PROPOSED SCOTT RIVER AND SHASTA RIVER WATERSHEDS EMERGENCY REGULATION:

FINDING OF EMERGENCY AND INFORMATIVE DIGEST

January 2024

LIST OF ATTACHMENTS

List of Abbreviations and acronyms

AF	acre-feet
BSID	Big Springs Irrigation District
BLW	Big Springs Lake west end
BSE	Big Springs East
BSW	Big Springs West
Board	State Water Resources Control Board
C	Celsius
CA	California
CDTFA	California Department of Tax and Fee Administration
CDFW	California Department of Fish and Wildlife
CDWR	California Department of Water Resources
CEFWG	California Environmental Flows Working Group
CFGC	California Fish and Game Commission
cfs	cubic feet per second
DPS	Distinct Population Segment
DWR	Division of Water Rights
eAR	electronic Annual Report
ETa	actual evapotranspiration
ESA	Endangered Species Act
ESU	Economically Significant Unit
eWRIMS	electronic Water Rights Information Management System
ft	feet
gpcd	gallons per capita per day
KMP	Klamath Mountain Province
KNF	Klamath National Forest
LCS	Local Cooperative Solution

LEPA	low energy precision application
LESA	low elevation spray application
MESA	mid-elevation spray application
mi	mile
MWCD	Montague Water Conservation District
NCRWQCB	North Coast Regional Water Quality Control Board
NIDIS	National Integrated Drought Information System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
NRC	National Research Council
NWCC	National Water and Climate Center
NWS	National Weather Service
OAL	Office of Administrative Law
OR	Oregon
PHABSIM	physical habitat simulation
PRISM	Parameter-elevation Regressions on Independent Slopes Model
Q_{fp}	estimated pass flow need equation
RM	river mile
RMS	River Modeling System
Scott watershed	Scott River watershed
SGMA	Sustainable Groundwater Management Act
Shasta watershed	Shasta River watershed
SONCC	Southern Oregon/Northern California Coast
SRFCF	Scott River Fish Counting Facility
State Water Board	State Water Resources Control Board
SWRCB	State Water Resources Control Board
UC	University of California

USGS	United States Geological Survey
USU	Utah State University
Watermaster	Scott Valley and Shasta Valley Watermaster District
WY	water year

1 FINDING OF EMERGENCY

1.1 EXECUTIVE SUMMARY

Western North America is experiencing an ongoing and persistent drought. Across California and within the Klamath Basin, the water years from 2013-2015 and 2020-2022 were some of the driest on record. The Scott and Shasta rivers, important tributaries to the Klamath river, specifically continue to experience lingering drought effects. Even after average precipitation in the watersheds in water year 2022-2023, the Scott River and Shasta River watersheds, continue to experience drought effects. Increases in weather extremes on a global and more local scale, as well as the extended drought conditions, heighten the risk of continued or worsening drought effects in 2024.

California and the Scott River and Shasta River watersheds are facing an uncertain hydrologic future that is driven by climate change and extreme hydrologic conditions. Water years (WYs) 2019-2020, 2020-2021, and 2021-2022 constitute one of the driest three-year periods on record in California. The recent California long-term drought also includes another three-year severe drought of WYs 2013-2014, 2014-2015, and 2015-2016 (National Drought Mitigation Institute, 2023). These back-to-back long droughts have reduced water resources and threatened water resiliency in California. During these years, the water supply in many parts of California was insufficient to meet a significant portion of water demands and ecological needs. During WY 2022-2023, California received significantly above average precipitation throughout most of the state. Northern California, and specifically the Scott River and Shasta River watershed, did not experience the same level of precipitation and is still experiencing drought related impacts including lower groundwater levels, longer periods of stream disconnection, and decline in salmon populations. On March 24, 2023, Governor Newsom signed an executive order repealing certain emergency drought provisions in select watersheds. The executive order specifically noted, however, that severe drought conditions in the Klamath River watershed had not abated and that continued action was needed to abate drought harm to native fish in the Klamath Basin: the region is still subject to the drought proclamation and emergency drought provisions (Newsom, 2023).

Water supply shortage is an ongoing concern in the Scott and Shasta watersheds. Addressing the severe water shortage in the Scott and Shasta watersheds requires continued urgent action to ensure water supplies are and will remain available to meet beneficial uses, including minimum instream flows for fish, human health and safety needs, and minimum livestock watering needs.

The Scott and Shasta Rivers are crucial sources of water in Siskiyou County and have immense economic, ecological, and cultural importance. The Scott and Shasta watersheds provide water for agriculture, domestic users, the environment, fire protection, municipalities, tribal nations, and recreation. These watersheds are home to

fish that are listed as threatened under the state and federal Endangered Species Acts (ESAs), as well as fish that hold significant cultural importance to California tribes and that are vital to the commercial and recreational fishing economy. Protecting these fish populations requires immediate action and continued implementation of minimum instream flow requirements. In addition to meeting baseline minimum fish flows, ensuring water is available to meet minimum human health and safety and livestock needs remains of utmost importance. Efforts continue towards ensuring that water right holders and claimants in these watersheds have access to water supplies for basic human health and safety and minimum livestock watering needs.

It is imperative that water right holders and claimants who do not have water available at their priority of right and do not provide water for minimum human health and safety or minimum livestock watering needs cease diversions of water that is needed for minimum instream flows to protect fish and more senior water rights, or implement other actions designed to provide equivalent or better protection to the fishery. Specifically, immediate action is needed to ensure the reasonable use of water in the Scott and Shasta watersheds – two high priority tributaries to the Klamath River that provide critically important habitat for the commercially significant and culturally important fall-run Chinook salmon (Trihey & Associates, 1996; SWRCB, 2020), Klamath Mountains Province (KMP) steelhead (steelhead), and the Southern Oregon/Northern California Coast (SONCC) coho salmon (coho salmon). The SONCC coho salmon is listed as a threatened species under both the federal and state ESAs and is identified as being at high and moderate risk of extinction in the Shasta River and Scott River, respectively (NMFS, 2014).

The State Water Resources Control Board (State Water Board or Board) may need to curtail water diversions if flows decrease below the California Department of Fish and Wildlife (CDFW) drought emergency minimum flow recommendation (detailed below) so that water is available for minimum flows for migration, rearing, and spawning of fall-run Chinook, steelhead, and SONCC coho salmon in the Shasta River and Scott River.

The proposed Scott River and Shasta River Emergency Regulation (Proposed Emergency Regulation or Emergency Regulation) is a revised and modified version of the expired Klamath River Drought Emergency Regulations (Drought Emergency Regulation) that was adopted on August 17, 2021, readopted with revisions on June 29, 2022, and expired on July 31, 2023 (SWRCB, 2021, 2022b). The Proposed Emergency Regulation maintains the same baseline flow requirements as the 2022 Drought Emergency Regulation with a clarification regarding natural flows, after consideration of updated information on the current state of the fisheries and baseline flow requirements. As compared to the expired Drought Emergency Regulation, the Proposed Emergency Regulation updates administrative processes for human health and safety exceptions; simplifies and refines conditions regarding the prohibition on inefficient livestock watering; includes additional options for overlying groundwater local cooperative solutions (LCSs); eliminates the provisions regarding streamlined curtailment based on water availability throughout the Klamath Basin; and clarifies the coordinating entities role and responsibilities among other more minor refinements.

This document makes findings and provides evidence of emergency and the need for the Proposed Emergency Regulation. These include information on recent conditions in the Scott River and Shasta River watersheds, State Water Board and North Coast Regional Water Quality Control Board's (North Coast Regional Water Board; collectively, the Water Boards) response to the ongoing emergency in these watersheds, benefits of the expired Drought Emergency Regulation, outreach and interaction in the watersheds, and the status of SONCC coho salmon, steelhead, and fall-run Chinook salmon. The findings and evidence regarding the need for the proposed Emergency Regulation includes an overview of water rights legal framework, the need for protective baseline minimum fishery flow requirements, a policy overview and discussion of the effect of the proposed changes to the regulation, descriptions of the watersheds, interconnectedness of the groundwater and surface water, and information on livestock watering efficiency. The document's informative digest section summarizes existing laws and regulations, consistency with existing state and federal regulations, and more in-depth information on the data and methodology for issuing and lifting curtailment orders under proposed Sections 875. The document concludes with a list of information relied on, statements on local mandates and California Environmental Quality Act (CEQA) exemption, a list of funding opportunities that could support cooperative agreements and livestock watering efficiency, and a summary of fiscal costs. The Fiscal Impact Statement is included as Attachment 1.

As such, the document meets the requirements for a digest described in Government Code section 11346.5, subdivision (a)(3).

1.1.1 Governor Newsom's Drought Emergency Proclamations

On April 21, 2021, Governor Gavin Newsom declared a drought state of emergency under the provisions of the California Emergency Services Act (Gov. Code, section 8550 et. seq.), in Mendocino and Sonoma counties due to drought conditions in the Russian River watershed (Newsom, 2021a), and directed state agencies to take immediate actions to bolster drought resilience across the state. On May 10, 2021, Governor Newsom expanded the drought proclamation to include counties in the Klamath River, Sacramento-San Joaquin Delta, and Tulare Lake watersheds (Newsom, 2021b). The May 2021 Proclamation directed the State Water Board, in part, to consider emergency regulations to curtail water diversions when water is not available at water right holders' priority of right. Additionally, to ensure critical instream flows for species protection, the proclamation directs the State Water Board and CDFW to evaluate minimum instream flows and other actions to protect salmon, steelhead, and other native fish in critical systems in the state and work with water users and other parties on voluntary measures to implement those actions. To the extent voluntary actions are not sufficient, the State Water Board, in coordination with CDFW, is to consider emergency regulations to establish minimum drought instream flow requirements. For purposes of approving these emergency regulations, the May 2021 Proclamation suspended CEQA (Pub. Resources Code, § 21000 et seq.) (Newsom, 2021b).

On July 8, 2021, Governor Newsom further expanded the emergency proclamation to include nine additional counties and urged increased water conservation of at least 15 percent compared to 2020 levels (Newsom, 2021c; Newsom, 2021d). On October 21, 2021, Governor Newsom expanded the drought declaration statewide, and required additional drought emergency planning measures for local water supply agencies (Newsom, 2021e). On March 28, 2022, Governor Newsom affirmed the continued state of drought emergency for California, extended authorities under prior drought proclamations, and required additional actions regarding drinking water supplies and water reliability, as well as groundwater recharge projects (Newsom, 2022). On March 24, 2023, Governor Newsom repealed many provisions of the above-noted drought proclamations in light of significant precipitation, particularly in the Sierra Nevada range (Newsom, 2023). However, the executive order specifically found that the severe drought conditions in the Klamath watershed had not abated, and that continued action is needed to abate drought harm to native fish in the Klamath watershed.

On August 17, 2021, the State Water Board adopted a Drought Emergency Regulation that went into effect on August 30, 2021 (Cal. Code Regs., tit. 23, §§ 875–875.9, Register 2021, No. 36) (SWRCB, 2021). On June 21, 2022, the State Water Board readopted the Drought Emergency Regulation, with revisions (Cal. Code Regs., tit. 23, §§ 875–875.9, Register 2022, No. 30) (SWRCB, 2022b). The Drought Emergency Regulation expired on July 31, 2023, and no emergency regulation is currently in effect for the Scott and Shasta watershed.

The Proposed Emergency Regulation provides authority to the State Water Board to set minimum instream flow numbers, curtailment authority to protect senior water rights and meet minimum instream flows, establish exceptions for minimum human health and safety, non-consumptive use, and livestock watering, and limit inefficient diversions for livestock during the September through March timeframe (SWRCB, 2021, 2022b). The State Water Board issued curtailment and information orders in the Scott River[1] and Shasta River[2] watersheds to protect minimum instream flows and gather information. Curtailment of water rights was adaptively managed to maintain minimum instream flows while maximizing water right diversions.

1.1.2 Petition for Rulemaking Seeking Permanent Regulation Establishing Minimum Flows in the Scott River

On May 23, 2023, the Karuk Tribe of California, Environmental Law Foundation, Pacific Coast Federation of Fishermen's Associations, and Institute for Fisheries Resources

---

[1] URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/scott_addendums.html

[2] URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/shasta_addendums.html

(Petitioners) submitted to the State Water Board a Petition for Rulemaking to Set Minimum Flows on the Scott River in Siskiyou County (Petition; Karuk Tribe et al., 2023). The Petition was submitted pursuant to the California Constitution, Article 1, Section 3, and Government Code Section 11340.6. The Petition requests that the State Water Board establish permanent stream flow requirements on the Scott River based on a CDFW 2017 report, *Interim Flow Criteria for the Protection of Fishery Resources in the Scott River Watershed* (CDFW, 2017).

Per Government Code Section 11340.7, the Board was required to, within 30 days of receipt of the Petition, deny the Petition or schedule a hearing. On June 19, 2023, the Board issued a Notice that a hearing would be held on the Petition at the State Water Board's August 15, 2023, meeting and soliciting comments in response to the notice.

On August 15, 2023, the Board held a hearing in response to the Petition. The hearing was expanded to include the Shasta River watershed. At the hearing, the State Water Board directed Division of Water Rights staff to move forward with the proposed Emergency Regulation for the Scott River and Shasta River watersheds prior to the next irrigation season. The State Water Board also directed Division of Water Rights staff to identify and initiate the scientific work needed to pursue long-term flows in both the Scott and Shasta watersheds.

1.2 EMERGENCY DEFINED

Water Code section 1058.5 grants the State Water Board the authority to adopt drought emergency regulations for specific purposes in certain years. The specific purposes of such drought emergency regulations can be to: "prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water, to promote water recycling or water conservation, to require curtailment of diversions when water is not available under the diverter's priority of right, or in furtherance of any of the foregoing, to require reporting of diversion or use or the preparation of monitoring reports." Per Water Code section 1058.5 drought emergency regulations must be "adopted in response to conditions which exist, or are threatened, in a critically dry year immediately preceded by two or more consecutive below normal, dry, or critically dry years or during a period for which the Governor has issued a proclamation of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions." As described above, the May 2021 Proclamation declared a state of emergency covering the Klamath River watershed based on drought conditions. The drought emergency in the Klamath River watershed was confirmed again in March 2022 and acknowledged again in March 2023 (Newsom, 2022, 2023). The Governor terminated the drought proclamation for most of California but left the Klamath watershed still subject to drought provisions.

Emergency regulations adopted under Water Code section 1058.5 remain in effect for up to one year and may be renewed if the Board finds that drought conditions as defined remain in effect. Section 1058.5, subdivision (b) provides that, notwithstanding Government Code sections 11346.1 and 11349.6, the Board's finding of emergency in

connection with an emergency regulation promulgated under Water Code section 1058.5 is not subject to review by the Office of Administrative Law (OAL).

Government Code section 11346.1, subdivision (a)(2), requires that, at least five (5) working days prior to submission of the proposed emergency action to OAL, the adopting agency provide a notice of the proposed emergency action to every person who has filed a request for notice of regulatory action with the agency. After submission of the proposed emergency to OAL, OAL must allow interested persons five (5) calendar days to submit comments on the proposed emergency regulations as set forth in Government Code section 11349.6. The information contained in this finding of emergency provides the necessary information and factual basis to support the State Water Board's emergency rulemaking under Water Code section 1058.5 and also meets the applicable requirements of Government Code sections 11346.1 and 11346.5.

1.3 EVIDENCE OF EMERGENCY

Western North America has been experiencing a period of severe drought for the last 20 years. WYs 2019-2022 were one of the driest three-year periods on record, similar to the recent 2014-2016 drought, both of which caused significant drought related impacts throughout California. During these severe droughts, the water supply is insufficient to meet a significant portion of water demands and ecological needs. During WY 2022-2023, most of California received above-average precipitation. On March 24, 2023, Governor Newsom repealed many provisions of the above-noted drought proclamations in light of significant precipitation, particularly in the Sierra Nevada range (Newsom, 2023). However, the executive order specifically found that the severe drought conditions in the Klamath watershed had not abated, and that continued action is needed to abate drought harm to native fish in the Klamath watershed. Two priority tributaries to the Klamath River, the Scott and Shasta Rivers continue to experience lingering drought impacts and uncertain hydrologic future that may include more drought years. The following sections provide a detailed review of hydrologic conditions and forecasts in the Scott and Shasta watersheds.

1.3.1 Recent and Forecast Precipitation and Streamflow

The Scott and Shasta watersheds have experienced three consecutive years of below-average precipitation followed by one year of above average precipitation.

1.3.1.1 Scott River Watershed

1.3.1.1.1 Water Years 2019 to 2023

Rainfall has had a decreasing trend in the Scott River watershed. The recorded rainfall at Fort Jones station operated by US Forest service shows an average reduction of more than 3 inches in the total annual rainfall. The average total annual rainfall of WY 1941-1942 to WY 1998-1999 was 21.8 inches, which decreased to 18.5 inches for WY 1999-2000 to present.

Table 1 compares recent precipitation data in the Scott River watershed to long-term trends. Specifically, Table 1 compares April 1st snow water equivalent and annual precipitation for WY's 2019-2020, 2020-2021, 2021-2022, 2022-2023, and 2023-2024 data.

Table 1. Scott River: percent of average snow water equivalent and annual precipitation. Data source: CDWR (2023b).

Scott River	Percent of Average April 1st Snow Water Equivalent	Percent of Average Annual Precipitation	
Water Year	Average of Middle Boulder 1, Middle Boulder 3, Etna Mountain, Dynamite Meadow, and Swampy John precipitation gages (1946-present)	Callahan precipitation gage (1943-present)	Fort Jones precipitation gage (1935-present)
2019-2020	55%	52%	36%
2020-2021	78%	74%	55%
2021-2022	20%	76%	65%
2022-2023	167%	146%	94%
2023-2024	–	–	54% of average October and November, and 11% of average water year as of November 30

1.3.1.2 Streamflow in Fall 2023

The United States Geological Survey (USGS) Scott River gage near Fort Jones (USGS gage no. 11519500, USGS Fort Jones Gage) is about 21 miles upstream of the outlet of the Scott River watershed and represents the observed (impaired) flow of the watershed. In the past four years (WYs 2019-2023), the Scott River has experienced three consecutive severely dry water years (WYs 2019-2020, 2020-2021, and 2021-2022) followed by a near-average water year (WY 2022-2023) (Figure 1). As recorded at the USGS Fort Jones Gage, the recent three-year drought (WYs 2019-2020 to 2021-2022) was the most severe drought in the period of record, October 1941-present (USGS 2023a). Figure 1 shows the monthly streamflow and precipitation near Fort Jones in the Scott River watershed to demonstrate the surface hydrology of the watershed in recent decades and daily time series of flow and precipitation near Fort Jones and emergency minimum flows in the Scott River watershed for WY 2023, as of December 14, 2023. As shown in Figure 1 (c), most of Scott River watershed (as well as Shasta River watershed and the Upper Klamath Basin) is experiencing an abnormally dry condition as of December 14, 2023 (National Drought Mitigation Center, 2023).

