendix B. Results of synoptic flow survey on September 24, 2024, Salinas River, Chualar Bridge to Jensen Bluff, Monterey County, CA.

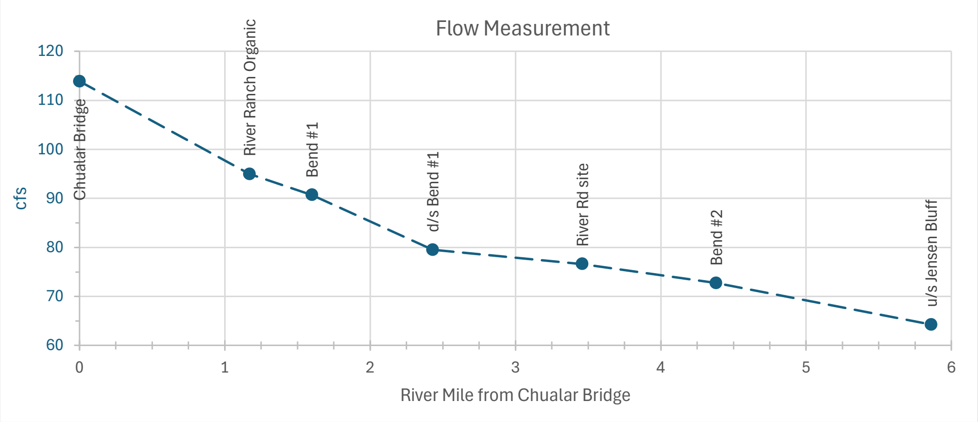
The reach infiltration rate from Chualar Bridge to Jensen Bluff was 8.5 cfs per mile, with a higher rate of 14 cfs per mile from Chualar Bridge through Bend 1,
and a highest rate of 16 cfs per mile from Chualar Bridge to River Ranch Organics.

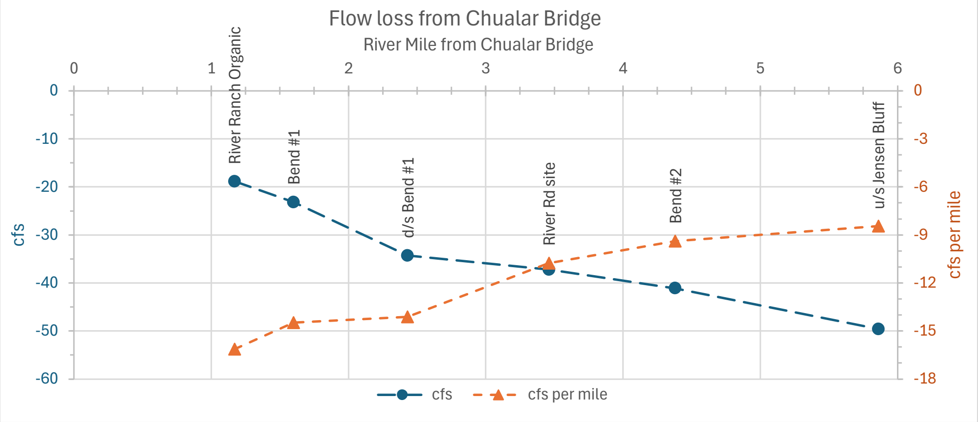
Station	**Time of flow measurement** (PST)		**River mile from Chualar Bridge**	**Flow Measurement** [1] (high precision)	**River Width**	**Average Depth**	**Water surface area from station to Chualar Bridge**	**Evaporative loss from station to Chualar Bridge** [2]	**Flow loss from station to Chualar Bridge**				**Flow loss between stations**		**Flow at USGS Chualar Gage 11152300**	**Flow at USGS Spreckels Gage 11152500**
	start	*end*	*miles*	*cfs*	*feet*	*feet*	*acres*	*ac-ft per day*	*cfs*	*ac-ft/day*	*%*	*cfs per mile*	*cfs*	*cfs per mile*	*cfs*	*cfs*
Chualar Bridge	8:35	9:40	0	114	80.8	1.03									111	61.8
River Ranch Organic	10:41	11:30	1.17	95.0	68.4	0.93	10.6	0.14	-18.88	-37.4	-17%	-16.1	-18.9	-16.1	111	61.2
Bend #1	12:57	13:48	1.60	90.7	68.0	1.21	14.1	0.19	-23.15	-45.9	-20%	-14.5	-4.27	-9.9	107	61.1
d/s Bend #1	14:35	15:10	2.43	79.6	53.7	1.01	20.3	0.27	-34.30	-68.0	-30%	-14.1	-11.2	-13.4	105	60.5
River Rd site	15:00	15:30	3.46	76.6	37.2	1.66	25.9	0.35	-37.23	-73.8	-33%	-10.8	-2.93	-2.8	104	60.5
Bend #2	12:33	13:08	4.38	72.8	33.4	1.35	29.9	0.40	-41.10	-81.5	-36%	-9.4	-3.87	-4.2	106	61.1
u/s Jensen Bluff	11:10	11:42	5.86	64.3	27.9	1.75	35.4	0.47	-49.57	-98.3	-44%	-8.5	-8.47	-5.7	108	60.5

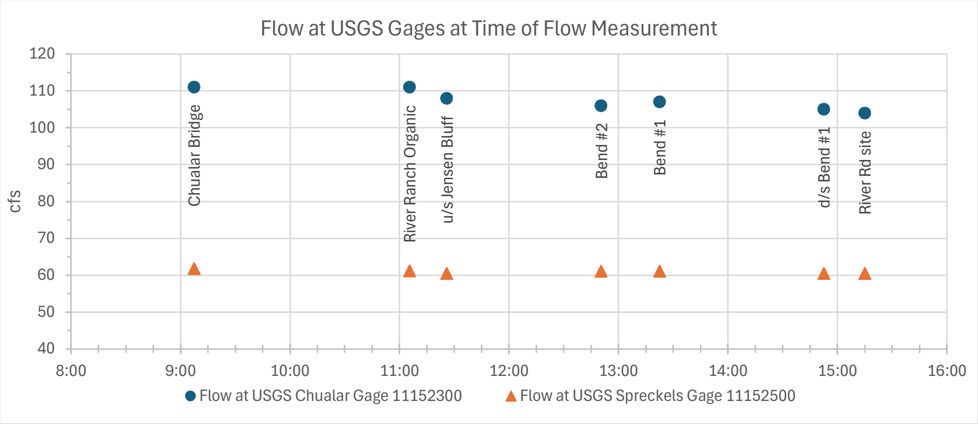
Notes:

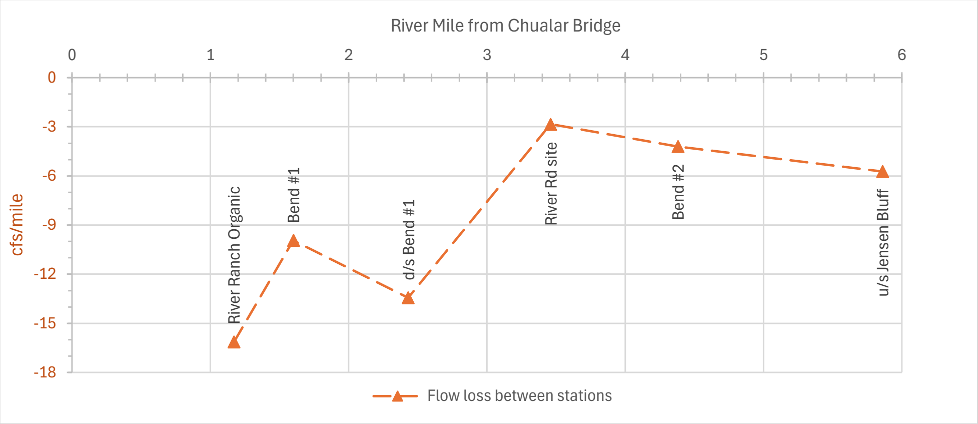
1. At the measured 1.4 feet per second mean flow, flow measurements were taken prior a change of flow recorded at the Chualar gage.

2. California Irrigation Management Information System (CIMIS) Salinas South II Station 214 recorded 0.16 inches of reference evapotranspiration (ETo) on September 24, 2024.


Flow Measurement


Flow loss from Chualar Bridge


Flow at USGS Gages at Time of Flow Measurement



APPENDIX C

Ring-infiltrometer tests of riverbed and backwater alluvium, January 15, 2025

Appendix C. Soil infiltration test: Salinas River downstream of Bend #1, Chualar, Monterey County, CA. ***Site: 1S, sand, single ring***

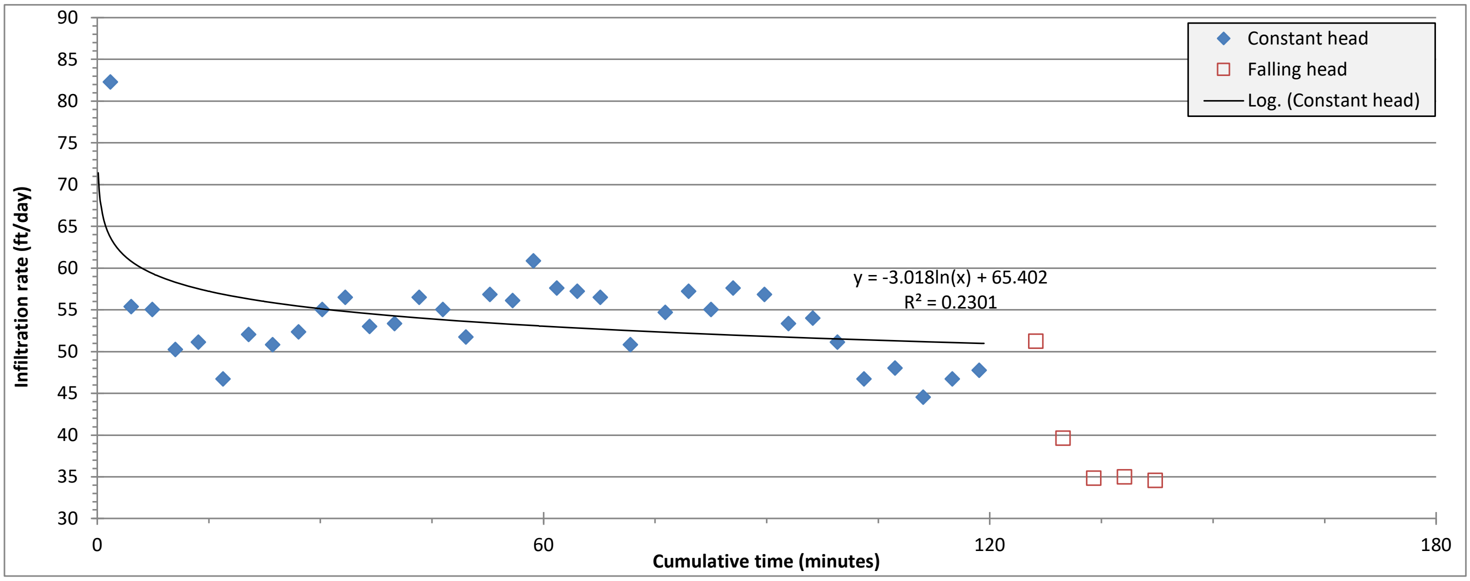
Top of rim: 0.70 feet Infiltrometer: 16 inch diameter single ring test Date: Wednesday, January 15, 2025