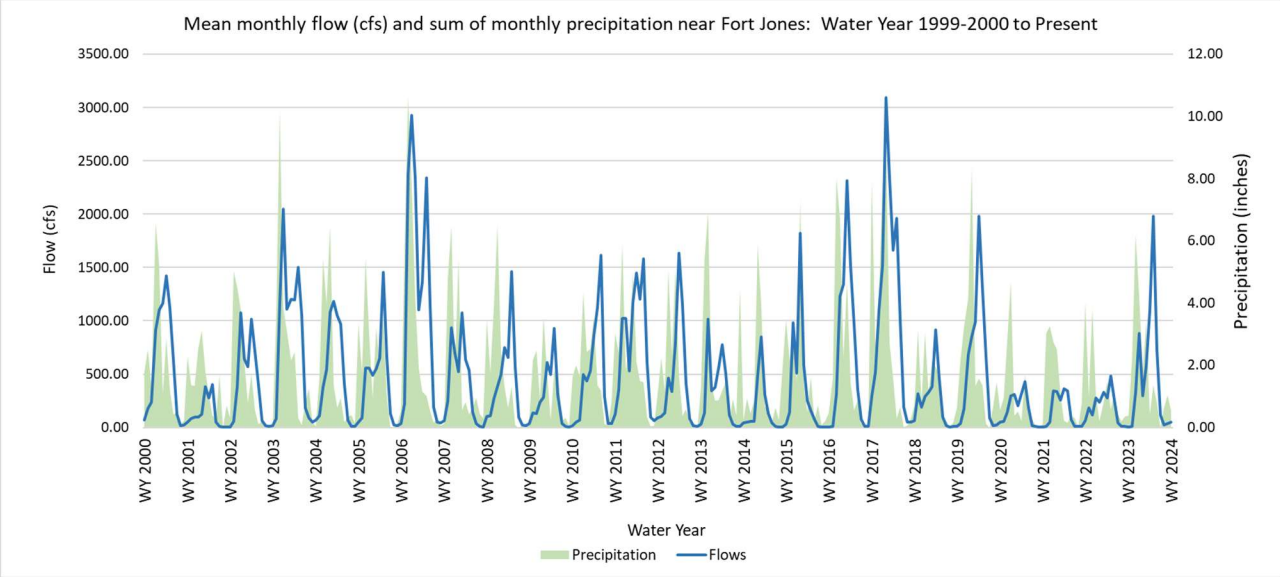


Figure 1a

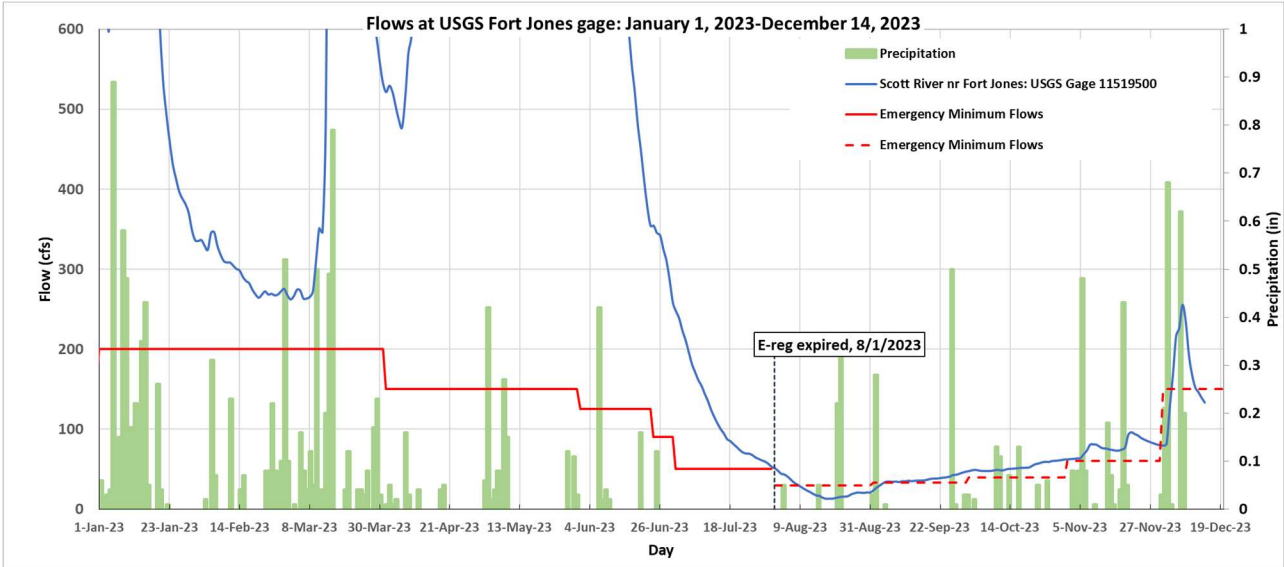


Figure 1b

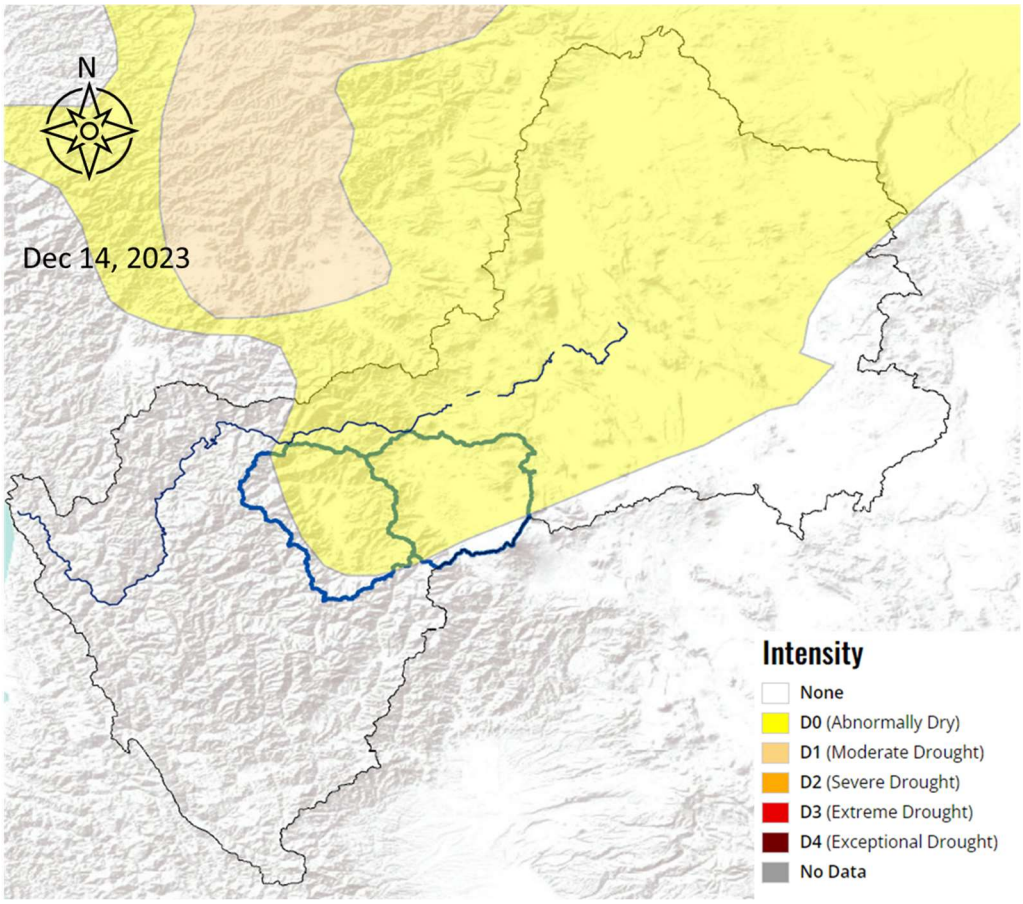


Figure 1c

Figure 1. Monthly time series of flow and precipitation near Fort Jones in the Scott River watershed for WY 1999-2000 to present (a); Daily time series of flow and precipitation near Fort Jones and emergency minimum flows in the Scott River watershed for Y 2023 as of December 14, 2023 (b); and regional drought condition as reported by US Drought Monitor (https://droughtmonitor.unl.edu/) as of December 14, 2023 (c). cfs = cubic feet per second. Streamflow data source: USGS Fort Jones (USGS gage no. 11519500; USGS, 2023a). Precipitation data source: PRISM Climate Group (2023). Precipitation is estimated at the location of USGS gage (with the assumption that it represents the average rainfall of the Scott River watershed).

As of December 14, 2023, USGS Fort Jones Gage is 133.0 cubic feet per second (cfs). The average flow of WY 2023-2024 (i.e., since October 1, 2023) at the gage has been 83.8 cfs (USGS, 2023a).

In the year 2023, flows at USGS Fort Jones were all above the proposed emergency minimum flows until August 8, 2023 (Figure 1 bottom). Flows increased above the proposed emergency minimum flows on September 4, 2023, and stayed higher than the emergency minimum flows until November 30, 2023 (USGS, 2023a).

In WY 2023-2024, as of December 14, 2023, except for six days in December 2023 (December 1 to December 3 and December 12 to December 14) flows at USGS Fort Jones Gage were above the minimum flow requirements of 40 cfs, 60 cfs, and 150 cfs of October, November, and December, respectively (USGS, 2023a).

Figure 2 shows a flow probability exceedance analysis of the full record, 1941-present, of streamflow data for the Scott River USGS gage near Fort Jones and the average annual streamflow for WYs 2021-2022 and 2022-2023. For WY 2022-2023, the annual average flow is 510 cubic feet per second (cfs), which is about 89 percent of the long-term average annual flow of October to September (579 cfs) for the period October 1941-September 2023. Flows during WY 2022-2023 represent a near-average year, with flows in the lowest 52 percent of the period of record. WY 2021-2022, the most recent year of severe drought, was very dry, with flows in the lowest 10 percent of the period of record.

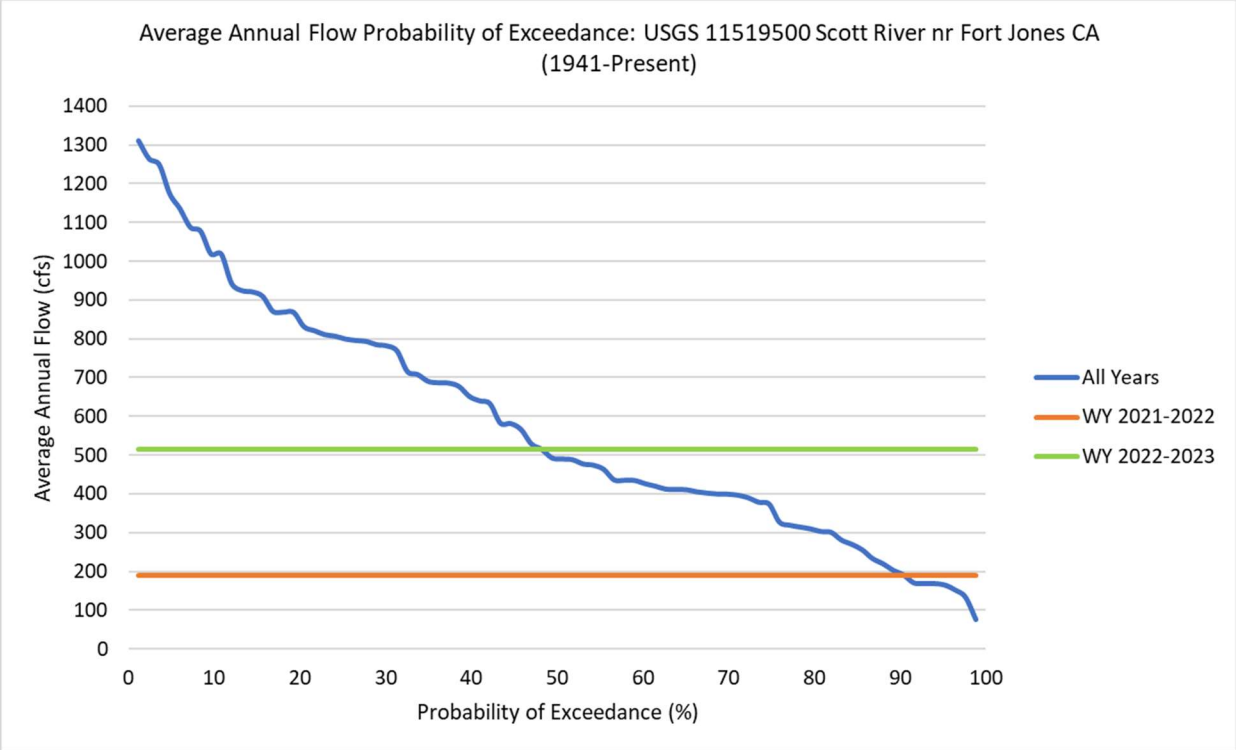


Figure 2. Probability of exceedance of average annual impaired flow at USGS Fort Jones Gage (USGS Gage no. 11519500) and annual average flow for WYs 2021-2022 and 2022-2023. Oct-Sep = October-September. Streamflow data source: USGS (2023a).

1.3.1.2.1 Streamflow Forecast for WY 2023-2024

Long-term forecasting of flows in the Scott River watershed is challenging due to uncertainty regarding future climate in forthcoming seasons and years. As shown in Figure 3, the National Weather Service (NWS) Climate Prediction Center has

forecasted equal chances of WY 2023-2024 being either above or below average precipitation for most of the water year. The most recent forecast, as of December 14, which was issued on November 16, 2023, by the NWS Climate Prediction Center, forecasted precipitation in early winter 2024 to be slightly above average. The NWS Climate Prediction Center has forecasted California's air temperature to be slightly above average for WY 2023-2024 (NWS, 2023).

Water Year 2023-2024 is predicated to be an El Niño year. El Niño is expected to persist and peak in winter, but without a clear impact on weather in the Scott River and Shasta River watersheds. Outlooks currently suggest equal chances of above-, below-, and near-normal conditions (NIDIS, 2023). As of December 6, 2023, snow water equivalent at Scott Mountain, in the Scott River watershed, shows a snow drought for the region meaning lack of snowpack storage to contribute to the future flows (NWCC, 2023). Snow conditions will continue to evolve throughout winter. At this time in the season, recovery from snow drought can be rapid but recovery from snow drought in late winter and early spring can be more difficult. (NWCC, 2023).

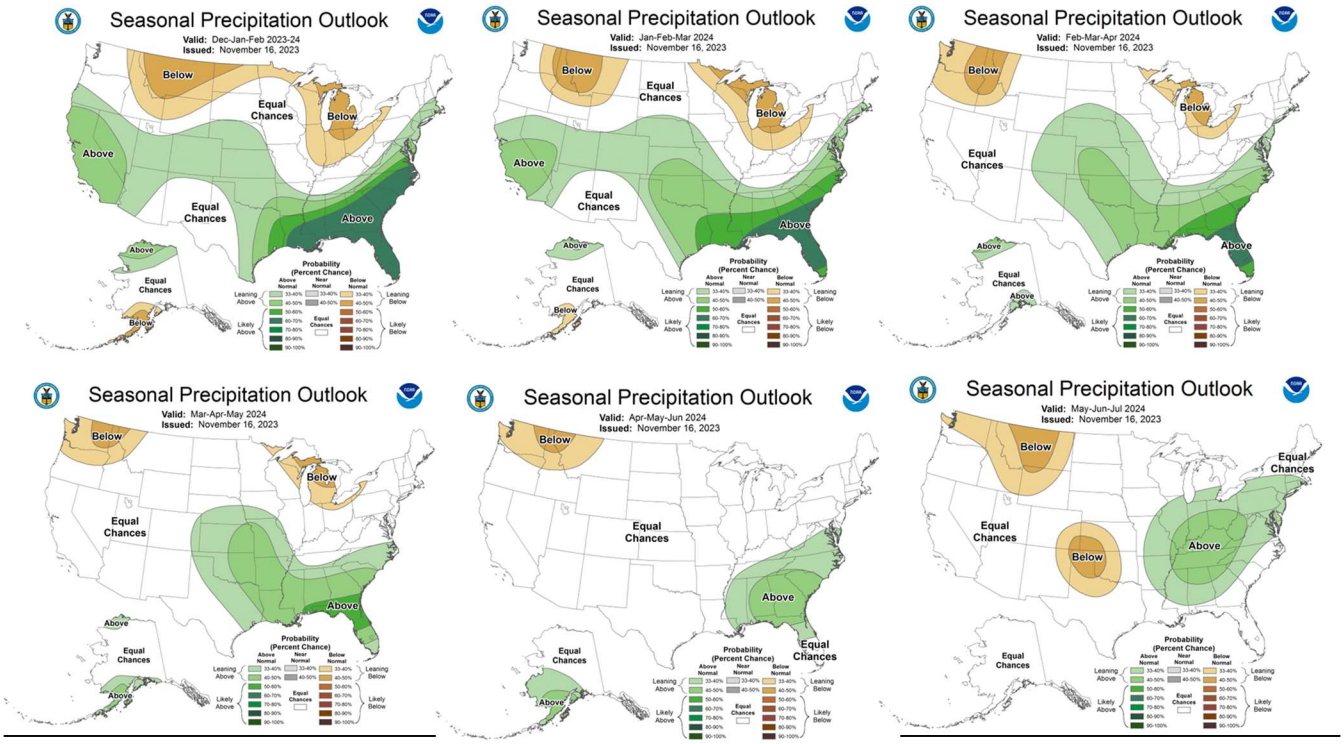


Figure 3. Seasonal precipitation outlook issued by National Weather Service Climate Prediction Center on November 16, 2023. Source: NWS (2023).

Figure 4 shows Scott River forecasted impaired streamflow (i.e., with diversions) for 2024 for expected-range, extreme-drought, and above-average scenarios, the average of streamflow data from the entire period of record, 1941-present, and the proposed emergency minimum flow requirements. Curtailment of diversions and local cooperative solution conservations are forecasted as needed to achieve the proposed monthly emergency minimum flow requirements throughout 2024.

As reported by National Weather Service (NWS, 2023), there are equal chances of being either above or below average precipitation for most of the WY 2023-2024. In such a condition, the best alternative for the expected flows of WY 2023-2024 could be the average of historical flows, as used in this document. However, two filters have been applied to select the historical years for the averaging process: 1: Only historical years after Water Year 1999-2000 are considered. It is assumed that the data of water years prior to WY 1999-2000, do not represent the current average flows, due to the land use and climate change; 2: to consider the effect of Fall baseflows on the annual hydrograph, only years with flows similar to the current November flow (latest available monthly data as of mid-December) are considered for averaging. It means that years with November flows much higher or much lower than the 2023 November flows are excluded from averaging.