Soil surface: 0.00 feet Persons: AM, MW

	Stopwatch			x						y		
Time	Hours	Min	Sec	Cumulative Time (min)	Elapsed Time (min)	Gage Height (ft)	Depth of water (ft)	Change in stage, ΔS (ft)	Infiltration rate, ΔS/Δt (inches/hour)	Infiltration rate, ΔS/Δt (ft/day)	Head above soil surface (ft)	Comments
	0	0	0	0	0	0.6	0.7					start test constant head test
	0	1	45	1.75	1.75	0.5	0.60	-0.1	41.14	82.3	0.65	refilled
	0	1	56	1.93	0.18	0.6	0.70	0.1				
	0	4	32	4.53	2.60	0.5	0.60	-0.1	27.69	55.4	0.65	refilled
	0	4	46	4.77	0.23	0.6	0.7	0.1				
	0	7	23	7.38	2.62	0.5	0.60	-0.1	27.52	55.0	0.65	refilled
	0	7	37	7.62	0.23	0.6	0.70	0.1				
	0	10	29	10.48	2.87	0.5	0.60	-0.1	25.12	50.2	0.65	refilled
	0	10	45	10.75	0.27	0.6	0.7	0.1				
	0	13	34	13.57	2.82	0.5	0.60	-0.1	25.56	51.1	0.65	refilled
	0	13	49	13.82	0.25	0.6	0.70	0.1				
	0	16	54	16.90	3.08	0.5	0.60	-0.1	23.35	46.7	0.65	refilled
	0	17	33	17.55	0.65	0.6	0.7	0.1				
	0	20	19	20.32	2.77	0.5	0.60	-0.1	26.02	52.0	0.65	refilled
	0	20	45	20.75	0.43	0.6	0.70	0.1				
	0	23	35	23.58	2.83	0.5	0.60	-0.1	25.41	50.8	0.65	refilled
	0	24	19	24.32	0.73	0.6	0.7	0.1				
	0	27	4	27.07	2.75	0.5	0.60	-0.1	26.18	52.4	0.65	refilled
	0	27	38	27.63	0.57	0.6	0.70	0.1				
	0	30	15	30.25	2.62	0.5	0.60	-0.1	27.52	55.0	0.65	refilled
	0	30	48	30.80	0.55	0.6	0.7	0.1				
	0	33	21	33.35	2.55	0.5	0.60	-0.1	28.24	56.5	0.65	refilled
	0	33	53	33.88	0.53	0.6	0.70	0.1				
	0	36	36	36.60	2.72	0.5	0.60	-0.1	26.50	53.0	0.65	refilled
	0	37	16	37.27	0.67	0.6	0.7	0.1				
	0	39	58	39.97	2.70	0.5	0.60	-0.1	26.67	53.3	0.65	refilled
	0	40	43	40.72	0.75	0.6	0.70	0.1				
	0	43	16	43.27	2.55	0.5	0.60	-0.1	28.24	56.5	0.65	refilled
	0	43	51	43.85	0.58	0.6	0.7	0.1				
	0	46	28	46.47	2.62	0.5	0.60	-0.1	27.52	55.0	0.65	refilled
	0	46	45	46.75	0.28	0.6	0.70	0.1				
	0	49	32	49.53	2.78	0.5	0.60	-0.1	25.87	51.7	0.65	refilled
	0	50	14	50.23	0.70	0.6	0.7	0.1				
	0	52	46	52.77	2.53	0.5	0.60	-0.1	28.42	56.8	0.65	refilled
	0	53	15	53.25	0.48	0.6	0.70	0.1				
	0	55	49	55.82	2.57	0.5	0.60	-0.1	28.05	56.1	0.65	refilled
	0	56	16	56.27	0.45	0.6	0.7	0.1				
	0	58	38	58.63	2.37	0.5	0.60	-0.1	30.42	60.8	0.65	refilled
	0	59	16	59.27	0.63	0.6	0.70	0.1				
	1	1	46	61.77	2.50	0.5	0.60	-0.1	28.80	57.6	0.65	refilled
	1	2	0	62.00	0.23	0.6	0.7	0.1				
	1	4	31	64.52	2.52	0.5	0.60	-0.1	28.61	57.2	0.65	refilled
	1	5	3	65.05	0.53	0.6	0.70	0.1				
	1	7	36	67.60	2.55	0.5	0.60	-0.1	28.24	56.5	0.65	refilled
	1	8	49	68.82	1.22	0.6	0.7	0.1				
	1	11	39	71.65	2.83	0.5	0.60	-0.1	25.41	50.8	0.65	refilled
	1	13	44	73.73	2.08	0.6	0.70	0.1				
	1	16	22	76.37	2.63	0.5	0.60	-0.1	27.34	54.7	0.65	refilled
	1	16	58	76.97	0.60	0.6	0.7	0.1				
	1	19	29	79.48	2.52	0.5	0.60	-0.1	28.61	57.2	0.65	refilled
	1	19	54	79.90	0.42	0.6	0.70	0.1				
	1	22	31	82.52	2.62	0.5	0.60	-0.1	27.52	55.0	0.65	refilled
	1	22	58	82.97	0.45	0.6	0.7	0.1				
	1	25	28	85.47	2.50	0.5	0.60	-0.1	28.80	57.6	0.65	refilled
	1	27	8	87.13	1.67	0.6	0.70	0.1				
	1	29	40	89.67	2.53	0.5	0.60	-0.1	28.42	56.8	0.65	refilled
	1	30	13	90.22	0.55	0.6	0.7	0.1				
	1	32	55	92.92	2.70	0.5	0.60	-0.1	26.67	53.3	0.65	refilled
	1	33	31	93.52	0.60	0.6	0.70	0.1				
	1	36	11	96.18	2.67	0.5	0.60	-0.1	27.00	54.0	0.65	refilled
	1	36	42	96.70	0.52	0.6	0.7	0.1				
	1	39	31	99.52	2.82	0.5	0.60	-0.1	25.56	51.1	0.65	refilled
	1	40	0	100.00	0.48	0.6	0.70	0.1				
	1	43	5	103.08	3.08	0.5	0.60	-0.1	23.35	46.7	0.65	refilled
	1	44	14	104.23	1.15	0.6	0.7	0.1				

Appendix C. Soil infiltration test: Salinas River downstream of Bend #1, Chualar, Monterey County, CA. *Site: 1S, sand, single ring*

1	47	14	107.23	3.00	0.5	0.60	-0.1	24.00	48.0	0.65	refilled
1	47	48	107.80	0.57	0.6	0.70	0.1				
1	51	2	111.03	3.23	0.5	0.60	-0.1	22.27	44.5	0.65	refilled
1	51	51	111.85	0.82	0.6	0.7	0.1				
1	54	56	114.93	3.08	0.5	0.60	-0.1	23.35	46.7	0.65	refilled
1	55	32	115.53	0.60	0.6	0.70	0.1				
1	58	33	118.55	3.02	0.5	0.60	-0.1	23.87	47.7	0.65	refilled
1	59	12	119.20	0.65	0.6	0.70	0.1				
2	0	0	120.00	0.80	0.62	0.62	0.02			0.66	Refilled to 0.6, start falling head test
2	3	21	123.35	4.15	0.5	0.50				0.56	transitioning to falling head
2	6	11	126.18	6.18	0.4	0.40	-0.22	25.62	51.2	0.45	
2	9	49	129.82	3.63	0.3	0.30	-0.1	19.82	39.6	0.35	
2	13	57	133.95	4.13	0.2	0.20	-0.1	17.42	34.8	0.25	
2	18	4	138.07	4.12	0.1	0.10	-0.1	17.49	35.0	0.15	
2	22	14	142.23	4.17	0	0.00	-0.1	17.28	34.6	0.05	end of test



Appendix C. Soil infiltration test: Salinas River downstream of Bend #1, Chualar, Monterey County, CA.

Site: 1D, sand, double ring

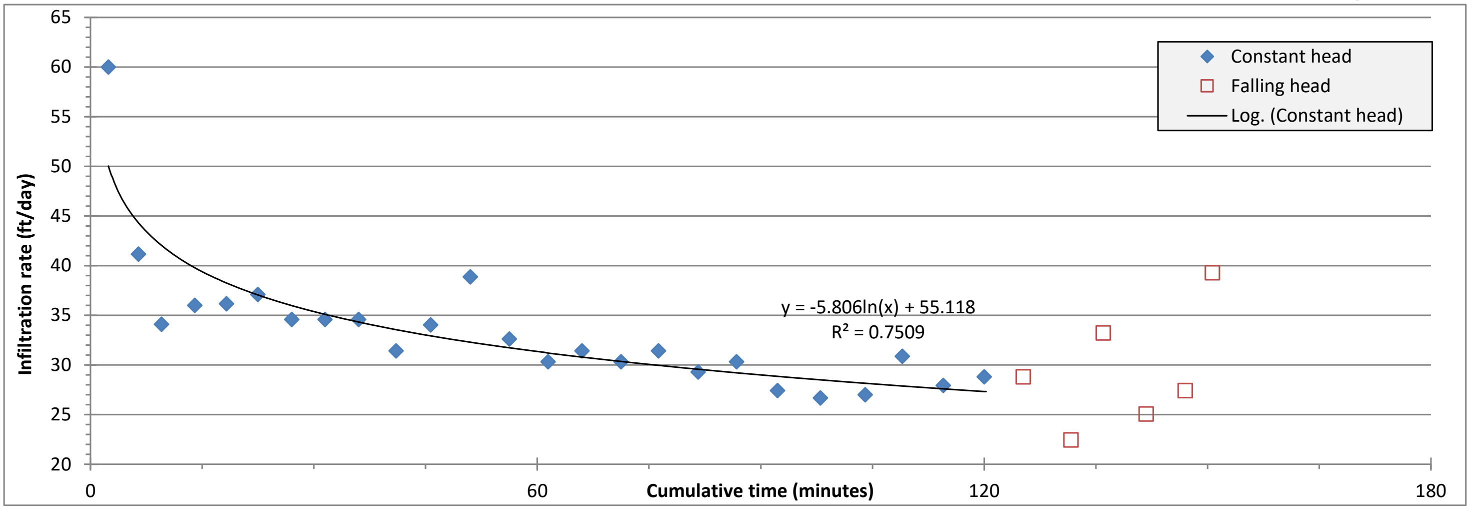
Top of rim: 0.70 feet
Soil surface: 0.00 feet

Infiltrometer: Double ring test
12 inch diameter inner ring, 20 inch diameter outer ring

Date: Wednesday, January 15, 2025
Persons: JP, MW

	Stopwatch			x						y		
Time	Hours	Min	Sec	Cumulative Time (min)	Elapsed Time (min)	Gage Height (ft)	Depth of water (ft)	Change in stage, ΔS (ft)	Infiltration rate, ΔS/Δt (inches/hour)	Infiltration rate, ΔS/Δt (ft/day)	Avg. Head above soil surface (ft)	Comments
14:20	0	0	0	0.00	--	0.7	0.70					start test constant head test
	0	2	24	2.40	2.40	0.6	0.60	-0.1	30.0	60.0	0.65	
	0	2	55	2.92	0.52	0.7	0.70	0.1				refilled
	0	6	25	6.42	3.50	0.6	0.60	-0.1	20.6	41.1	0.65	
	0	6	58	6.97	0.55	0.71	0.71	0.11				refilled
	0	9	30	9.50	2.53	0.65	0.65	-0.06	17.1	34.1	0.68	
	0	10	0	10.00	0.50	0.7	0.70	0.05				refilled
	0	14	0	14.00	4.00	0.6	0.60	-0.1	18.0	36.0	0.65	
	0	14	16	14.27	0.27	0.7	0.70	0.1				refilled
	0	18	15	18.25	3.98	0.6	0.60	-0.1	18.1	36.2	0.65	
	0	18	35	18.58	0.33	0.7	0.70	0.1				refilled
	0	22	28	22.47	3.88	0.6	0.60	-0.1	18.5	37.1	0.65	
	0	22	50	22.83	0.37	0.7	0.70	0.1				refilled
	0	27	0	27.00	4.17	0.6	0.60	-0.1	17.3	34.6	0.65	
	0	27	20	27.33	0.33	0.7	0.70	0.1				refilled
	0	31	30	31.50	4.17	0.6	0.60	-0.1	17.3	34.6	0.65	
	0	31	50	31.83	0.33	0.7	0.70	0.1				refilled
	0	36	0	36.00	4.17	0.6	0.60	-0.1	17.3	34.6	0.65	
	0	36	25	36.42	0.42	0.7	0.70	0.1				refilled
	0	41	0	41.00	4.58	0.6	0.60	-0.1	15.7	31.4	0.65	
	0	41	26	41.43	0.43	0.7	0.70	0.1				refilled
	0	45	40	45.67	4.23	0.6	0.60	-0.1	17.0	34.0	0.65	
	0	46	11	46.18	0.52	0.7	0.70	0.1				refilled
	0	51	0	51.00	4.82	0.57	0.57	-0.13	19.4	38.9	0.64	
	0	51	50	51.83	0.83	0.7	0.70	0.13				refilled
	0	56	15	56.25	4.42	0.6	0.60	-0.1	16.3	32.6	0.65	
	0	56	40	56.67	0.42	0.7	0.70	0.1				refilled
	1	1	25	61.42	4.75	0.6	0.60	-0.1	15.2	30.3	0.65	
	1	1	25	61.42	0.00	0.7	0.70	0.1				refilled
	1	6	0	66.00	4.58	0.6	0.60	-0.1	15.7	31.4	0.65	
	1	6	30	66.50	0.50	0.7	0.70	0.1				refilled
	1	11	15	71.25	4.75	0.6	0.60	-0.1	15.2	30.3	0.65	
	1	11	40	71.67	0.42	0.7	0.70	0.1				refilled
	1	16	15	76.25	4.58	0.6	0.60	-0.1	15.7	31.4	0.65	
	1	16	40	76.67	0.42	0.7	0.70	0.1				refilled
	1	21	35	81.58	4.92	0.6	0.60	-0.1	14.6	29.3	0.65	
	1	22	0	82.00	0.42	0.7	0.70	0.1				refilled
	1	26	45	86.75	4.75	0.6	0.60	-0.1	15.2	30.3	0.65	
	1	27	0	87.00	0.25	0.7	0.70	0.1				refilled
	1	32	15	92.25	5.25	0.6	0.60	-0.1	13.7	27.4	0.65	
	1	32	36	92.60	0.35	0.7	0.70	0.1				refilled
	1	38	0	98.00	5.40	0.6	0.60	-0.1	13.3	26.7	0.65	
	1	38	40	98.67	0.67	0.7	0.70	0.1				refilled
	1	44	0	104.00	5.33	0.6	0.60	-0.1	13.5	27.0	0.65	
	1	44	20	104.33	0.33	0.7	0.70	0.1				refilled
	1	49	0	109.00	4.67	0.6	0.60	-0.1	15.4	30.9	0.65	
	1	49	36	109.60	0.60	0.695	0.70	0.095				refilled
	1	54	30	114.50	4.90	0.6	0.60	-0.095	14.0	27.9	0.65	
	1	54	45	114.75	0.25	0.705	0.71	0.105				refilled
	2	0	0	120.00	5.25	0.6	0.60	-0.105	14.4	28.8	0.65	
	2	0	15	120.25	0.25	0.7	0.70	0.1			0.65	refilled to 0.7 ft and start falling head
	2	5	15	125.25	5.00	0.6	0.60	-0.1	14.4	28.8	0.65	
	2	11	40	131.67	6.42	0.5	0.50	-0.1	11.2	22.4	0.55	
	2	16	0	136.00	4.33	0.4	0.40	-0.1	16.6	33.2	0.45	
	2	21	45	141.75	5.75	0.3	0.3	-0.1	12.5	25.0	0.35	
	2	27	0	147.00	5.25	0.2	0.2	-0.1	13.7	27.4	0.25	
	2	30	40	150.67	3.67	0.1	0.1	-0.1	19.6	39.3	0.15	end of test