Therefore, in the expected-range scenario, daily streamflow data for every month of November from WY 1999-2000 to the present was evaluated. In eight selected WYs, monthly average streamflow was close to 77 cfs (= average flows of November 2023) during the month of November. Daily average streamflow from all months in the eight selected WYs are plotted for the expected-range scenario case. All the WY lines are represented with the same color in Figure 4. In the expected-range scenario, daily average streamflow is forecast to fall below the minimum flow requirements during August 2024 to November 2024 for most of those eight selected WYs.

In the extreme-drought scenario, daily average streamflow from WY 2020-2021 is assumed to occur again in WY 2023-2024. WY 2020-2021 was an extremely dry WY. In the extreme-drought scenario, daily average streamflow is forecast to fall below the minimum flow requirements during January 2024, June 2024 to October 2024, and in December 2024.

The above-average scenario in this document means a year with above-average precipitation (which does not necessarily provide an above-average runoff). Therefore, the recent water year 2022-2023, which had near, but above average precipitation is considered as an alternative for the above-average scenario. In the above-average scenario, daily average streamflow from WY 2022-2023 is assumed to occur again in WY 2023-2024. In the above-average scenario, daily average streamflow is forecast to exceed the minimum flow requirements, except during August 2024.

Fall and Winter flows on the Scott River are influenced by the timing and volume of precipitation events and the groundwater levels. Essentially, if groundwater levels are too low, surface flows sink below the riverbed and the river disconnects. Once this occurs, fall or winter precipitation is required to both raise groundwater levels and

provide sufficient surface flows to reestablish connection. The overall precipitation received for the year and the amount of groundwater pumping has a significant role in the groundwater levels and the amount of precipitation needed for reconnection to Klamath River. Depending on the water year type and the amount of groundwater pumping, if precipitation arrives early in the fall, which sometimes occurs in dry years, the minimum flow requirements could be met in October. In dry years, groundwater levels are typically lower. More fall precipitation would be needed to recharge groundwater and sustain increased streamflow on the Scott River and its tributaries. Decreased groundwater pumping (Harter, 2021a), as well as earlier precipitation, would provide for earlier reconnection of the stream system.

Groundwater levels in September 2023 and October 2023 were the highest, for their respective months, since September 2019 (UC Davis, 2023). Therefore, even with current fall 2023 precipitation less than fall 2022 precipitation, Scott River watershed tributaries were connected to the main stem of the Scott River, earlier than last year.

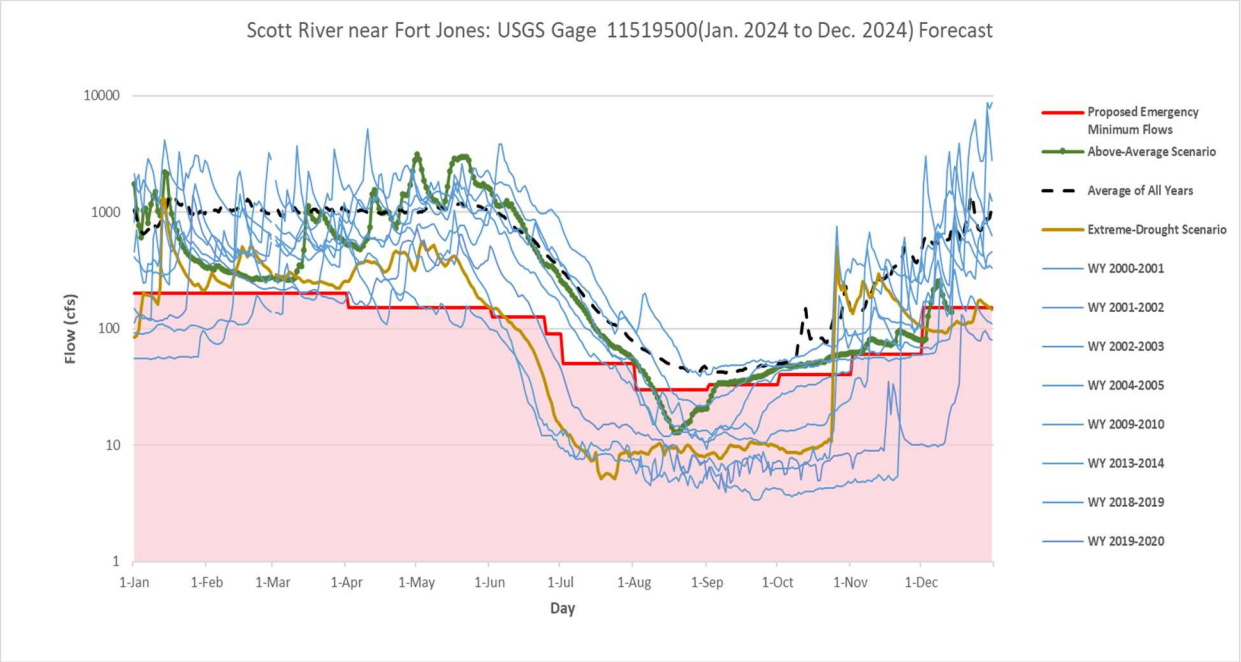


Figure 4. Forecasted monthly average flow for Scott River gage near Fort Jones (USGS gage no. 11519500). cfs = cubic feet per second; WY = water year. Streamflow data source: USGS (2023a).

1.3.1.2.2 Shasta River Watershed

1.3.1.2.2.1 Water Years 2019 to 2023

The average total annual rainfall of Yreka rainfall station operated by US Forest Service has decreased since WY 2000, going from 19.8 (WY 1982-1983 to WY 1999-2000) inches to 17.0 inches (WY 2000 to present).

Table 2 compares recent precipitation data in the Shasta River watershed to long-term trends. Specifically, Table 2 compares April 1st snow water equivalent and annual precipitation for WYs 2019-2020, 2020-2021, 2021-2022, 2022-2023, and 2023-2024 data to the long-term average.

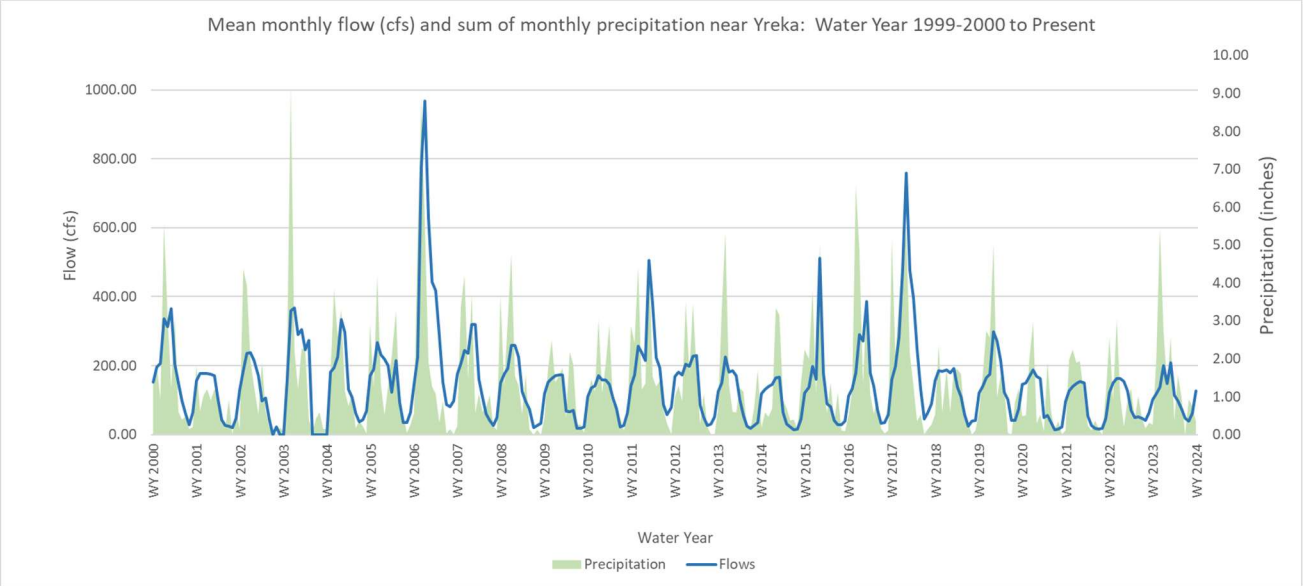
Table 2. Shasta River: percent of average snow water equivalent and annual precipitation. Data source: CDEC

Shasta River	Percent of Average April 1st Snow Water Equivalent	Percent of Average Annual Precipitation
Water Year	Average of Parks Creek, Little Shasta, and Sweetwater precipitation stations (1947-present)	Yreka precipitation gage (1982-present)
2019-2020	57%	51%
2020-2021	91%	61%
2021-2022	32%	74%
2022-2023	162%	96%
2023-2024	_	27% of October and November and 6% of average water year as of November 30.

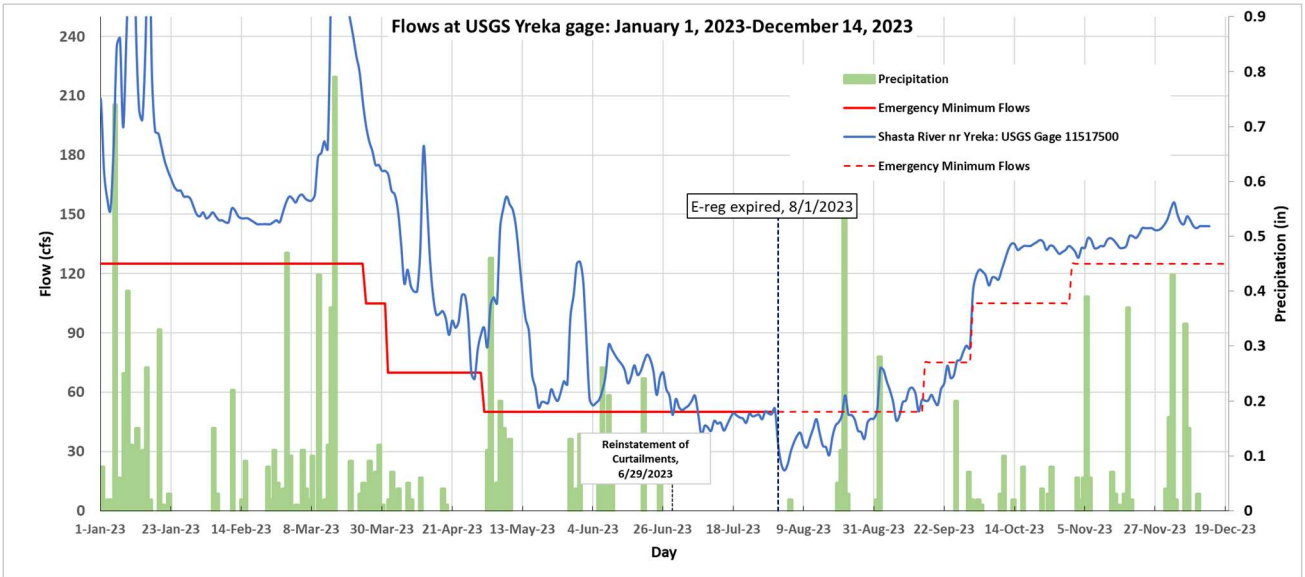
In the Shasta River watershed April and May, when available, generally represent the best approximate date of annual maximum snowpack extent.

1.3.1.2.2.2 Streamflow in Fall 2023

The USGS Shasta River gage near Yreka (USGS gage no. 11517500, USGS Yreka Gage) is at the outlet of the Shasta River watershed and represents the impaired flow of the entire watershed. Similar to the Scott River watershed, in the past four years, the Shasta River has experienced three consecutive severely dry WYs (2019-2020, 2020-2021, 2021-2022) followed by a near-average water year as defined by annual flows at USGS Shasta River gage (WY 2022-2023) (Figure 5). Streamflow data from the USGS Yreka Gage indicate the recent three-year extreme drought (WYs 2019-2020 to 2021-2022) was the second driest period since WYs 1933-1936. Figure 5(a) shows that WYs 2019-2022 were the driest period in the recent past (defined as since WY 1999-2000). Figure 5 shows the monthly flows and precipitation near Yreka in the Shasta River watershed to demonstrate the surface hydrology of the Shasta River watershed in recent decades as well as time series of daily flow and precipitation near Yreka in the Shasta River watershed and emergency minimum flows for year 2023 as of December 14, 2023, to demonstrate the recent surface hydrology in the watershed. As shown in Figure 1 (c), most of Shasta River watershed is experiencing an abnormally dry condition as of December 14, 2023 (https://droughtmonitor.unl.edu/).



(a)



(b)

Figure 5. Time series of monthly flow and precipitation near Yreka in the Shasta River watershed for WY 1999-2000 to present (a) and time series of daily flow and precipitation near Yreka in the Shasta River watershed and emergency minimum flows for Y 2023 as of December 14, 2023 (b). cfs = cubic feet per second; WY = water year. Streamflow data source: USGS Yreka gage (USGS Gage no. 11517500; USGS (2023c)). Precipitation data source: (PRISM Climate Group, 2023). Precipitation

is estimated at the location of USGS gage (with the assumption that it represents the average rainfall of the Shasta River watershed).

As of December 14, 2023, streamflow at the USGS Yreka Gage was at 144 cfs (USGS, 2023c) and the average flow of water year 2023-2024 at this gage was 135.3 cfs (USGS, 2023c). These numbers are in part influenced by water use reduction effects of the expired Drought Emergency Regulation (SWRCB, 2022b) and are in part influenced by the efforts of a group of large water users in the Shasta River watershed to maintain higher flows than implemented prior to the drought emergency regulation efforts (but lower than those of the expired Drought Emergency Regulation), as proposed by these water users (Shasta Producers) at the Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds on October 6, 2023.

In 2023, except for two days in April, flows at USGS Yreka gage were above the emergency minimum flows until July 6, 2023. Flows at USGS Yreka gage were lower than the minimum flow requirements for 23 days in July, 30 days in August, and 12 days in September.

In the current water year of 2023-2024, as of December 14, flows at the USGS Yreka gage have always been higher than the minimum emergency flows of 105 cfs in October, and 125 cfs of November and December.

Figure 6 shows a flow probability exceedance analysis of the full record, 1933-present, of streamflow data for the USGS Yreka Gage and the annual average streamflow for WYs 2021-2022 and 2022-2023. For the recent WY 2022-23, the annual average flow is 112 cfs, which is about 64 percent of the long-term average of annual flow (176 cfs) for the time-period of October 1988 – September 2023. Despite the above-average snow water equivalent measurements in the Shasta River watershed (Table 2), flows at the USGS Yreka gage in WY 2022-2023 were in the lowest thirty-three percent (33%) of the historical period of record (1933–present). Further, as a part of recent extreme drought years, flows at the USGS Yreka gage in WY 2021-2022 fell to the lowest twenty-two percent (22%) of the historical period of record flows at the Yreka USGS gage.

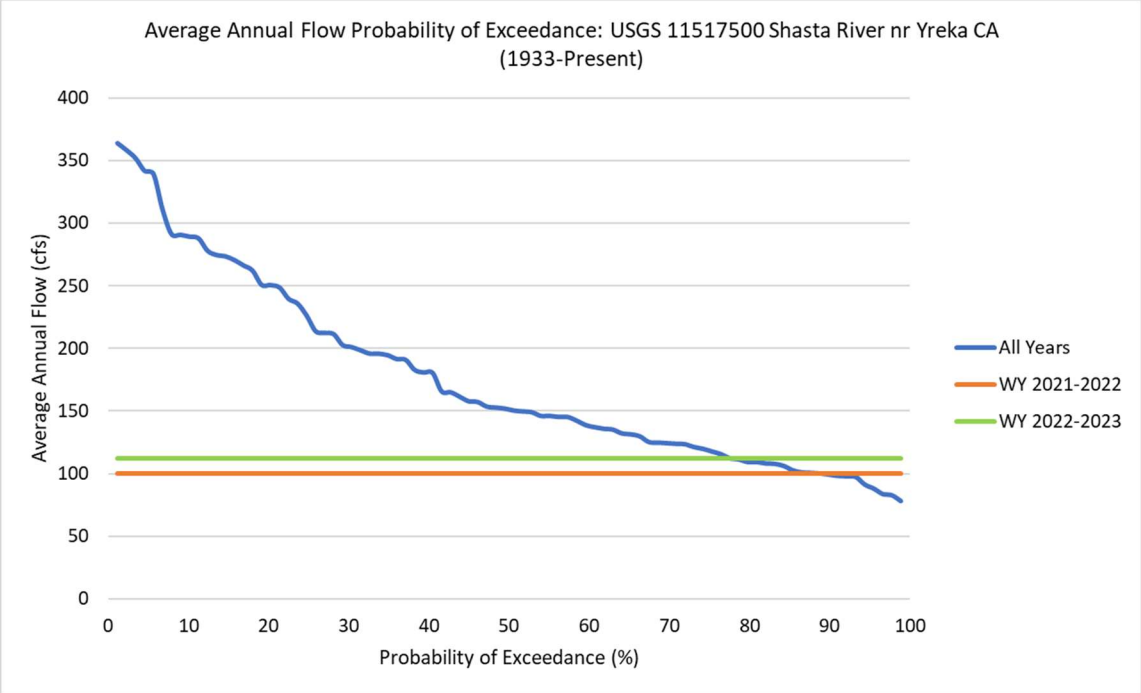


Figure 6. Probability of exceedance of annual impaired flow for Shasta River near Yreka (USGS gage no. 11517500) and annual average flow for WYs 2021-2022 and 2022-2023. cfs = cubic feet per second; Oct-Sep = October to September, a water year; WY = water year. Data source: USGS (2023c).

1.3.1.2.2.3 Streamflow Forecast for WY 2023-2024

Figure 7 shows forecasted impaired streamflow (i.e., with diversions) for 2024 for expected-range, extreme-drought, and above-average scenarios, the average of streamflow data for the period of record, 1933-present, and the proposed emergency minimum flow requirements. Curtailment of diversions and LCSs are forecast as needed to achieve the proposed minimum flows during many months of the 2024.

In the expected-range scenario, due to the strong correlation between hydrologic conditions of Scott River and Shasta River watersheds, the same eight years selected for the Scott River watershed are used and analyzed for the Shasta River watershed. Daily average streamflow from all months in the eight WYs are plotted for the expected-range scenario case; all the WY lines are represented with the same color in Figure 7. In the expected-range scenario, daily average streamflow is forecast to fall below the minimum flow requirements during mid-June 2024 to end of September 2024 for most of the selected WYs.