Appendix C. Soil infiltration test: Salinas River downstream of Bend #1, Chualar, Monterey County, CA. ***Site: 1D, sand, double ring***



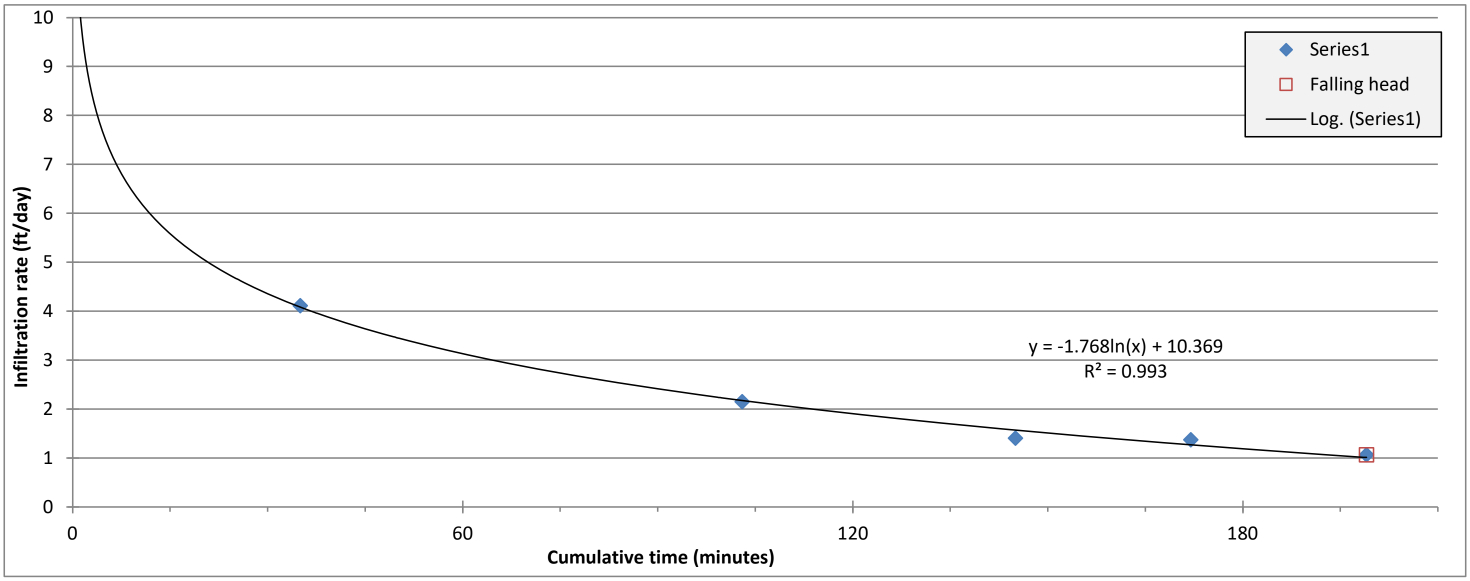
Appendix C. Soil infiltration test: Salinas River downstream of Bend #1, Chualar, Monterey County, CA. ***Site: 2S, silt-clay, single ring***