In the extreme-drought (i.e., WY 2020-2021) scenario, daily average streamflow is forecast to fall below the minimum flow requirements during April 2024 to end of September 2024.

Above-average scenario in this document means a year with above-average precipitation (which does not necessarily provide an above-average runoff). Therefore, the recent water year 2022-2023 with above average precipitation is considered as an alternative for the above-average scenario. In the above-average scenario, daily average streamflow from WY 2022-2023 is assumed to occur again in WY 2023-2024. In the above-average scenario, daily average streamflow is forecast to fall below the minimum flow requirements during July 2024 to September 2024.

The Shasta River is fed by large spring sources and its mainstem is less dependent than the Scott River on heavy rains to increase streamflow in the fall. Typically, when irrigation diversions end around October, streamflow on the Shasta River near Yreka (USGS gage no. 11517500) increases in a pattern not dependent on the timing of fall precipitation.

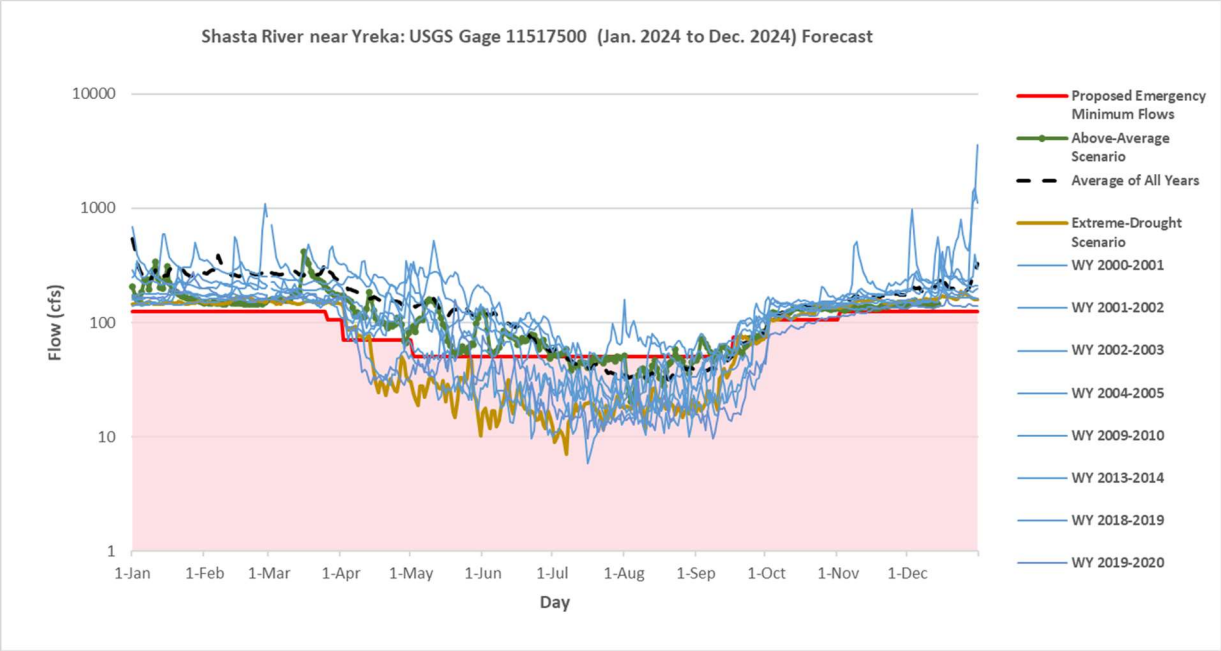


Figure 7. Shasta River average daily impaired streamflow at Yreka gage (USGS gage no. 11517500) for forecast for January 2024 to December 2024. Streamflow data source: USGS (2023c).

1.3.1.3 Water Boards' Response: 2021 and 2022 Drought Emergency Regulation and Related Public Outreach Actions in 2020

On March 12, 2020, National Marine Fisheries Service (NMFS) staff contacted North Coast Regional Water Board staff out of concern for low flows in the Scott River watershed. Snowpack conditions at that time were poor (73% of average and 5% of average at the Middle Boulder and Scott Mountain snow gages, respectively) and indicative of drought conditions. In response to these conditions, North Coast Regional Water Board, NMFS, CDFW, and Division of Water Rights staff organized an ongoing bi-weekly drought response call to coordinate agency actions around voluntary instream

flow efforts. These bi-weekly calls expanded to include additional interests in the watershed, including local and tribal government representatives, nongovernmental organizations, the Scott Valley and Shasta Valley Watermaster District (Watermaster), and interested individuals. Despite these efforts, fall-run Chinook salmon were unable to reach spawning grounds in the Scott Watershed and coho salmon, forcing more spawning in the main channels and leaving the brood year at higher risk.

1.3.1.3.1 Development of 2021 and 2022 Drought Emergency Regulation

On March 22, 2021, the State Water Board sent Letters Regarding Ongoing Dry Conditions in most California watersheds to all water right holders and claimants in the state regarding ongoing dry conditions in most California watersheds. These information letters encouraged water right holders and claimants to plan and prepare for potential water shortages later this year. The letter also reminded water right holders and claimants that accurate and timely reporting of water use data will help to provide critical information needed to manage the state's water resources. On April 20, 2021, the Deputy Director and CDFW representatives presented at the Siskiyou County Board of Supervisors regularly scheduled meeting regarding dry conditions in the Scott River watershed, fisheries and water management concerns, and funding opportunities to help address these challenges. Additionally, on July 6, 2021, the State Water Board began distributing an informational flyer encouraging conservation throughout the Klamath watershed, with a focus on the Scott and Shasta watersheds.

On June 1, 2021, the State Water Board sent notices of water unavailability to 102 water right holders, accounting for 158 of the 803 water rights in the Scott River watershed, urging them to stop diverting amid worsening hydrologic conditions. The same day, State Water Board staff circulated a Press Release titled: Extremely Dry Conditions Prompt Restrictions for Some Water Right Holders in the Scott River.

On July 1, 2021, State Water Board and CDFW staff hosted a public meeting on potential drought actions for the Scott River and Shasta River watersheds. Staff presented information on the drought conditions, potential drought response actions in the Scott and Shasta watersheds and solicited comments. A full recording of the July 1, 2021 meeting is available online here: https://youtu.be/fx3x4eB8LG8. Presentation slides from the July 1, 2021 meeting are available online here: https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/scott_shasta_drought_presentation_070121.pdf.

On July 14, 2021, State Water Board staff met with representatives from local environmental organizations to discuss an emergency drought regulation.

On July 16, 2021, State Water Board staff issued a Notice of Public Meeting and Opportunity for Comment: Draft Drought Emergency Regulation for Scott River an Shasta River Watersheds that announced the release of draft 2021 Drought Emergency Regulation for public comment and advertising a July 20, 2021 public meeting. During the public meeting on July 20, 2021, State Water Board and CDFW staff described the draft Drought Emergency Regulation, presented responses to past comments on the

CDFW flow recommendations, answered participants questions, and listened to comments. A full recording of the July 20, 2021 public meeting is available at: https://youtu.be/DgEs3GEJ-f0. Presentation slides from the meeting are available at: https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/scott_shasta_e_reg_presentation_072021.pdf

The public comment period extended from July 16, 2021 to July 23, 2021, and the State Water Board received more than 100 written comments.

On August 17, 2021, the State Water Board adopted a Drought Emergency Regulation that went into effect on August 30, 2021, when it was approved by the Office of Administrative Law and filed with the Secretary of State (Cal. Code Regs., tit. 23, §§ 875–875.9). The Drought Emergency Regulation provided the State Water Board with curtailment authority to protect minimum instream flows, establishes minimum human health and safety and livestock watering exceptions, and limits inefficient diversions for livestock during the September through January timeframe. The Drought Emergency Regulation declared certain diversion practices unreasonable and declared that diversions are unreasonable when the drought emergency minimum instream flows are not met (SWRCB, 2021).

On May 4, 2022, State Water Board and CDFW staff hosted a public meeting to provide information and solicit input on re-adoption of the regulation. Staff presented information on drought and fisheries conditions, potential changes to the Drought Emergency Regulation, and solicited comments. A full recording of the May 4, 2022 meeting is available online here: https://youtu.be/fx3x4eB8LG8. Presentation slides from the May 4, 2022 meeting are available online here: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/2022-may4-ereg-re-adopt.pdf.

On May 18, 2022, State Water Board staff issued a Notice of Public Meeting and Release of Preliminary Changes to Drought Emergency Regulation for Scott River and Shasta River Watersheds that announced the release of draft revised Drought Emergency Regulation for public comment and advertising a May 25, 2022 public meeting. On May 25, 2022, State Water Board and CDFW staff hosted a public meeting to provide information on the revised regulation and solicit input on changes to the regulation. A full recording of the May 25, 2022 meeting is available online here: https://youtu.be/-ZhZOjufiYo. Presentation slides from the May 4, 2022 meeting are available online here: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/2022-05-25-meeting-ssd.pdf.

On May 26, 2022, a revised Notice was released that extended the comment period for the preliminary draft of proposed changes. The public comment period extended from May 18, 2022 to May 31, 2022. The State Water Board received approximately 17 written comment letters and emails.

On June 21, 2022, the State Water Board re-adopted the Drought Emergency Regulation, with modifications, and it went into effect on July 29, 2022, when it was approved by the Office of Administrative Law and filed with the Secretary of State (Cal. Code Regs., tit. 23, §§ 875–875.9) (SWRCB, 2022b). The Drought Emergency Regulation expired on July 31, 2023.

1.3.1.3.2 Implementation of 2021 and 2022 Drought Emergency Regulation

The Drought Emergency Regulation was in effect from August 30, 2021 through July 31, 2023. The State Water Board issued curtailment and informational orders in the Scott River and Shasta River watersheds to protect minimum instream flows and gather information (SWRCB, 2021, 2022b). Curtailment of water rights was managed adaptively to maintain minimum instream flows while maximizing water right diversions. Throughout implementation, Water Boards staff met frequently with tribal leadership and representatives, local diverters, stakeholders, and members and staff from the Siskiyou County Board of Supervisors to discuss the status of hydrology and fisheries, regulation implementation, local cooperative solutions, and potential regulatory changes.

To assist compliance with curtailments and informational orders, Water Boards staff setup and managed a dedicated phone and email hotline. Water Boards staff responded to at least 536 inquiries, usually within one business day of receipt. Staff developed online video tutorials for compliance and held a workshop on compliance on September 23, 2021. On October 21, 2021, State Water Board staff issued a letter to water users clarifying the regulation's rules regarding livestock water diversions in both watersheds. On December 10, 2021, State Water Board and CDFW staff hosted an in-person compliance assistance day in Yreka.

Throughout 2022 and 2023, State Water Board staff met extensively with coordinating entities and local diverters to help diverts develop Local Cooperative Solutions.

On June 1, 2022, Water Boards staff and Board Members toured the watersheds with members of the agricultural community and Siskiyou County Board of Supervisors and discussed the aforementioned topics.

On November 15, 2022, State Water Board staff hosted a webinar where state and federal agencies presented information on funding opportunities available for farmers and ranchers in the Scott and Shasta watersheds. On December 8, 2022, State Water Board staff hosted an in-person meeting in Yreka to present the same information.

On March 20, 2023, State Water Board staff participated in an informational tour of the Scott and Shasta watersheds organized by Siskiyou County and attended by Siskiyou County Supervisors and staff, CDFW and United States Bureau of Reclamation staff, and irrigators from both watersheds. The tour provided an opportunity for feedback and discussion about implementation of the emergency regulation, and thoughts about potential updates or modifications should the regulation be readopted.

On April 26, 2023, State Water Board staff hosted two in-person technical assistance meetings and presentations in Yreka to provide information on the 2023 overlying groundwater local cooperative solution program.

At the June 6, 2023, Board meeting, staff presented information on the Scott and Shasta watersheds related to hydrologic conditions, drought response, and Drought Emergency Regulation activities. Staff recommended that the Drought Emergency Regulation (SWRCB, 2022) not be readopted. Staff continued to provide updates on hydrologic conditions in the Scott and Shasta Rivers to the State Water Board, as well as to participate in efforts to support ongoing improved flow conditions in the watersheds moving forward based on the momentum gained as part of the Drought Emergency Regulation.

The Drought Emergency Regulation expired on July 31, 2023. Directly following expiration of the Drought Emergency Regulation on July 31, 2023, flows on the Shasta River dropped significantly to less than half of the emergency flow requirement and took more than twenty days for flows to recover. At the August 2, 2023, Board meeting, members expressed concern regarding the decreased flows in the Shasta River immediately following expiration of the Drought Emergency Regulation.

1.3.1.3.3 Response to 2023 Petition for Rulemaking, Continued Watershed Engagement, and Proposed Emergency Regulation

As described in Section 1.1.2, on May 23, 2023, the Karuk Tribe the Environmental Law Foundation, the Pacific Coast Federation of Fishermen's Associations and the Institute for Fisheries Resources submitted a petition requesting the Board adopt long-term regulations establishing minimum flows in the Scott River. On June 19, 2023, State Water Board staff issued a Notice of Opportunity to Comment and of Public Hearing on the Petition for Rulemaking to set Minimum Flows on the Scott River. The comment period closed on July 20, 2023. The State Water Board received approximately 30 unique written comment letters and emails and 223 nearly identical comment emails. On August 4, 2023, the Board expanded the scope of the hearing to also include consideration of potential actions concerning minimum flows on the Shasta River.

The hearing for the Petition occurred on August 15, 2023. At the hearing, State Water Board staff provided an overview of the previous Drought Emergency Regulation, the Petitioners and other parties presented information, and the State Water Board solicited verbal comments. At the conclusion of the hearing, in light of the petition and comments thereon, the State Water Board directed Division of Water Rights staff to further engage with experts and community members on the basis for and implementation of prior emergency regulations to inform a proposed Emergency Regulation for the Scott River and Shasta River watersheds for Board consideration. The Board emphasized that urgent action was required to address grave fishery conditions and to be prepared for the risk of dry conditions in the upcoming irrigation season, and that it was necessary to maintain continuing baseline protection for fisheries even as more permanent longer-term recovery-focused efforts continued. The

State Water Board also directed Division of Water Rights staff to identify and initiate the scientific work needed to pursue long-term flows in both the Scott and Shasta watersheds.

On July 26-28, 2023, Board Chair Esquivel, Board Vice Chair D'Adamo, and Water Boards staff, and toured the Scott and Shasta watersheds with representatives from the Karuk Tribe, Yurok Tribe, CDFW, Siskiyou County Board of Supervisors, and environmental and agricultural stakeholders. On September 27-29, 2023, Board Members Firestone and Maguire, and Water Boards staff, toured the Scott and Shasta watersheds with representatives from the Karuk Tribe, Yurok Tribe, Quartz Valley Indian Reservation, NOAA-NMFS and CDFW, Siskiyou County Board of Supervisors, and environmental and agricultural stakeholders.

On August 3, 2023, State Water Board staff hosted a Water Rights 101: Scott-Shasta Watersheds webinar to provide an overview of water rights in the Scott and Shasta watersheds, and to answer questions. On September 19, 2023, CDFW and State Water Board staff hosted a Fish 101: Scott-Shasta Watersheds webinar to provide an overview of fisheries in the Scott and Shasta watersheds, and to answer questions. Recordings of the presentation given in both meetings are available online.

On October 6, 2023, State Water Board staff hosted a public workshop to discuss specific elements of the Drought Emergency Regulation that the State Water Board adopted for the Scott and Shasta watersheds. Representatives and technical experts from tribes federal, state, and local agencies, and stakeholder groups participated on technical panels.

The workshop focused on technical items related to the previous Drought Emergency Regulation for the Scott and Shasta River watersheds: minimum flows, the state of the fisheries, data, and local cooperative solutions. The input that State Water Board staff receive helped inform the timing and content of the proposed Emergency Regulation. Workshop presenters discussed the need for minimum flows, state of the fisheries, data needs, and potential LCS solutions. NMFS recommended flows return to a more natural hydrograph that aligns with life history requirements and supports their Viable Salmonid Population parameters for healthy populations in the Shasta watershed. NMFS noted that the primary stressors to salmon and steelhead in the Scott and Shasta watersheds are altered hydrology and poor water quality. NMFS mentioned that a minimum flow setting process will result in improved water quality and address salmon passage issues in both the Scott and Shasta rivers. In terms of the state of the fisheries, NMFS noted that the Shasta coho population is predominantly impacted by poor water quality and has been significantly below the depensation threshold for the last 10 years and is at high risk of extinction in the near future. The Yurok tribe noted there have been some good efforts to restore coho habitat, particularly in the Scott watershed, but we are seeing a slight rebound on the tail of a long decline. NMFS and CDFW noted that Chinook fisheries throughout California and parts of Oregon, including the ocean fisheries and Klamath tribal fisheries, were closed in 2023 due in part to insufficient abundance of fall Chinook. This is the second time this has occurred in 3 years. CDFW noted 2015 to 2020 returns for Chinook in the Klamath Basin are 43% below historical

average and 2015 to 2020 returns for Chinook in the Scott watershed are 65% below the historical average. In regard to data, the Quartz Valley Indian tribe noted that the Scott River needs more gages and flow requirements at more locations throughout the watershed because there can be flows at the Fort Jones USGS gage by the mouth of the canyon while the tributaries are dry. There were also discussions about the lack of groundwater pumping data. For LCS's, presenters discussed some of the following topics: participant's high interest and willingness to engage in LCS's in the Scott River watershed to ensure compliance, techniques to achieve 30% water savings, the limitations of compliance monitoring, observations of the results of groundwater LCS's, an evaluation of the hydrologic effects of 2021-2022 Scott and Shasta irrigation curtailments, and recommendations to improve the process of developing and verifying groundwater local cooperative solutions.

On October 30, 2023, State Water Board staff hosted three in-person listening sessions in Montague, CA. The listening sessions were opportunities for members of tribes, local diverters, residents, and others to provide feedback and comments on prior efforts in the watershed, including the previous Drought Emergency Regulation. Comments concerned a range of topics, including access to water for human health and safety, recommended changes and feedback on the LCS program, and the desire to have or not have regulations in the short and long terms.

On November 7, 2023, the Board staff released a preliminary draft version of the Proposed Emergency Regulation, and solicited comments through November 16, 2023. The State Water Board received 32 unique written comment letters and emails. On November 14, 2023, State Water Board staff hosted a virtual meeting to provide information on potential changes from the previous Drought Emergency Regulation and solicit comments comment period. In addition, between August 16, 2023, the day after the hearing on the Petition, and the release of the preliminary draft, the State Water Board received six relevant written comment letters and emails.

From December 8, 2023, to December 14, 2023, the State Water Board solicited comments on the draft Proposed Emergency Regulation. The State Water Board received 11 unique written comment letters and emails. The comments concerned local cooperative solutions, the prohibition on inefficient livestock watering, Shasta River flow requirements, hydrology, the State Water Board's continued use of emergency authorities, the Shasta River Safe Harbor Agreement, environmental monitoring, compensation for loss of water, and provisions for groundwater recharge.

On the morning of December 19, 2023, staff released a Change Sheet with proposed changes to the December 8 draft Proposed Emergency Regulation in response to comments. The State Water Board considered adoption of the Proposed Emergency Regulation at a public meeting on the afternoon of December 19, and made additional changes. The Board approved the Proposed Emergency Regulation under State Water Board Resolution No. 2023-0047.

1.3.1.4 Status of Species: Coho salmon, Chinook Salmon, and Steelhead

The Scott and Shasta watersheds are important steelhead- and salmon-producing streams in the Klamath River Basin and support numerous fisheries including the culturally and commercially significant Upper Klamath Trinity fall-run Chinook Salmon evolutionarily significant unit (ESU), the culturally significant KMP steelhead Distinct Population Segment (DPS), and the culturally significant Southern Oregon/Northern California Coast (SONCC) coho salmon ESU. The SONCC coho salmon is listed as a threatened species under both the federal and state ESAs and is identified as being at high and moderate risk of extinction in the Shasta River and Scott River, respectively (NMFS, 2014). Both coho salmon and Chinook salmon will migrate up the Klamath during fall and early winter months to spawn. Both species will migrate into tributaries including the Scott River and Shasta River watersheds, in search of viable spawning grounds found in smaller, higher tributary habitats. These higher tributary reaches provide a multitude of benefits for spawning and rearing including preferred gravel sizes for redds, appropriate stream gradient, reduced chance of high flow scour, canopy cover, and riparian vegetation providing habitat and refugia for the emerging fry. After spawning the adults die, and the young will hatch and rear for a year in the tributary watersheds. When they reach maturity, the juveniles then move out of the tributaries, enter the mainstem Klamath, and travel to the ocean. The adult fish then typically return three years later to the same tributary where they hatched in order to spawn. The Scott River and Shasta River coho salmon are both “core, functionally independent” populations of the SONCC Evolutionarily Significant Unit under the federal ESA, indicating that the Scott River and Shasta River have a critical role in the continuation and recovery of SONCC coho salmon. The SONCC coho recovery plan identifies increasing instream flows as one of the highest priority recovery actions in the Scott River and Shasta River watersheds (NMFS, 2014). The Chinook salmon populations are critical for tribal cultural, spiritual, and nutritional significance, and commercial salmon fishing along the North Coast. It is vital that both these populations are protected during years of drought and given a chance to recover.

Populations of coho salmon in the Klamath River have declined between 52% and 95% from historical levels. Fall-run Chinook Salmon populations have declined between 92% and 96%, and Spring-run Chinook have declined 98%, compared to historical levels (Belchik, 2023).

Summer-run steelhead within the KMP DPS are a CDFW recognized species of special concern. Steelhead exhibit one of the most complex life histories of any salmonid species. Two reproductive forms of steelhead are recognized, the summer-run (stream-maturing) and winter-run (ocean-maturing), which describes the level of sexual development following return to the freshwater environment. Unlike salmon, steelhead can spawn more than once before they die. Adult winter-run steelhead typically enter the Klamath River from late August to February before spawning, which extends from January through April, peaking in February and March (NRC, 2004). Summer-run steelhead enter freshwater as immature fish from May to July, migrate upstream to the cool waters of larger tributaries, and hold in deep pools roughly until December, when

they spawn (NRC, 2004). Juvenile steelhead typically rear in freshwater for one to three years, mostly two, before migrating downstream toward the ocean in spring, primarily during the months of March through May. They then typically reside in marine waters for one to three years prior to returning to their natal stream to spawn as three- or four-year olds. Steelhead have similar habitat requirements to other salmonid species. Like coho salmon, steelhead require adequate flows, temperatures, water depths and velocities, appropriate spawning and rearing substrates, and availability of instream cover and food (Bisson et al., 1988). Declines of steelhead throughout California have been documented in recent decades and have been mainly attributed to habitat degradation (Moyle et al., 2008). Steelhead populations in the Klamath River watershed have declined 67% (population estimate of 130,000) compared to the historical population estimate of 400,000 (Belchik, 2023). The Scott River adult steelhead population estimate in 1965 was 5,000 (Harris 2023a). In 2022, a net total of 18 adult steelhead entered and remained in the Scott River, one of the lowest returns since 2007 (CDFW 2023c). The Shasta River adult steelhead population estimate in 1933 was 8,400 (Harris 2023a). In 2022, a net total of 82 adult steelhead were estimated to have entered and remained in the Shasta River, the third lowest total since 2008 (CDFW 2023d, Harris 2023a). In the Scott River and Shasta River, monitoring adult steelhead migration is challenging because monitoring equipment is removed due to the potential for high flows while migration is still underway. Therefore, the number of observed steelhead should be considered a minimum number of returns and not basin estimates (CDFW 2023c, CDFW 2023d).

On May 3, 2021, CDFW submitted a letter to the State Water Board expressing concern with the recent pattern of critically dry years and low flow conditions in the Scott River and the United States Drought Monitor prediction of an ongoing drought in Siskiyou County (CDFW, 2021a). Dry conditions have led to extreme events that threaten coho and Chinook salmon survival in these watersheds. For example, in the fall and winter of 2020, adult coho and Chinook salmon were unable to pass above the confluence of Oro Fino Creek within the mainstem Scott River, resulting in significant migration delays. The extended delays raised concerns regarding the potential loss of that year's run of salmon (also known as a brood year, the calendar year when the majority of adults from the same group of offspring return to spawn. Salmon that can't make it to the upper tributaries for spawning, are forced to spawn in the lower main river. Spawning in the main channel poses a higher risk to the redds and fry, with potential for high flow velocity scouring of redds, decreased availability of suitable gravel sizes, higher summer stream temperatures, and reduced riparian habitat and refugia. All these pose a risk to the successful spawning and rearing for the brood year. Fortunately, outmigration numbers gathered in 2022 indicate that such a drastic loss did not occur (CDFW, 2022d). CDFW's letter notes the importance for a successful brood year and that cohort failure represents loss of a significant component of the population, increases the potential for extirpation, and greatly impedes natural recovery. CDFW (2021a) further identified the best available scientific information for assessing long-term flow needs, and priority actions, for the protection of Coho and Chinook salmon in the Scott River. On June 15, 2021, with drought conditions worsening and the May 2021 Proclamation, CDFW sent a letter to the State Water Board recommending drought

emergency minimum flows for the Scott and Shasta River watersheds and urged the State Water Board to adopt flows in the current drought emergency (CDFW, 2021d). On April 20, 2022, CDFW sent a letter to the State Water Board requesting that the Drought Emergency Regulation be renewed for an additional 12 months, with specific recommendations to update the regulation (CDFW, 2022b).

On March 10, 2023, the NMFS announced the cancellation of opening the ocean salmon sport fishery between Cape Falcon, Oregon, and the United States-Mexico border through May 15, 2023. The actions were taken to protect Sacramento River fall-run Chinook, which returned to the Central Valley in 2022 at near-record low numbers, and Klamath River fall-run Chinook, which had the second lowest abundance forecast since the current assessment method began in 1997 (CDFW, 2023a). On May 16, 2023, federal regulations went into effect for closure of commercial and recreational ocean salmon fisheries off the California coast. On May 17, 2023, the California Fish and Game Commission acted unanimously to enact a full closure of California's recreational salmon fishing season in the Klamath River Basin and Central Valley rivers no later than July 1, 2023, through its annual process for adjusting seasons and bag limits (CDFW, 2023b; CFGC, 2023)

On July 20, 2023, CDFW submitted a letter in which the agency indicates support for the development of long-term instream flows for the Scott River and for the Shasta River. CDFW noted it's multi-prong fish and wildlife restoration effort across the entire Klamath Basin with Tribal communities and other organizations and provided an assessment of benefits to fish and wildlife resources observed from implementing the emergency drought regulation flows in both the Scott and Shasta Watersheds from 2021 to 2023. CDFW suggests the Water Board consider adopting the flows from the emergency drought regulation as an interim flow backstop against further local Chinook salmon, coho salmon and steelhead cohort declines or at worst extirpation from the Scott and Shasta Rivers (CDFW, 2023e).

1.3.1.4.1 Scott River Watershed Fishery Status

The periodicity of salmonids in the Scott River watershed is summarized in Figure 8 and described here. CDFW does not perform adult and juvenile salmonid surveys year-round. CDFW tries to perform surveys during the period when a majority of the salmonids for a particular life stage have typically been observed in the watershed over the years. Therefore, the time-period when life stages of salmonids are shown in Figure 8 and described below is when that life stage is typically observed. However, there is potential for a salmonid life stage to occur outside the time periods described below and shown in Figure 8.

In the Scott River, fall-run Chinook salmon migration occurs from September to December and spawning occurs from mid-September through December. Fall-run Chinook fry emergence occurs from November through May and out-migration occurs from February through July. SONCC coho salmon migration occurs from October to January and spawning occurs from October to February. SONCC coho salmon fry

emerge from February through June and rear in the stream for approximately one year. The following February through July juvenile coho out-migrate to the ocean.

Adult winter-run steelhead typically enter the Klamath River during August to February and spawn during January through April. Spawning in February and March (NRC, 2004). Summer-run steelhead enter freshwater as immature fish from May to July, migrate upstream to the cool waters of larger tributaries, and hold in deep pools roughly until December, when they spawn (NRC, 2004). Juvenile steelhead typically rear in freshwater for one to three years, most commonly two years, before migrating downstream toward the ocean in spring and summer, peaking in April and May (NRC, 2004). Tributary-specific migration data for steelhead in the Scott River are less well captured than for Coho and fall-run Chinook because a large fraction of the adult steelhead migration occurs outside the operational window of the CDFW Scott River Fish Counting Facility (SRFCF) (CDFW 2022c). As previously mentioned, there is potential for a salmonid life stage to occur outside the time periods described below because CDFW does not perform adult and juvenile salmonid surveys year-round. In the Scott River, Steelhead adult migration occurs year-round, spawning occurs from mid-December through May, fry emergence occurs from February through June, and out-migration occurs from February through July.

SONCC coho salmon populations are generally tracked as three separate brood years, with cohorts returning every three years. In the Scott River, brood year strength has been tracked for multiple decades, and the difference in brood year strength in this watershed is notable. When conditions are good during successive brood generations, coho salmon populations can respond quickly, as brood year 2 and year 3 have seen roughly order of magnitude increases in populations since 2008. Likewise, populations can suffer order of magnitude decreases following poor river conditions. Brood year 1 reduced in population size by over 90 percent following the 2013 drought, from 2,644 fish in 2013 to 250 fish in 2016 (CDFW, 2021b). During the 2019 and 2022 returns of brood year 1, estimates of 346 and 238 adults were observed, respectively (CDFW 2023). These numbers are far below the population level prior to the impact of the 2013 drought. The coho salmon populations remain far below the NMFS Recovery Criteria of 6,500 spawners for the Scott River, at times approaching the depensation threshold of 250 spawners, and have a moderate risk of extirpation. Depensatory effects are problems with successive reproduction when the overall population abundance of a species is low. The depensation threshold is the number of spawners that are needed to avoid depensatory effects. A spawning number below the depensation threshold poses a higher risk of extinction (Abrams, 2023).

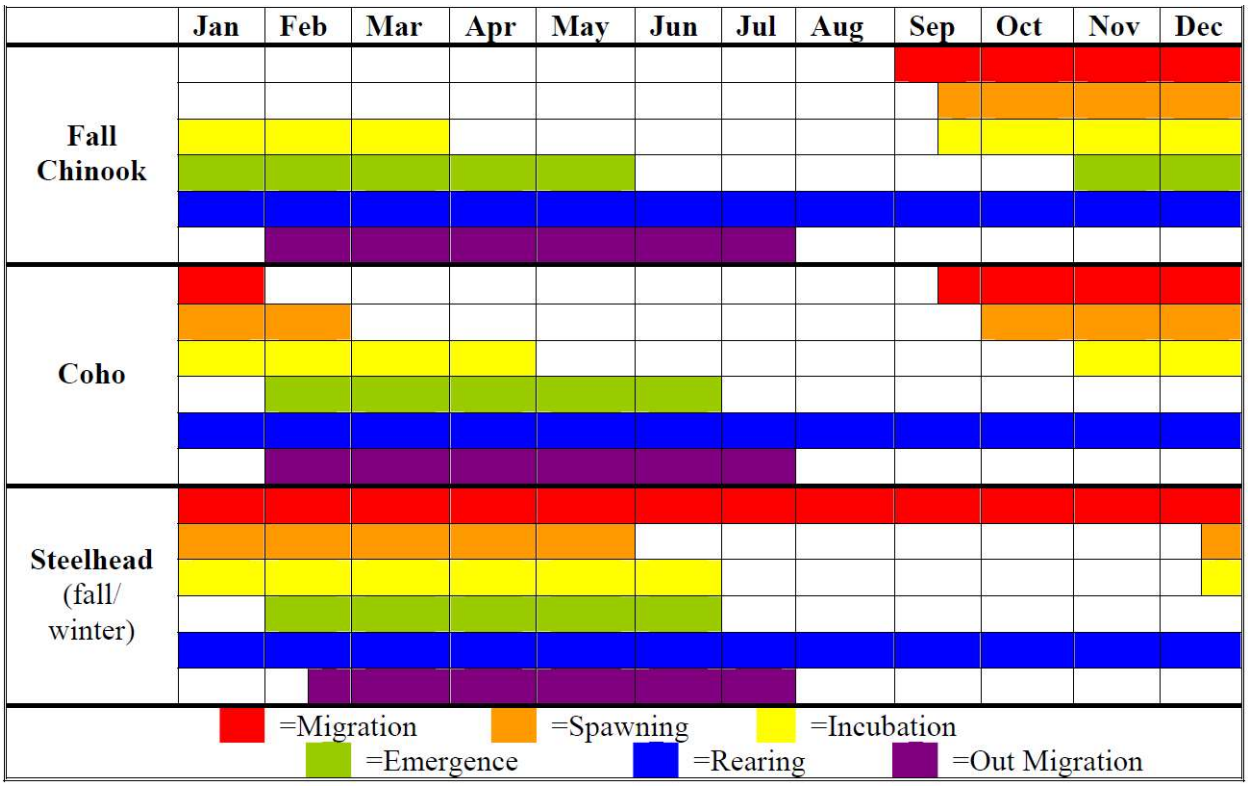


Figure 8. Salmonid periodicity in Scott River watershed. Source: NCRWQCB (2005).

The spatial distribution of annual spawning in the Scott River watershed is an important metric as there is a lower risk of catastrophic loss due to potential redd scour when eggs are deposited throughout the watershed (i.e., eggs are deposited in the tributaries rather than the mainstem). The tributaries and upstream floodplain provide refuge, cover, and feeding opportunities for juvenile salmonids that are not available in the downstream canyons. Access to more rearing habitat increases potential production, which can in turn increase adult returns (Harris, 2023a).

Low flow barriers in the Scott River degrade the migratory corridor and limit the spatial distribution and diversity of life history strategies. Other limiting factors stemming from altered hydrologic function include stream disconnection and degraded riparian habitat. Stream disconnection results in habitat fragmentation and isolated habitats (Abrams, 2023). Stream disconnection also limits salmon access to crucial spawning grounds and habitat. Chinook Salmon that cannot access preferred spawning areas in the Scott Valley are forced to spawn in the Scott River canyon, which poses risks due to the potential for scouring of redds during winter storms. CDFW found this to be the case in 2023 fish surveys, catching unusually high amounts of Chinook sac fry. Typically, the fry will leave the redd once they have completely absorbed their yolk sac and have biologically matured. These high numbers of sac fry indicate that redds were being scoured during high velocity flows in the Scott River canyon (Harris, 2023a).

Since 2008, an average of 65 percent of the Chinook Salmon have spawned upstream of the Scott River Fish Counting Facility (location shown in Figure 9). However, in three of the five years (2015, 2018, and 2020) prior to adoption of the Drought Emergency Regulation (SWRCB, 2021), more than 68 percent of the Chinook Salmon spawning occurred in mainstem canyon reaches downstream of the SRFCF (82%, 68%, and 69%, respectively), which corresponds with the three lowest October flow years to date (CDFW, 2021b).