Top of rim: 0.70 feet
Soil surface: 0.00 feet

Infiltrometer: 16 inch diameter single ring test

Date: Wednesday, January 15, 2025
Persons: JP, MW

	Stopwatch			x						y		
Time	Hours	Min	Sec	Cumulative Time (min)	Elapsed Time (min)	Gage Height (ft)	Depth of water (ft)	Change in stage, ΔS (ft)	Infiltration rate, ΔS/Δt (inches/hour)	Infiltration rate, ΔS/Δt (ft/day)	Head above soil surface (ft)	Comments
14:35	0			0	0	5.7	0.7					start test constant head test
	0	35	0	35.00	35.00	5.6	5.60	-0.1	2.06	4.1	3.15	refilled
	0	36	0	36.00	1.00	5.7	5.70	0.1				
	1	43	0	103.00	67.00	5.6	5.60	-0.1	1.07	2.1	5.65	refilled
	1	44	0	104.00	1.00	5.7	5.70	0.1				
	2	25	0	145.00	41.00	5.66	5.66	-0.04	0.70	1.4	5.68	refilled
	2	31	0	151.00	6.00	5.62	5.62	-0.04				
	2	52	0	172.00	21.00	5.6	5.60	-0.02	0.69	1.4	5.61	refilled - left alone for falling head
	3	19	0	199.00	27.00	5.58	5.58	-0.02	0.53	1.1	5.59	end of test



APPENDIX D

Gaging station photos and observer logs

Balance Hydrologics

Appendix D. Photos of Downstream Bend 1 temporary gaging station, GSA Somavia Reach study, Monterey County, CA

Appendix D. Photos of Bend 2 temporary gaging station, GSA Somavia Reach study, Monterey County, CA

Appendix D. Observation Log, Water Year 2024-2025, Salinas River at Chualar (USGS Gage 111523000), Monterey County, California.

Site Conditions				*Streamflow*				*Water Quality*			*High-Water Marks*		*Remarks*
Date/Time	Observer(s)	Stage (elevation=stage+70.54)	Hydrograph	Measured Flow	Estimated Flow	Instrument Used	Estimated Accuracy	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C		Inferred dates?	
(mm/dd/yr)		*(feet)*	*(R/F/S/B)*	*(cfs)*	*(cfs)*	*(AA/PY/H)*	*(e/g/f/p)*	*(°C)*	*(µmhos/cm)*	*(at 25°C)*	*(feet)*	*(mm/dd/yr)*	
8/28/2024 9:00	jp, mw, em	2.93 (73.47 ft)	B	92	-	Hach, Flow Tracker 2	g	19.4	361	322	-	-	Flow measurement conducted 40 ft upstream bridge, JP used a Hach, EM a FT2. Velocity lines indicate laminar flow. Bed is sandy, water is very turbid.
9/24/2024 11:30	jp, bl	3.04 (73.58 ft)	B	114	-	Hach	g	18.6	300	342	-	-	Synoptic flow measurement through the reach.
10/22/2024 10:30	USGS	No flow	-	0	-	-	-	-	-	-	-	-	No flow
10/24/2024 8:30	jp, mw, em	No flow	-	0	-	-	-	-	-	-	-	-	No flow, reach is dry. There are a lot of tire tracks from off-road vehicles.
12/3/2024 13:00	USGS	No flow	-	0	-	-	-	-	-	-	-	-	No flow
12/12/2024 13:00	USGS	No flow	-	0	-	-	-	-	-	-	-	-	No flow
1/23/2025 11:45	USGS	No flow	-	0	-	-	-	-	-	-	-	-	No flow
2/12/2025 12:30	USGS	No flow	-	0	-	-	-	-	-	-	-	-	No flow
2/14/2025 15:10	USGS	9.17	-	1,990	-	-	p	-	-	-	-	-	No flow
2/20/2025 9:27	USGS	3.78	-	206	-	-	g	-	-	-	-	-	Stage dropped 0.01 ft during measurement.
2/21/2025 9:15	jp, em, mm	3.68 (74.22 ft)	B	176	-	H, FT2	g	12.3	328	432	9.0	recent	Some woody debris on the upstream side of the bridge footing. Water is very turbid greyish brown. Banks and bridge footing have silty high-water marks at about stage of 9 ft. Temperature sensors upstream appear to be in about 3 ft of water - did not access. Flow tracker on-site calculated 176 cfs, USGS is reporting 194 cfs.
3/31/2025 9:14	USGS	3.16	-	134	-	-	-	-	-	-	-	-	Debris Moderate
4/10/2025 14:50	jp	2.97	B	103	-	H	g	22.3	495	469	-	-	Flow/velocity lines in the cross section are somewhat uneven. Temperature sensor piezometers upstream are submerged in 2+ feet of water. Significant sand bar has aggraded downstream of the bridge - USGS has moved the gage sensor from that area to the thalweg right at the staff plate. The sensor wire extends from the staff plate into the channel exposing it to floating debris.
5/1/2025 8:54	USGS	2.56	-	68	-	-	g	-	-	-	-	-	No notes.
5/29/2025 9:12	USGS	3.16	-	139	-	-	g	-	-	-	-	-	No notes.
7/9/2025 11:19	USGS	2.74	-	87	-	-	g	-	-	-	-	-	No notes.
8/5/2025 9:20	USGS	2.86	-	107	-	-	g	-	-	-	-	-	No notes.
8/26/2025 10:48	USGS	2.95	-	109	-	-	g	-	-	-	-	-	No notes.
9/30/2025 8:34	USGS	2.14	-	26.1	-	-	f	-	-	-	-	-	No notes.
11/11/2025 9:00	jp, nb	dry	-	-	-	-	-	-	-	-	-	-	Removed surface water sensor and stilling well. Removed temperature sensors, unable to remove the temperature piezometer pvc casings from the bed using a t-post puller and shovel.

Observer Key: (em) Ella Myr, (jp) Jason Parke, (mw) Mark Woyshner, (mm) Maya Montalvo, (am) Andrew Marasco, (bl) Brigid Lynch, Montgomery & Associates :Nicholas Byler (nb)

Stage: Water level observed at outside staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type"), HACH (H) or Flow Tracker (FT2) . If estimated, from rating curve (R) or visual (V).

Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given

High-water mark (HWM): Measured or estimated at location of the staff plate

Specific conductance: Measured in micromhos/cm in field then normalized to 25degC by equation (specific conductance at 25degC) = (field specific conductance) * (1.8813774452 - 0.050433063928 * (field temp) + 0.00058561144042 * (field temp)^2).

Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Appendix D. Observation Log, Water Year 2024-25, Salinas River Downstream of Bend #1, Monterey County, California. (page 1 of 2)

Site Conditions							Streamflow				Water Quality			High-Water Marks		Remarks
Date/Time	Observer(s)	Stage	Stage converted to elevation (stage+62.8ft)	Depth to water - deep piezometer (elevation=68.01ft.-dtw)	Depth to water - shallow piezometer (elevation=67.98ft.-dtw)	Hydrograph	Measured Flow	Estimated Flow	Instrument Used	Estimated Accuracy	Water Temperature	Specific Conductance at field temperature	Specific Conductance at 25C		Inferred dates?	
(mm/dd/yr)		*(feet)*	*62.8*	*(feet)*	*(feet)*	*(R/F/S/B)*	*(cfs)*	*(cfs)*	*(AA/PY, H, FT2)*	*(e/g/f/p)*	*(°C)*	*(µmhos/cm)*	*(at 25°C)*	*(feet)*	*(mm/dd/yr)*	
8/28/2024 13:20	jp, mw, em	-		-	-	B	70.5		Hach, FT2	g	24.0	349	355	-	-	-
9/24/2024 14:45	am, em	-		-	-	B	79.6		Hach, FT2	g	24.0	343	350	-	-	Synoptic flow measurement through the reach.
10/24/2025 16:48	jp, mw, em	0.45	63.25	no water in piezometers while on site		B	-	see notes		-	-	-	-	-	-	**Installed gage**, shallow/deep piezometer, and two temperature piezometers. Temperature piezometers are located next to the surface water gage and about 6 ft into the channel from the surface water gage. Flow was going into the gaged pool at the start of the day at about 9am (54 gpm inflow, 35 gpm outflow) and outlet of the gage pool flow stopped at 12:45 with all inflow percolating.
11/20/2024 10:57	jp	0.18	62.98	15.2	dry	-	-	-	-	-	-	-	-	0.76	recent	Some standing water/muck at the gage. Recent high-water marks up to about 0.76 ft from recent flow. Entire flood plane below road levee has been cleared of vegetation.
1/15/2025 11:19	jp, am, mw	0.52	63.32	-	-	-	-	0.04	Visual est.	f	-	-	-	1.01-1.02	recent	Perform infiltration tests today on bank across from gage. Flow from the alternate channel upstream on the right bank is flowing about 20 gym and infiltrating to the bed upstream of the gage. Zero flow is at about the current stage.
1/15/2025 11:47	jp, am, mw	0.51	63.31	-	-	-	-	-	-	-	-	-	-	-	-	Flow has stopped from upstream.
2/21/2025 10:15	jp, me, mm	3.6	66.40	-	-	B/F	158	-	H, FT2	g/f	12.9	348	454	9.0	recent	Left bank (facing downstream) has been scraped/cleared of vegetation and likely most of the clay. Some quicksand conditions are present at the bar across from the gage. Had to view the staff plat from about 100 ft away due to deep conditions at the gage. High-water marks present in the vegetation on the right bank and up to the base of the levee on the left bank. High-water confined in the lower level in-channel bar/levee and then spread out to the broad plane about 75 ft upstream of the gage - set orange flagging at both high-water marks.
4/10/2025 12:30	jp	2.65	65.45	-	-	B	89	-	H	g	21.5	549	590	3.46, 3.55 on staff	recent	Velocity was fairly laminar, bed felt smooth and a bit armored under foot. Temperature piezometers were in 2+ feet of water. Flow cross section was right at the gage.
5/6/2025 13:45	jp	1.995	64.80	14.4	dry	B	46.9	-	H	g	25.1	457	455	3.0	recent	Water is very turbid. Temperature piezometers are submerged in approximately 1.8 ft of water, unable to download. Stage dropped to 1.98 ft after downloading.

Observer Key: (em) Ella Myr, (jp) Jason Parke, (mw) Mark Woyshner, (mm) Maya Montalvo, (am) Andrew Marasco, (bl) Brigid Lynch, Montgomery & Associates :Nicholas Byler (nb)
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type"), HACH (H) or Flow Tracker (FT2) . If estimated, from rating curve (R) or visual (V).
Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given
High-water mark (HWM): Measured or estimated at location of the staff plate
Specific conductance: Measured in micromhos/cm in field then normalized to 25degC by equation (specific conductance at 25degC) = (field specific conductance) * (1.8813774452 - 0.050433063928 * (field temp) + 0.00058561144042 * (field temp)^2).
Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Appendix D. Observation Log, Water Year 2024-25, Salinas River Downstream of Bend #1, Monterey County, California. (page 2 of 2)

Site Conditions							*Streamflow*				*Water Quality*			*High-Water Marks*		*Remarks*
Date/Time	Observer(s)	Stage	Stage converted to elevation (stage+62.8ft)	Depth to water - deep piezometer (elevation=68.01ft.-dtw)	Depth to water - shallow piezometer (elevation=67.98ft.-dtw)	Hydrograph	Measured Flow	Estimated Flow	Instrument Used	Estimated Accuracy	Water Temperature	Specific Conductance at field temperature	Specific Conductance at 25C		Inferred dates?	
(mm/dd/yr)		*(feet)*	*62.8*	*(feet)*	*(feet)*	*(R/F/S/B)*	*(cfs)*	*(cfs)*	*(AA/PY, H, FT2)*	*(e/g/f/p)*	*(°C)*	*(µmhos/cm)*	*(at 25°C)*	*(feet)*	*(mm/dd/yr)*	
7/8/2025 14:40	jp	2.13	64.93	14.28	dry	F	68.2	-	H	g	25.5	364	361	-	-	Water is very turbid. Temperature piezometers are submerged in approximately 1.5 ft of water, unable to download. Stage dropped to 2.12 ft after downloading.
9/19/2025 15:25	mm	2.19	64.99	14.47	dry	F	61.0	-	FT2	g	24.2	351	356	2.4	recent	Stage started at 2.2 ft at 14:43 and dropped to 2.18 ft by the end of the site visit at 16:45. Stage appeared to be stable at 2.19 ft during measurement from 15:01 to 15:40. Sediment is at 1.59 ft on the staff plate - there is approximately 0.6 ft of water at that staff plate.
9/29/2025 15:40	jp	1.62	64.42	14.38	dry	F	15.8	-	H	g	-	-	472	2.8, 2.3	recent	Temperature sensors were submerged in about 0.5 ft of water. Lots of vegetation in the channel on the right bank just upstream of the gage - moved cross section upstream of the vegetation. Very laminar velocity at the flow cross section. Zero flow about 1.1-1.2 ft below current stage based on depth downstream outlet of the gage. Took water sample to measure SCT in the office.
11/11/2025 11:39	jp, nb	dry	-	15.82	dry	-	-	-	-	-	-	-	-	-	-	Removed temperature sensors and downloaded all other sensors. Had to dig out the surface water stilling well of about 0.3 ft of clay that has accumulated around the gage. There is large amount of vegetation that has grown on the same bank just upstream of the gage likely creating a velocity shadow at just downstream. Sensors had a thick coating of fat clay. Cleaned the stilling well and reset the base of the casing at stage of 0.8 ft to help prevent the stilling well from getting stuck in clay again.