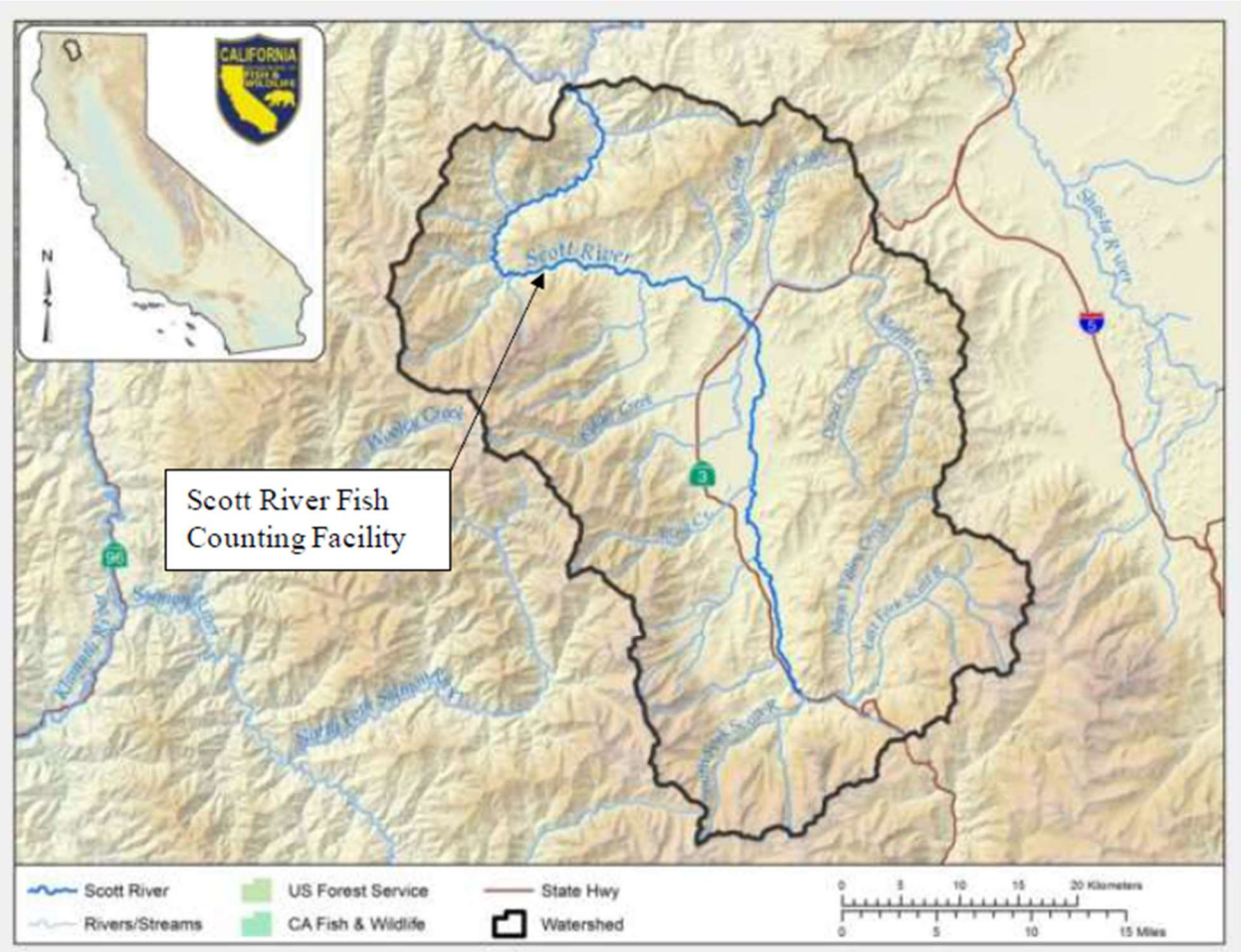


Figure 9. Location of the Scott River Fish Counting Facility. Source: CDFW (2023c)

The Scott River is TMDL listed for sediment and water temperature (NCRWQCB, 2005; Scott, 2023). Elevated, yet sublethal, water temperatures can have a myriad of detrimental impacts on the survival of salmon including stress, increased susceptibility to parasites and disease, altered metabolic rates, decreased growth rates, inhibition of smoltification, and altered competitive dominance. The stressful impacts of temperature on salmon are cumulative, and positively correlated to the duration and severity of exposure (NCRWQCB, 2005). Scott River temperature impairment is driven by anthropogenically influenced factors including stream shade provided by riparian vegetation, streamflow affected by changes in groundwater accretion, streamflow

affected by surface water diversions, and channel geometry. Groundwater accretions create temperature refugia and increase flow and thermal mass of the water body. Increased thermal mass buffers the water body to changes in atmospheric temperature, solar radiation, and warm water inputs (i.e., warmer tributaries or tailwater return flows). Increased flow reduces travel time, thus reducing the time a unit of water is exposed to solar radiation. Increased flow also increases pool depths, providing enhanced temperature refugia. The impact of surface diversions on streamflow is especially important in smaller tributaries which tend to host summer juvenile salmonid rearing. In these water bodies, the total diversions can constitute a large proportion of the total streamflow, particularly in French Creek, Shackleford Creek, Kidder Creek, and the East Fork Scott River (Scott, 2023).

Timing of flow also has an important role in salmonid migration. Coho salmon respond almost instantaneously to fall flow increases in the Scott River, indicating that these fish are staging downstream of the SRFCF in the canyon reaches, waiting for a flow increase to migrate upstream. An annual average of 99.2 percent of coho salmon in the Scott River watershed spawn upstream of the SRFCF. However, if the increase in flow occurs too late in the spawning season, coho salmon are forced to spawn in the mainstem reaches of the Scott River. Mean daily flows more than 60 cfs were required to restore effective tributary access for coho salmon during the 2013-2014 season (CDFW, 2021b).

For example, in fall 2013 and winter 2014, average daily flows at the USGS Fort Jones Gage were less than 60 cfs for the entire coho salmon migration period (mid-September through January). As a result, 97 percent of coho salmon spawning occurred in the mainstem Scott River (CDFW, 2021b).

In another example, in fall 2020, a lack of adequate flow in the Scott River during November and December prevented approximately 1,700 coho salmon from accessing spawning tributaries. CDFW hypothesizes that some of these coho salmon eventually managed to access a portion of available spawning habitat after a mid-December rain event, and narrowly avoided complete spawning failure of the cohort for that year (CDFW, 2021b).

Chinook Salmon were also impeded or prevented from accessing spawning tributaries during the second half of October 2020 due to inadequate flows. During 2015 to 2020, the fall-run Chinook Salmon run averaged 1,738 fish per year, which is a 65 percent reduction compared to the average of 4,977 fish per year during 1978 to 2020. The fall-run Chinook Salmon run in the Scott watershed is declining at a faster rate than in the Klamath River watershed as a whole. From 2015 to 2020, the average Chinook fall-run migration in the Klamath Basin declined 43% from the historical average (CDFW, 2021b).

In July 2021, in response to severely limited habitat exacerbated by declining flows, NMFS conducted a fish relocation effort on Sugar Creek, a tributary to the Scott River (NMFS, 2021a). Fish were relocated to an adjacent off-channel pond with reliable cold-water inputs from groundwater sources. A total of 473 juvenile coho salmon were

relocated. Due to fish health risks associated with relocation efforts, it is only attempted in the Scott River watershed when a significant number of juvenile fish are threatened by decreasing flows and have no natural path to refugial waters. The last time a large-scale fish rescue operation was conducted in the Scott River watershed was in 2014, another significantly dry year. Coho salmon smolts ratios, as compared to the number of returning adult females, in the year of the 2014 rescue were quite low, suggesting that the survivability of the smolts was severely reduced despite these efforts (CDFW, 2020a). The success of the 2021 relocation effort remains unknown, as the applicable brood year has not been completed and the results have not been analyzed.

In fall 2021, following the adoption of the Drought Emergency Regulation (SWRCB, 2021) and the implementation of a large groundwater forbearance agreement in the Scott River watershed, 29% of Chinook salmon spawning occurred downstream of the SRFCF in the Scott River canyon and 71% occurred upstream in the Scott River valley, in more suitable spawning reaches (CDFW, 2022b). During fall 2021, 92% of the cumulative annual Chinook migration occurred in a narrow 10-day period between October 21 and October 30 (CDFW 2022c). During this time there was one precipitation event that caused an increase in flows on the Scott River. On Oct 24, 2021, a storm caused flows to increase from 11 cfs to 717 cfs. The increase in flow resulted in stream reconnection and allowed for a majority of Chinook Salmon to migrate upstream of SRFCF and into suitable spawning reaches.

Coho salmon migration peaked on three occasions during the 2021. The pulses of coho migration were observed from October 27, 2021, through November 5, 2021, December 7, 2021, through December 10, 2021, and from December 23, 2021, through December 25, 2021 (CDFW 2022c). Following the storm of October 24th, 2021, flows in the Scott River continued to increase through December 7, 2021. Two of the three pulses of coho migration were associated with increases in base flow (CDFW 2022c).

In fall 2022, 92% of the fall-run Chinook spawned below the SRFCF due to insufficient flows to provide passage (Harris 2023a). The run peaked between October 26, 2022, and November 6, 2022, when 82.4% of the Chinook Salmon migration was observed. During this period, flows were relatively low for this time of year, between 6 cfs and 11 cfs. The Emergency Regulation flow requirement was 40 cfs in October and 60 cfs in November. There were no storms during this period. Coho salmon migration peaked on two occasions during the 2022 season. These periods of migration were observed from December 13, 2022, through December 15, 2022, and from December 23, 2022, through December 26, 2022. During these seven days, 97.5% of the coho salmon (232) were observed. The counting station was removed during the day with the highest observed daily coho salmon migration. If the counting station was not removed additional coho salmon would have been counted (CDFW 2023c). Both pulses of coho migration were associated with increases in base flow from 6 cfs on November 15, 2022, to 56 cfs on Dec 15, 2022, and continually increasing to a peak flow of more than 3000 cfs on December 31, 2022.

The number of returning adult steelhead has been monitored at the SRFCF since 2007. From 2007 to 2021, the number of observed adult steelhead has ranged from a high of

917 to a low of 8, with an average of 250. The run size of adult steelhead prior to 2007 is unknown. Although recent adult run size data is sparse on the Scott River, monitoring of the juvenile emigration has taken place since 2003. A large fraction of the adult steelhead migration occurs outside the operational window of the SRFCF. Therefore, the number of observed steelhead should be considered a minimum number of returns and not basin estimates (CDFW, 2022c). The Scott River rotary screw trap project has operated since 2000. In 2021, one rotary screw trap was operated on the Scott River from January 26 to June 22 to sample all age classes of emigrating salmonids. In 2021, it is estimated that a total of 19,539 young-of-the-year (zero-plus years old) steelhead, 41,281 one-plus year-old steelhead, 3,065 two-plus year-old steelhead; and 5 three-plus year-old steelhead emigrated out of the Scott River watershed. Estimates of the number of two-plus year-old steelhead produced from the Scott River watershed for 2021 were compared with the data from the previous 20 years of sampling. The estimate of 3,062 two-plus year-old steelhead is 15% of the seasonal average population estimate for the Scott River (CDFW, 2021g).

1.3.1.4.2 Shasta River Watershed Fishery Status

The periodicity of salmonids in the Shasta River watershed is summarized in Figure 10 and described here. CDFW does not perform adult and juvenile salmonid surveys year-round. Instead, CDFW tries to perform surveys during the period when a majority of the salmonids, for a particular life stage, have typically been observed in the watershed over the years. Therefore, the time-period when life stages of salmonids are shown in Figure 10 and described below, is when that life stage is typically observed. However, there is potential for a salmonid life stage to occur outside the time periods described below and shown in Figure 10.

In the Shasta River, SONCC coho salmon migration occurs from mid-October through January and spawning occurs from November to January. Coho salmon fry emerge from February to June and rear in the stream for approximately one year. The following February through mid-July juvenile coho salmon out-migrate to the ocean. Fall-run Chinook Salmon migration occurs from September through mid-December and spawning occurs from mid-September through December. Fall-run Chinook Salmon fry emergence and dispersal occurs from December through August. Juvenile Chinook begin rearing in January and 0+ smolts out-migrate to the ocean from April to mid-July. Chinook 1+ juveniles out-migrate to the ocean from January through April of the following year.

Obtaining migration and life history data for Steelhead is challenging in the Shasta River because the objectives of the CDFW Klamath River project have traditionally focused on monitoring the escapement of Chinook salmon, and more recently coho salmon. The weir at the Shasta video site is removed before steelhead migration is completed. In addition, individual steelhead are often observed moving repeatedly through the video flume in upstream and downstream directions (CDFW, 2022a). Adult winter-run steelhead typically enter the Klamath River from late August to February before spawning, which extends from January through April, peaking in February and March

(NRC, 2004). Summer-run steelhead enter freshwater as immature fish from May to July, migrate upstream to the cool waters of larger tributaries, and hold in deep pools roughly until December, when they spawn (NRC, 2004). Summer steelhead are potentially entering into the Shasta system but CDFW monitoring efforts are currently not focused on monitoring this population (CDFW 2023h). Juvenile steelhead typically rear in freshwater for one to three years, most commonly two years, before migrating (CDFW, 2017). In the Shasta, steelhead migration occurs from September through April, spawning occurs from mid-December through April, fry emergence occurs May through June, and out-migration occurs from February through July.

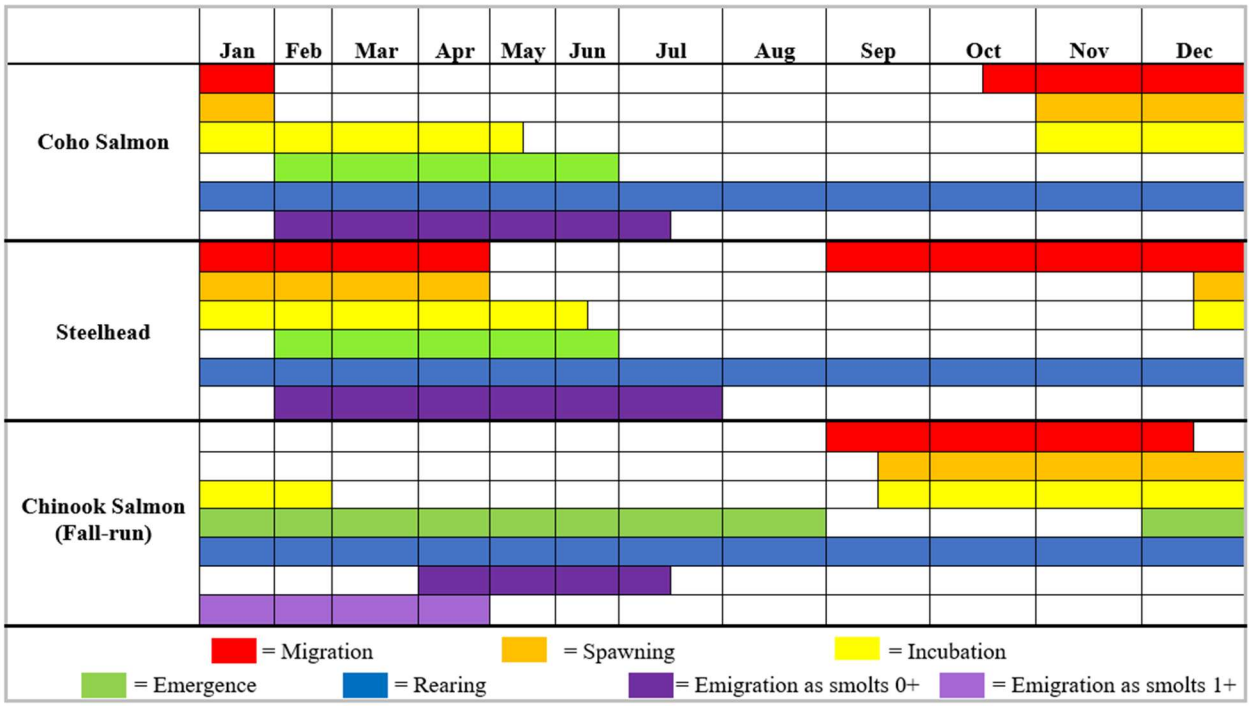


Figure 10. Salmonid periodicity in Shasta River watershed. Source: CDFW (2023h).

The Shasta River watershed, including the Big Springs Complex, mainstem Shasta River, and other key tributaries, has supported roughly 10 to 30 percent of the natural Klamath River watershed, including the Trinity River, fall-run Chinook Salmon population over the last decade (CDFW, 2020c). The Shasta River watershed is also key to supporting spawning and rearing habitat for Klamath Basin coho salmon. In the previous two years before implementation of the Drought Emergency Regulation (SWRCB, 2021), out-migration conditions for fall-run Chinook and coho salmon in the Shasta River watershed were critically impaired. Daily average flows in May 2021 and July 2021 were as low as 5.8 cfs at the Shasta River near Montague gage, the lowest on record during 2001 to 2021 (USGS gage no. 11517000; USGS (2023b)) and 6.9 cfs at the Shasta River near Yreka gage, the third lowest on record during 1988-2021 (USGS gage no. 11517500; USGS, 2023c). According to the NMFS SONCC coho salmon Recovery Plan, coho salmon are at high risk of extirpation in the Shasta River watershed. The recovery criteria are 4,700 spawners and the depensation threshold is

144 (Abrams, 2023). The Shasta River coho salmon returns have averaged 43 adults since 2014 (Harris, 2023a).

Construction of Dwinnell Dam in 1928 at river mile (RM) 40 has blocked access to over 18 miles of high-quality steelhead habitat. The dam, along with other downstream diversions, has changed the Shasta River hydrograph and has contributed to an increase in summer water temperatures, limiting the availability of high-quality habitat for steelhead (Moyle et al., 2008).

The Shasta River rotary screw trap project has operated since 2000, sampling all age classes of emigrating Chinook Salmon, coho salmon, and steelhead. In 2021, the rotary screw trap on the Shasta River was in operation from January 19 to May 29, to sample all age classes of emigrating salmonids. During this period, it was estimated that 3,810 young-of-the-year (zero-plus years old) steelhead, 977 one-plus year-old steelhead, 20,316 two-plus year-old steelhead, and 3,638 three-plus year-old steelhead emigrated from the Shasta River. The estimated number of two-plus year-old steelhead produced from the Shasta River for 2021, represents only 38% of the 2019 estimate (CDFW, 2021h). In 2022, there were under 100 returning adult steelhead observed, the third lowest total since 2008. Adult steelhead from previous years could still be residing in the river upstream of the Shasta River Fish Counting Facility that would not be observed during the survey period (CDFW 2023h). In 1933, the steelhead population estimate for the Shasta River was 8,400 adults (Harris, 2023a).

The Shasta River is TMDL listed for dissolved oxygen and temperature (NCRWQCB, 2006). As shown in Figure 11, there is a high correlation of low flows in the Shasta watershed with temperatures that impair salmon, at both sublethal and lethal levels (CDFW, 2020b).

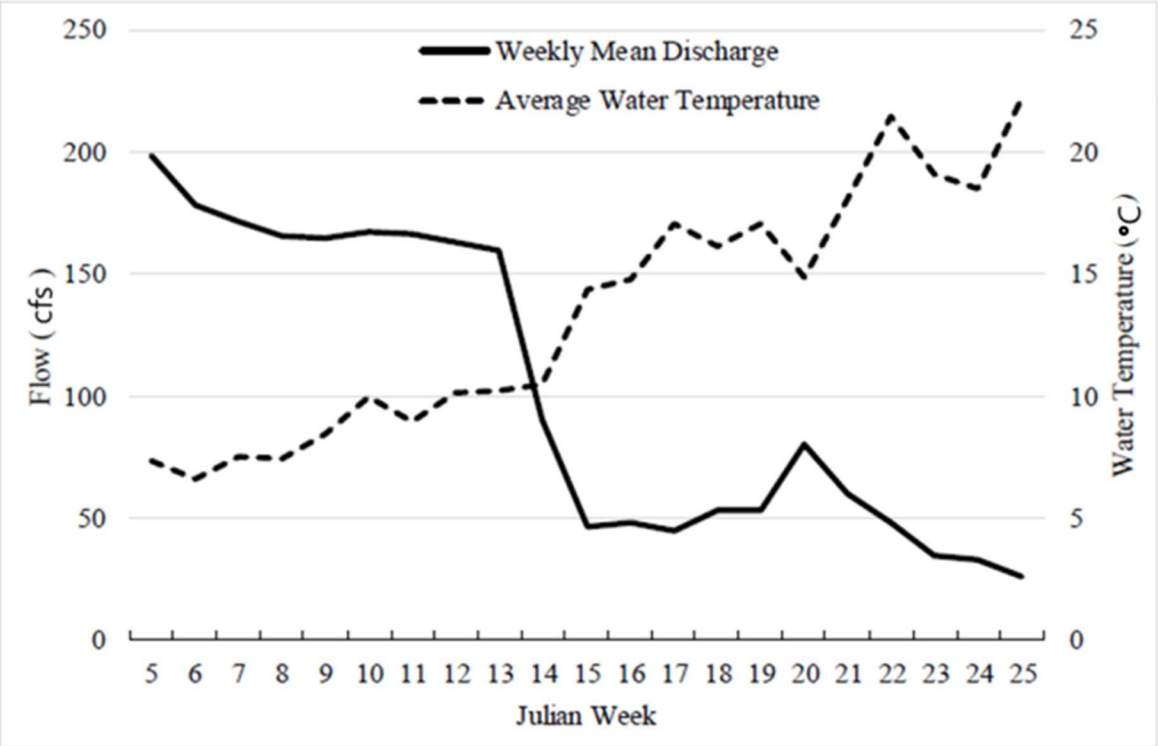


Figure 11. Average weekly flow in cfs and average water temperature in Cº on the Shasta River in 2020. Flow measurements are from the USGS Shasta River gage near Yreka (USGS gage no. 11517500) and temperatures recorded at the Shasta rotary screw trap, near confluence with Klamath River (CDFW, 2020b)

Anthropogenic drivers of temperature impairment include degradation of stream shade provided by riparian vegetation, tailwater return flows, Lake Shastina releases and minor channel impoundments, groundwater pumping which reduces groundwater accretion and spring inflows to streamflow, and streamflow affected by surface diversions. Important sources of cold water include Big Springs Creek and Little Springs Creek which contribute to a majority of the flow in the Shasta River during the summer. On June 16, 2022, these spring-fed streams were observed contributing about 80% of the total flow of the Shasta River. Smaller springs and accretions provide over-summering cold water refugia for salmonids in the Shasta River watershed (Scott, 2023).

Lethal temperatures are defined for Chinook and coho salmon in the Shasta River as occurring at 25°C, for a period of seven days. Elevated but sublethal water temperatures can have a myriad of detrimental impacts on the survival of salmon including stress, increased susceptibility to parasites and disease, altered metabolic rates, decreased growth rates, inhibition of smoltification, and altered competitive dominance. The stressful impacts of temperature on salmon are cumulative, and positively correlated to the duration and severity of exposure (NCRWQCB, 2006).

In Spring 2021, CDFW (2021h) recorded unprecedented temperatures at its rotary screw trap, which is located near the USGS Shasta River gage near Yreka (USGS gage no. 11517500; USGS, 2023c). As described in CDFW (2021h), CDFW operates the rotary screw trap when water temperatures are below 21 degrees Celsius (70 degrees Fahrenheit) to protect fish from additional stress. Shasta River water temperatures have allowed CDFW to operate the trap until the end of June in 14 of the last 20 years. In 2021, this temperature threshold was reached in mid-May 2021. In the 20-year record of operation, the previous earliest day this threshold was reached was June 17 (CDFW, 2021h).

CDFW (2022f) states that temperatures greater than 20.3 degrees Celsius can be detrimental to juvenile salmonid growth and survival. In the 2022 rotary screw-trapping season, this temperature was first reached on May 17. Between May 17, 2021, and the last day of operations on June 29, 2021, a total of 28 days were logged with temperatures above 20.3 degrees Celsius. For days when the 20.3 degrees Celsius water temperature threshold was reached, the average duration at that temperature was 12 hours (CDFW, 2022f).

During many years, fishery managers have been concerned with flow and temperature conditions in the Shasta River during the early weeks of the fall migration. For the past decade, resource agencies and local landowners coordinated a range of voluntary efforts to try and ensure adequate flows in the Shasta River for the fall migration of Chinook Salmon during the critical month of September.

CDFW (2020c) estimated that the 2020 spawning season was the second consecutive year that the Shasta River fall-run Chinook Salmon spawning migration population fell below the annual average population, 6,632 for the period of record, 1978 to 2020. For the 2021 spawning season, CDFW (2021a) estimated 6,908 returning adults entered the Shasta River. For the 2022 spawning season, CDFW (2023d) estimated 4,509 fall run Chinook entered the Shasta River. For the 2023 spawning season, as of December 4, 2023, CDFW (2023g) observed 4,867 adult Chinook Salmon enter the Shasta River. Current Chinook Salmon return numbers are less than the average with early December being the historic peak migration time for the period on record.

1.3.1.5 Fisheries Impacts on Tribal Nations

Tribal Nations in the Klamath River watershed depend upon fish for their physical and cultural survival (Belchik, 2023; Hockaday and Kane, 2023; Shaefer, 2023). The Yurok Tribe depends upon fall and spring Chinook salmon, coho salmon, steelhead, lamprey, and sturgeon for ceremonial, subsistence, and commercial purposes. The Yurok Tribe estimates that current salmon populations are, at a maximum, approximately 2 to 5 percent of historical estimates. The minimum number of adult natural origin Chinook Salmon spawners needed to maximize sustained yield in the Klamath River watershed (40,700) has not returned in seven of the past eight seasons. The 2023 adult migration is predicted to be the second-lowest return for Chinook Salmon since 1997. The Yurok Tribe has not had a viable commercial fishery since 2015. In 2023, the Yurok Tribal Council cancelled the fall fishery for the first time ever, including subsistence fishing,

food supply for elders, and take for ceremonies. The reduction in subsistence fishing has a negative impact on the tribal economies because subsistence fishing is a crucial part of tribal economies in the Klamath watershed (Belchik, 2023).

The Karuk Tribe currently has a poverty rate of 40% and an unemployment rate of 16%. In a study on the altered health of the Karuk Tribe, the elimination of traditional foods including multiple runs of salmon, pacific lamprey, sturgeon, and other aquatic species, has had adverse health, social, economic, and spiritual effects on the Karuk people. Historical fish consumption for the Karuk Tribe is estimated at 450 lbs per person per year. In contrast, estimates from 2004 indicate the rate has fallen to less than 5 lbs of salmon per person per year. The loss of the Spring Chinook Salmon in Scott and Shasta Rivers in the 1970s has caused the Karuk Tribe to experience one of the most dramatic diet shifts of any Native American tribe in the United States (Hockaday and Kane, 2023). The diet shift is directly linked to catastrophic increases in diabetes to the Karuk Tribe, Yurok Tribe, and Quartz Valley Indian Reservation. For example, diabetes rates in the Karuk Tribe are four times the national average. (Hockaday and Kane, 2023; Belchik, 2023; Schaefer, 2023).

The decline of fishery populations has negative impacts on tribal cultures. Low fish populations inhibit or prevent the Karuk Tribe, Yurok Tribe, and Quartz Valley Indian Reservation’s from performing the cultural and ceremonial practices they have practiced since time immemorial (Hockaday and Kane, 2023; Belchik, 2023; Schaefer, 2023).

1.4 BENEFITS OF THE 2021 AND 2022 DROUGHT EMERGENCY REGULATION

The Drought Emergency Regulation (SWRCB, 2021, 2022b) improved overall stream conditions and land management practices in both watersheds. Benefits included improved stream flows and improved timing of fall reconnection of the Scott River. Additional benefits were observed in water quality, habitat availability, efficiency of ranch operations through the LCS program, and reduced low stream flow impacts. The regulation also supported the acquisition of new data to better understand supply and demand in the watersheds.

1.4.1 Benefits of Reduced Groundwater Pumping

Acknowledging the interconnected nature of groundwater and surface water in the Scott and Shasta watersheds, the Drought Emergency Regulation addressed both surface and groundwater use. A pathway for LCSs was built into the Drought Emergency Regulation to encourage reductions in high priority overlying groundwater use while also allowing for greater economic certainty to the agricultural community around water availability during curtailments (SWRCB, 2021, 2022b). During 2022, overlying groundwater reduction LCSs were widely pursued in the Scott River watershed. While similar overlying groundwater reduction LCSs were available for landowners in the Shasta River watershed, no landowners chose to adopt them, perhaps since the potential for curtailments to reach these very senior rights was lower.

1.4.1.1 Scott River Watershed

Prior to the adoption of the Drought Emergency Regulation on August 30, 2021, several landowners entered into a forbearance agreement with CDFW to cease groundwater pumping in August 2021. This forbearance agreement resulted in an early and significant rise in groundwater elevation, showing the result of reduced groundwater pumping on groundwater elevation. Considering the response observed to the groundwater forbearance agreement and the modeled results for a 20% increase in irrigation efficiency (Kouba, 2021), the State Water Board expected to see an increase in surface flow from these 30% groundwater conservation LCS agreements.

During the 2022 irrigation season, 47 landowners in the Scott River watershed operated under 30% water use reduction LCS agreements. These irrigators encompassed about 17,268 acres, or 97% of the Scott River watershed's acreage that is irrigated with groundwater. In 2023, 14 landowners in the Scott River watershed submitted 30% water use reduction plan documents to State Water Board staff. Upon expiration of the Drought Emergency Regulation on July 31, 2023, these landowners were not held to the terms of their LCSs.

In fall 2022, surface flows on the mainstem Scott River were lower than the emergency minimum flows. However, benefits to groundwater elevations and streamflow were observed during the summer in the watershed. Comparisons of precipitation and groundwater elevation data show potential benefits of curtailments and LCSs. Figure 12

shows July through June variation of average monthly depth to groundwater level (ft) in the Scott watershed based on the active “Valley Floor” wells in the UC Davis Scott Valley water level monitoring program (UC Davis, 2023). Streamflow at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500; USGS, 2023a) observed on the day of well water level sampling is also added to the figure. These data are shown for WYs 2020-2023 and October of WY 2023-2024 (UC Davis, 2023). The following observations and interpretations are made by comparing flows and depth to groundwater in the valley floor (Figure 12).

- Overall, groundwater levels follow the seasonal variations of streamflow. Generally, with some exceptions, groundwater levels are higher in years with higher streamflow (UC Davis, 2023).
- The general trend of average “groundwater level” in Scott River watershed “Valley Floor” wells has increased since implementation of the Drought Emergency Regulation began in September 2021.
- The average “groundwater level” in Scott watershed “Valley Floor” wells in June 2022 was higher than in June 2021 (UC Davis, 2023). In WY 2020-2021, the Scott watershed received 14.56 inches of annual precipitation, measured near Fort Jones, CA. In WY 2021-2022, the Scott watershed received 14.99 inches of precipitation, measured near Fort Jones, CA (PRISM Climate Group, 2023). Despite the negligible difference in precipitation, groundwater levels in June 2022 were almost 3 feet higher than the groundwater levels in June 2021 (UC Davis, 2023). The increase in average groundwater levels in Scott “Valley Floor” wells is an expected result from water use reduction from curtailments and LCSs during implementation of the Drought Emergency Regulation.
- In June 2023, the average “groundwater level” in Scott watershed “Valley Floor” wells was about 7 feet higher than groundwater levels in June 2021 (UC Davis, 2023). In WY 2022-2023, the Scott River watershed received 22.48 inches of precipitation, measured near Fort Jones, CA (PRISM Climate Group, 2023). Elevated groundwater levels in June 2023 were likely a result of significant increase in precipitation.
- Groundwater levels in September and October 2023, were the highest levels for their respective months since 2019.

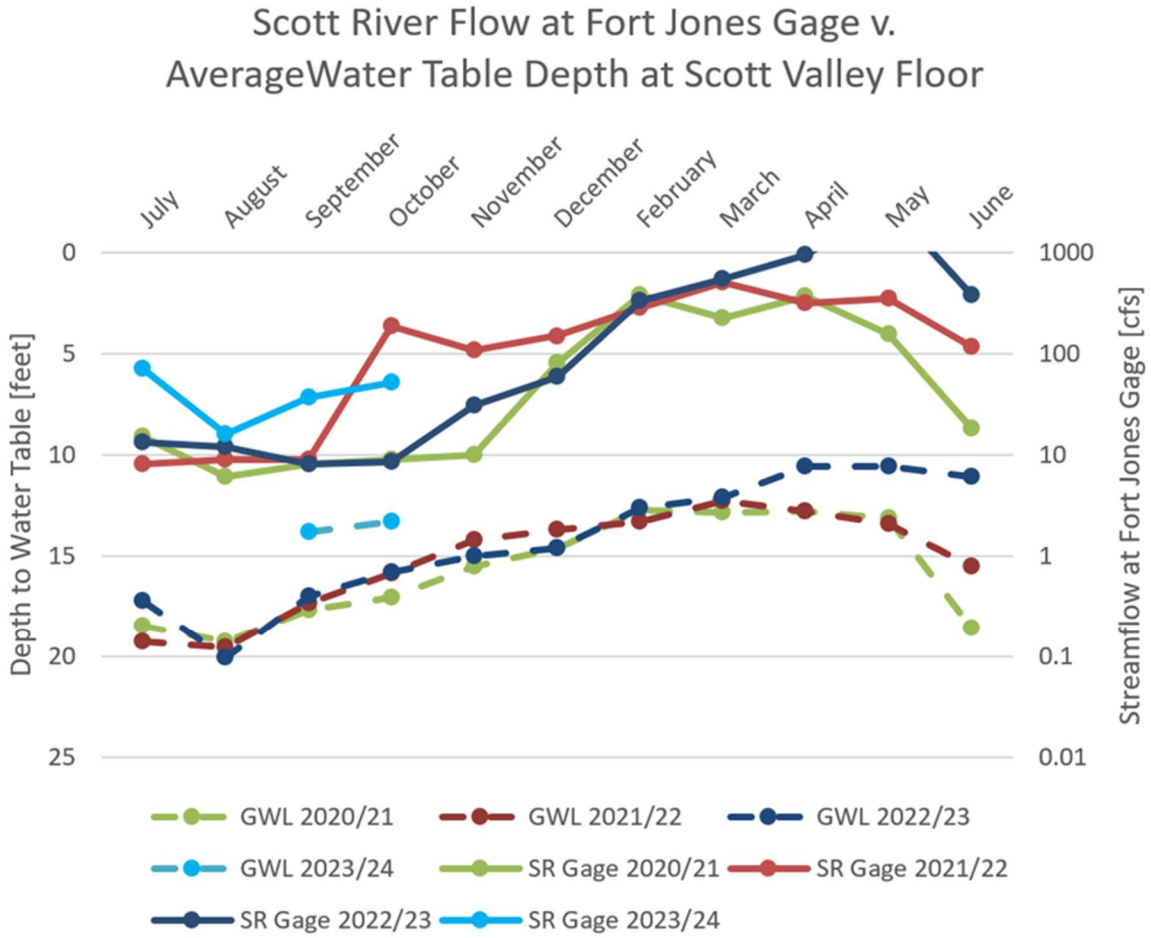


Figure 12. Streamflow at Scott River gage near Fort Jones (USGS gage no. 111519500) and average depth to groundwater level for Scott watershed "Valley Floor" wells. Dashed lines show monthly average depth to groundwater (ft) in WY 2020-2021 (green), WY 2021-2022 (red), WY 2022-2023 (dark blue), and WY 2023-2024 (light blue) for "Valley Floor" wells of the Scott Valley Monitoring Network. Solid lines show the streamflow at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) in WY 2020-2021 (green), WY 2021-2022 (red), WY 2022-2023 (dark blue), and WY 2023-2024 (light blue) for "Valley Floor" on the day the groundwater level was measured. Note: Streamflow in May 2023 was between 1,100 cfs and 3,100 cfs. Figure copied from UC Davis (2023). Streamflow data source: USGS (2023a).

In addition to measured increases in groundwater levels during implementation of the Drought Emergency Regulation, comparison of NCRWQCB field observations from 2021 and 2022 show improved streamflow conditions on streams throughout the Scott River watershed in 2022 when curtailments and LCSs were in effect. Several locations within the mainstem of the Scott River showed significant expansion of wetted area available as habitat to aquatic organisms. This is likely due to elevated groundwater levels in 2022 as compared to 2021. These changes were observed despite hydrologic conditions in 2022 being overall drier than 2021, with comparable precipitation as rain in both years and April 1 snowpack measurements indicating 78% and 20% of average in

2021 and 2022, respectively. In 2023, the State Water Board received comments questioning the effectiveness and need for the LCS program, since flows in Scott River did not meet the minimum flow requirements in fall 2022. Staff, consultants, and external parties are analyzing the impacts of curtailments and LCSs. Hypothesized explanations for lower-than-expected mainstem Scott River streamflow in fall 2022 include pre-existing impacts from drought and water demand (e.g., low soil moisture and low groundwater levels), potential lack of compliance, 30% baseline reduction isn't the correct amount, and the potential that some groundwater conservation actions, such as some types of irrigation efficiency improvements, may not reduce net impacts on groundwater levels.

Riverbend Sciences (2023) compared the benefits of different groundwater reduction actions or irrigation efficiency improvements and found some irrigation efficiency practices reduce actual evapotranspiration (ETa), including crop switching (i.e. replacing alfalfa with grain), early cessation of irrigation, fallowing, and permanent water rights purchasing. Riverbend Sciences (2023) found that some irrigation efficiency practices increase ETa, including decreasing the size of sprinkler nozzles, converting flood to irrigation to inefficient sprinklers, and irrigating additional land, and recommended these practices not be pursued.

Data that may improve evaluation of the groundwater reduction LCS program includes metered groundwater well pumping data and groundwater level data with higher spatial and temporal resolution. As described further in this digest, revisions to the LCS program provisions of the emergency regulation includes requirements to provide well pumping data.

1.4.1.2 Scott River Reconnection Response to Rainfall in Fall

In the Scott watershed, full curtailment of surface and groundwater diversions, except for minimum health and safety and livestock-watering, was ordered pursuant to Order WR 2021-0083-DWR on September 10, 2021, following the adoption of the 2021 Drought Emergency Regulation (SWRCB, 2021). Prior to this, three landowners with groundwater-irrigated alfalfa approached CDFW with a plan to forbear their irrigation and cease pumping from the aquifer that underlays a critical reach of the Scott River that must be connected to allow Chinook to move from the Scott River canyon to their spawning grounds (Reach 9). While this was a "gaining" reach through the 1970's (i.e. groundwater contributions caused an increase in surface flow over the reach), in more recent decades this reach has been "losing", meaning that surface flow sinks underground to the groundwater table, and the reach disconnects (SWRCB, 1974). The CDFW-funded forbearance initiated in early August 2021 during the drafting and preparation of the Drought Emergency Regulation. SVHIM results indicated that reductions in groundwater use no later than August 15 would be needed to facilitate reconnection of the Scott River in time for Chinook migration. These forbearance agreements resulted in an increase in groundwater elevation in Reach 9 prior to the first major rainfall of the season.