Observer Key: (em) Ella Myr, (jp) Jason Parke, (mw) Mark Woyshner, (mm) Maya Montalvo, (am) Andrew Marasco, (bl) Brigid Lynch, Montgomery & Associates :Nicholas Byler (nb)

Stage: Water level observed at outside staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type"), HACH (H) or Flow Tracker (FT2) . If estimated, from rating curve (R) or visual (V).

Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given

High-water mark (HWM): Measured or estimated at location of the staff plate

Specific conductance: Measured in micromhos/cm in field then normalized to 25degC by equation (specific conductance at 25degC) = (field specific conductance) * (1.8813774452 - 0.050433063928 * (field temp) + 0.00058561144042 * (field temp)^2).

Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate

Appendix D. Observation Log, Water Year 2024-25, Salinas River at Bend #2, Monterey County, California.

Site Conditions									*Streamflow*				*Water Quality*			*High-Water Marks*		*Remarks*
Date/Time	Observer(s)	Stage - surface water gage	Stage converted to elevation (stage +54.82ft)	Depth to water - deep piezometer	Depth to water deep piezometer converted to elevation (62.47ft-dtw)	Depth to water - shallow piezometer (elevation=67.98ft-dtw)	Depth to water shallow piezometer converted to elevation	Hydrograph	Measured Flow	Estimated Discharge	Instrument Used	Estimated Accuracy	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C		Inferred dates?	
(mm/dd/yr)		*(feet)*	*54.82*	*(feet)*	*(feet)*	*(feet)*	*(feet)*	*(R/F/S/B)*	*(cfs)*	*(cfs)*	*(AA/PY, H, FT2)*	*(e/g/f/p)*	*(°C)*	*(µmhos/cm)*	*(at 25°C)*	*(feet)*	*(mm/dd/yr)*	
9/24/2024 12:33	em, am	0.74	55.56	-	-	-	-	B	72.8	-	H, FT2	-	-	-	-	-	-	Synoptic flow measurement. Used survey from 12/20/24 to estimate stage on this date.
12/20/2024 13:00	jp, mw, em	dry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Installed gage**, shallow/deep piezometer, and two temperature piezometers. Sediment is at 0 on staff plate.
2/21/2025 12:31	jp, em, mm	1.73	56.55	-	-	-	-	B	140	-	H, FT2	g	12.9	348	454	7.17	recent	No notes.
4/10/2025 10:15	jp	1.04	55.86	-	-	-	-	B	87	-	H	g	17.7	467	543	1.17,1.1	recent	Water is very turbid. Can hear a large fish hunting/splashing around downstream. Temperature piezometers are just barely exposed.
5/6/2025 11:00	jp	0.44	55.26	7.32	55.15	4.41	55.44	B	38.1	-	H	g	21.5	245	262	-	-	Gage has localized aggraded sand at the base of staff plate up to 0.3 ft. Downstream of gage there is localized scour and zero flow is about 1.5 ft below current water level. As water levels drop the surface water sensors will likely be dry soon. Temperature piezometers are exposed, Piezo A (close to the gage) is in 0.18 ft of water with 0.87 ft of stick-up, Piezo B (6 ft into the channel) is in 0.48 ft of water with stick-up of 1.22 ft.
7/8/2025 11:45	jp	0.91	55.73	6.87	55.60	4.44	55.41	B	62.3	-	H	g	23.0	335	348	-	-	Base of staff plate is at 0.33 ft - localized aggradation has occurred at the gage. Downloaded and relaunched temperature piezometers.
9/19/2025 11:45	mm	0.87	55.69	6.92	55.55	4.31	55.54	B	58.9	-	FT2	g	21.3	310	333	1	recent	Sediment is at 0.42 ft on the staff plate. Saw a large fish breach the water during measurement.
9/29/2025 14:00	jp	water below staff		7.61	54.86	dry	-	F	11.9	-	H	g	18.1	412	476	1.3-1.2	recent	Staff plate is dry, sediment is at 0.44 ft on staff plate. Channel at the gage is isolated in the thalweg with localized aggradation at the gage. Visual estimate of stage is 0.2-0.3 projecting the water surface in the channel to the staff plate. Zero flow at about 1.2 ft below water about 40 ft downstream of the gage.
11/11/2025 13:11	jp, nb	dry	-	16.34	46.13	dry	-	-	-	-	-	-	-	-	-	-	-	Staff plate is dry, sediment is at 0.44 ft on staff plate - mostly sand with about 1 inch of desiccated clay. Surface water sensors had a coating of fat clay. Cleaned the sensors and stilling well, reset the stilling well at approximately the same stage. Just the tip of the sensor in the deep piezo is wet - depth of water in the piezo is approximately 0.25 ft deep.

Observer Key: (em) Ella Myr, (jp) Jason Parke, (mw) Mark Woyshner, (mm) Maya Montalvo, (am) Andrew Marasco, (bl) Brigid Lynch, Montgomery & Associates :Nicholas Byler (nb)

Stage: Water level observed at outside staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Instrument: If measured, typically made using a standard (AA) or pygmy (PY) bucket-wheel ("Price-type"), HACH (H) or Flow Tracker (FT2) . If estimated, from rating curve (R) or visual (V).

Estimated measurement accuracy: Excellent (E) = +/- 2%; Good (G) = +/- 5%; Fair (F) = +/- 9%; Poor (P) estimated percent accuracy given

High-water mark (HWM): Measured or estimated at location of the staff plate

Specific conductance: Measured in micromhos/cm in field then normalized to 25degC by equation (specific conductance at 25degC) = (field specific conductance) * (1.8813774452 - 0.050433063928 * (field temp) + 0.00058561144042 * (field temp)^2).

Additional Sampling: Qbed = Bedload, Qss = Suspended sediment, Nutr = nutrients; other symbols as appropriate