The groundwater curtailments and LCS participation reduced groundwater pumping in the watershed and improved overall groundwater levels and overall surface water flows. This is seen with the different response rates for Scott River flows after significant rainfall since the regulation went into effect. On December 7, 2023, USGS For Jones gage reached a flow of more than 250 cfs, while cumulative precipitation near Fort Jones was 4.56 inches (PRISM Climate Group, 2023). This flow was significantly more than flows of the same date in 2022 with a very similar cumulative precipitation (Figure 13). It is likely that the elevated groundwater levels, resulting from the combined effect of past curtailments and local cooperative solutions as well as a better hydrologic condition in recent year, contributed to the Scott River runoff response to precipitation events.

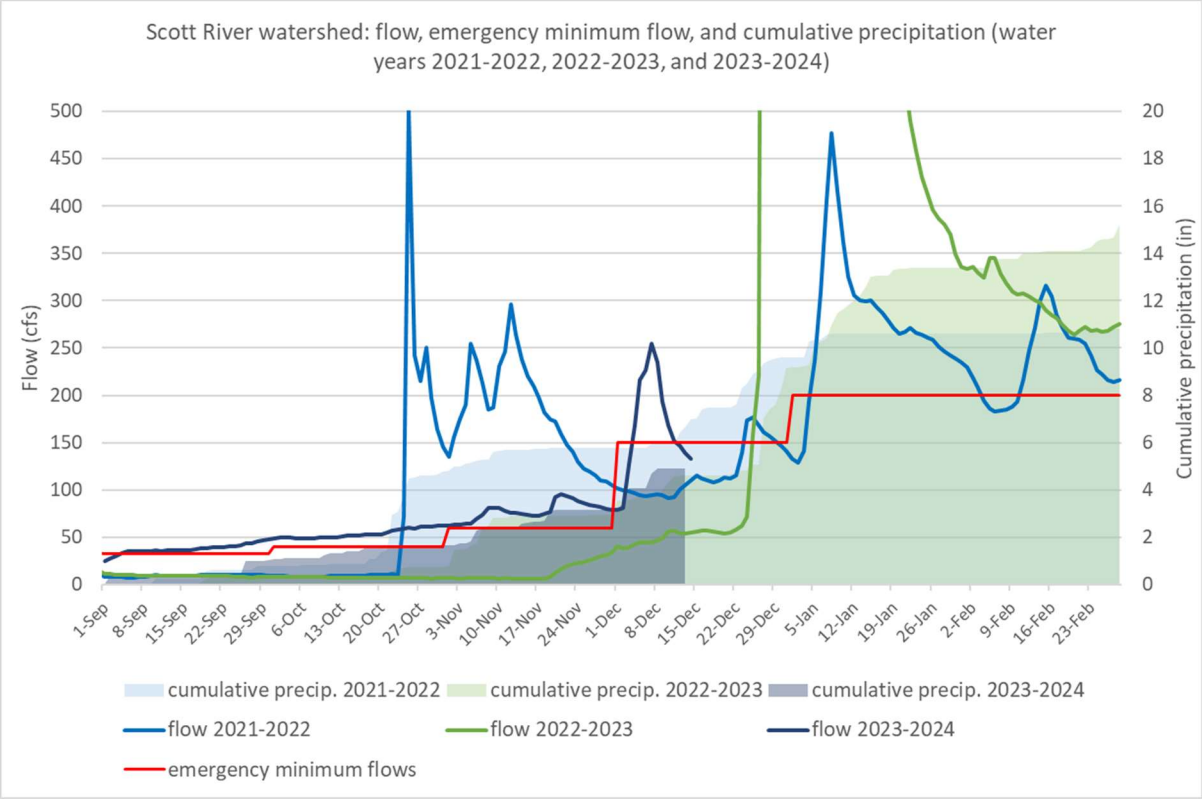


Figure 13. Daily average flow (cfs) and cumulative daily precipitation (in) at USGS Scott River near Fort Jones gage in the period of September through February of WY's 2021-2022, 2022-2023, and 2023-2024 (as of December 14). Streamflow data source: USGS Scott River gage near Fort Jones (USGS gage no. 11519500). Precipitation data source: PRISM Climate Group (2023). Precipitation is estimated at the location of USGS gage (with the assumption that it represents the average rainfall of the Scott River watershed).

1.4.2 Benefit to the 2022 Coho and Chinook Salmon Outmigrant Cohorts

In WY 2020-2021 prior to the adoption of the Drought Emergency Regulation (SWRCB, 2021), significant efforts were underway by a collaborative group of agencies, tribes,

and watershed groups to address the impacts of low rainfall and critically dry conditions on salmonid species, including coho salmon. Without a groundwater forbearance agreement or any emergency regulation in place, a limited toolset was available. For the 2020 brood year, a total of 1,766 adult coho salmon were estimated to have passed the SRFCF, downstream of the USGS Scott River gage near Fort Jones (USGS gage no. 11519500). Efforts in the spring of 2021 were focused on ensuring coho salmon redds, deposited in spawning gravels in French and Miner's Creeks, key spawning tributaries to the Scott River, were kept wetted through a combination of voluntary instream dedications and flow transactions. These tools were also utilized to support redistribution of smolts higher up in the watershed where both flow and temperature would reliably support juvenile rearing through critically dry conditions.

In 2022, despite continued drought conditions, improved west-side tributary habitat for coho salmon juveniles was observed compared to the previous year (Harris 2023b). Increased groundwater elevations provided earlier surface water reconnection and increased cold water discharge to the river, supporting healthy riparian habitat and improved surface flows and connectivity during Chinook Salmon, coho salmon, and steelhead migration (Harris 2023b). Improved connectivity through the Scott River tailings allowed juveniles that may have over-summered in the South Fork and East Fork of the Scott River to move out of those sub-watersheds and out-migrate to the Klamath River. In 2022, outmigrant data from CDFW's rotary screw trap on the Scott River indicated 68,616 age 1+ coho salmon out-migrated from the Scott watershed (CDFW, 2022e). In the Scott River, coho salmon juveniles typically rear in the stream system for a year before out-migrating to the ocean the following spring and summer. Therefore, these outmigrants are from the 2020 brood year (1,766 adults) that benefitted from both limited voluntary transactions on French Creek, Miner's Creek and upper tributaries for spawning and rearing, and from emergency regulations for rearing and outmigration.

It is estimated that 493,084 age 0+ Chinook salmon out-migrated from the Scott River (CDFW, 2022e). These are juveniles from the 2021 brood year (1,961 adults). The promising outmigration of 0+ Chinook salmon benefitted from the emergency regulations and are positive results during an extreme drought.

1.4.3 2023 Coho and Chinook Salmon Outmigrant Cohorts

Outmigrant data from CDFW's rotary screw trap on the Scott River indicate that an estimated 6,565 age 1+ coho salmon have out-migrated from the Scott River to the Klamath River resulting from the 2021 brood year of 852 adults. This cohort was spawned, incubated, reared and out-migrated under the emergency regulation, and benefitted from significantly wetter conditions than previous years. It is estimated that 106,912 age 0+ Chinook Salmon have out-migrated to the Klamath River resulting from the 944 adult Chinook Salmon that entered the Scott River in the 2022 season. These outmigrant numbers declined significantly from the previous year presumably because much fewer adult Coho and Chinook spawned in the brood year corresponding to each population of juveniles.

There is a large decline in the estimated 0+ Chinook Salmon outmigrant populations from 493,084 in 2022 to 106,912 in 2023. While the benefits to 2023 Scott River Chinook outmigrants from the 2021 and 2022 Emergency Regulations may not have resulted in increase in fish from the previous years, the outmigrant population numbers may have been much lower without the improvements in hydrologic conditions resulting from curtailments and groundwater conservation in 2022. Improved groundwater levels enabled stream connectivity to occur earlier in the season, improving adult returns and therefore preventing further collapse in 2023 0+ outmigration. Improved rearing habitat likewise should have improved 2023 1+ outmigration relative to what may have occurred in the absence of curtailments and groundwater conservation.

1.4.3.1 Water Supply and Water Demand Data Collection

Both watersheds have seen increased reporting of water use on a more regular interval under the drought emergency regulation and some of this coordination has continued after expiration of the regulations as well. This includes increased coordination with the Watermaster, Montague Water Conservation District, and Scott Valley Irrigation District, among others. Individual landowners diverting more than 1 cfs were required to report daily average diversion information in the Scott watershed, beginning with Addendum 11 to Order for Reported Water Rights in the Scott River Watershed issued September 9, 2021. Additionally, two information orders were issued to better understand water use related to livestock diversion and better understand diversions on Willow, Julian and Yreka Creeks, tributaries to the Shasta River. These actions have contributed to a more thorough understanding of agricultural water use and the overall water balance in the Scott and Shasta watersheds and allowed issuance of more tailored curtailment addenda that both improved meeting Drought Emergency Regulation flows and allowed additional diversion.

In addition to better information regarding diversions, the State Water Board, CDFW, the Watermaster, and the North Coast Regional Water Board collaborated on the location and maintenance of four new flow gages in the Shasta watershed and two new flow gages in the Scott watershed. The additional data collection allowed State Water Board staff to better understand the impacts of management decisions in real time, including information related to groundwater-surface water connectivity in critical tributaries to the Shasta River like Big Springs Creek. These gages include temperature loggers, allowing staff to better understand the relationship between water quality and water quantity in both watersheds. Staff continue to coordinate and work on gaging efforts in the watersheds to obtain more efficient real-time data.

Additionally, new information submitted by petitioners in the curtailment process enabled re-assessment of flow requirements, resulting in the changes to winter drought emergency flow requirements on the Shasta River during implementation of the 2021 Drought Emergency Regulation and readoption of the Drought Emergency Regulation in 2022 (SWRCB, 2022b).

1.4.4 Moderated Drop in Shasta River Flows Following the Onset of Irrigation Season

A direct benefit of the Drought Emergency Regulation in the Shasta River was a reduction in the magnitude of difference between pre-irrigation flows and flows following the onset of irrigation season. For example, between March 15, 2021, and May 1, 2021, flows ranged from 160 cfs to 19 cfs, with regular fluctuations of more than 20 cfs in a 24-hour period (Figure 14). The large fluctuations in flow likely increased stranding of juvenile salmonids, or their redds, resulting in an increase of fish stress and fish mortality and reduction of viable redds. Between March 15, 2022, and May 2, 2022, during implementation of the Drought Emergency Regulation, flows ranged from 129 cfs to 42.9 cfs. (Figure 15). The reduced variation in flow likely reduced fish stress and mortality resulting from large variations in flow. The reduced variation in flow was a result of coordination between the State Water Board, the Watermaster, and surface water diverters in response to the Drought Emergency Regulation.

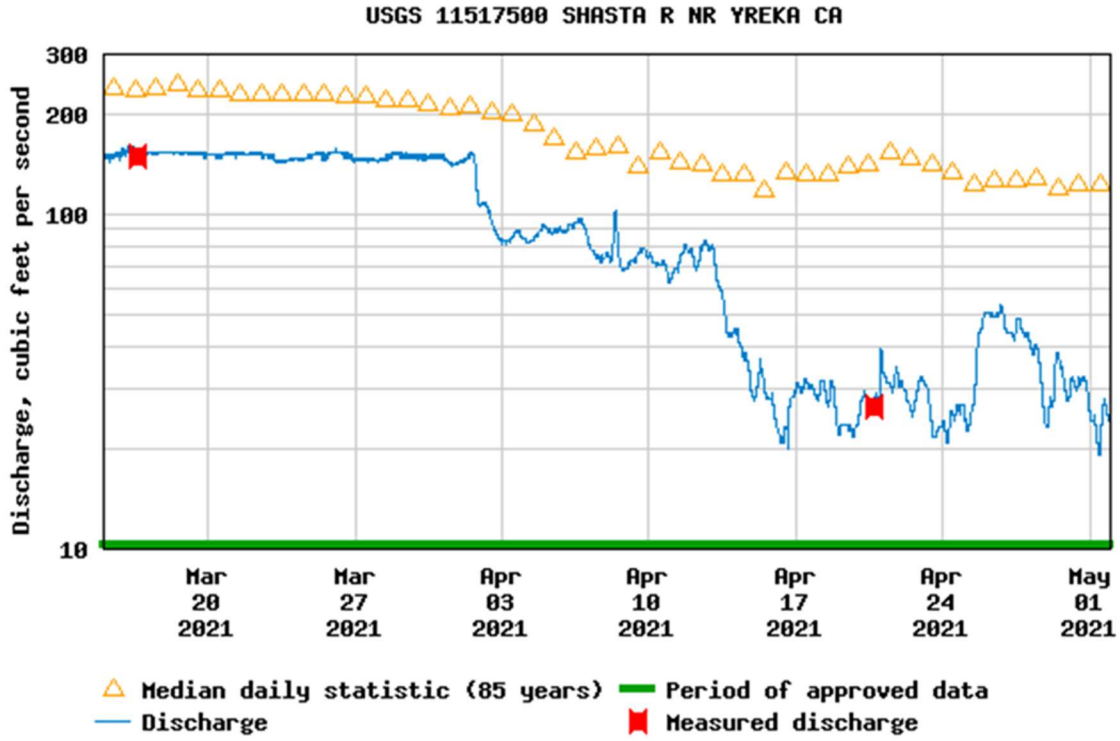


Figure 14. Shasta River flow at the USGS Gage near Yreka (USGS gage no. 11517500) between 3/15/2021 and 5/1/2021. Source: USGS (2023c).

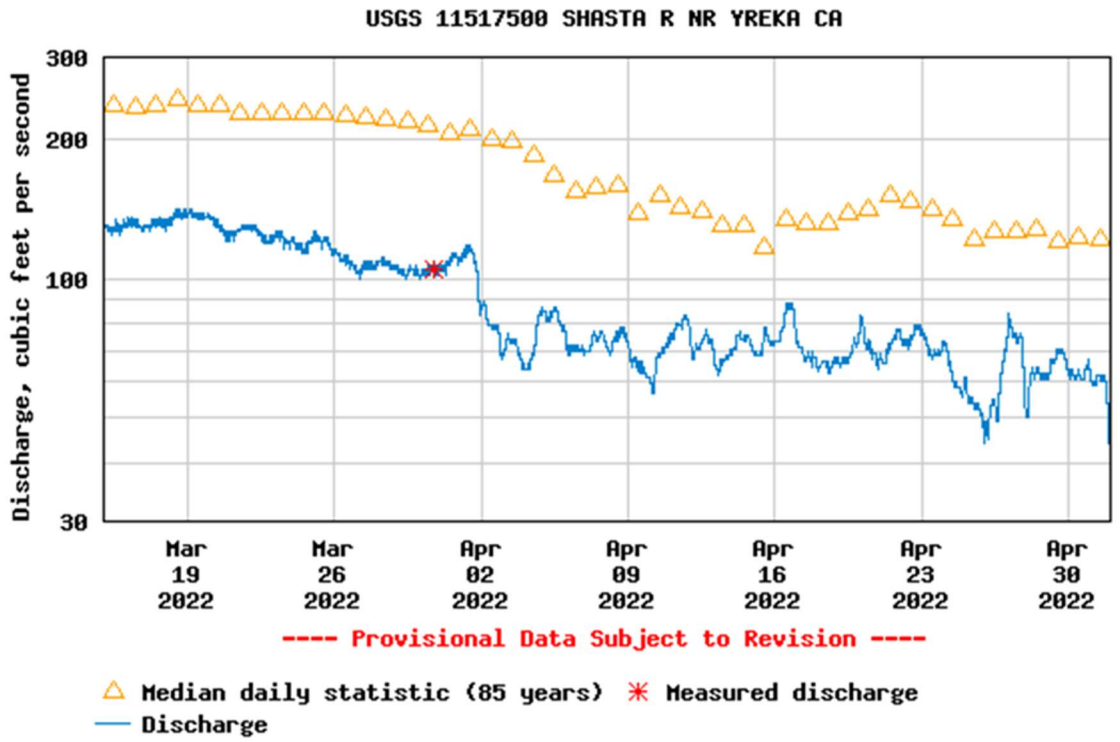


Figure 15 – Shasta River flow at the USGS Gage in Yreka between 3/15/2022 and 5/1/2022. Source: USGS Shasta River gage near Yreka (USGS gage no. 11517500).

1.5 POLICY OVERVIEW, NEED, AND EFFECT OF PROPOSED EMERGENCY REGULATION

The Proposed Emergency Regulation, like the 2021 and 2022 Drought Emergency Regulation, would establish emergency minimum flow requirements for salmonid protection in the Scott River and Shasta River watersheds, consistent with flow recommendations from CDFW. As under the expired Drought Emergency Regulation, the State Water Board will have authority to curtail diverters in these watersheds in the order of priority as necessary to maintain a reasonable assurance of meeting the minimally protective flows. The Proposed Emergency Regulation would also reestablish important exceptions to priority-based curtailments to protect human health and safety, minimum livestock watering needs, and non-consumptive uses. In light of competing needs, the Proposed Emergency Regulation will continue to limit certain low-efficiency diversions for livestock outside the irrigation season, as was done similarily in 2021 and 2022. The Proposed Emergency Regulation would amend these limits based on their implementation under the expired Drought Emergency Regulation and other new information.

This Proposed Emergency Regulation provides the State Water Board the tools it needs to:

1. Establish emergency drought minimum flow requirements to protect the threatened SONCC coho salmon, the culturally and commercially significant fall-run Chinook Salmon, and the culturally significant steelhead;
2. Ensure that adequate water is available to meet baseline minimum instream flow requirements for the protection of SONCC Coho, fall-run Chinook Salmon, and steelhead;
3. Implement the water rights priority system (including in systems with closely interconnected surface and groundwater), as necessary to protect such instream flows;
4. Provide a path for local cooperative solutions to allow for improved agricultural planning while supporting flow and fishery needs, with the additional benefits of incentivizing investment in long-term efficiency to provide resilience in future water shortages, and improving groundwater information to inform immediate and longer-term management actions;
5. Ensure continued access to water supplies for minimum human health and safety needs;
6. Ensure continued access to minimum water supplies for livestock watering;
7. Generally prohibit inefficient conveyance of water for livestock watering needs outside the primary irrigation season, with exceptions to limit the prohibition when reasonable under specified conditions, in light of fishery needs and the potential for winter groundwater storage;
8. Provide allowances for non-consumptive uses;
9. Require curtailment order reporting; and
10. Authorize information gathering related to implementing the regulation for the above purposes.

This section provides an overview of California's water rights framework, the specific emergency minimum flow needs in the Scott River and Shasta River watersheds, watershed descriptions, and additional detail regarding the effect of the Proposed Emergency Regulation and changes from the expired Drought Emergency Regulation.

1.5.1 Water Rights Framework

A very generalized overview of water rights is provided here to help understand the need for the Proposed Emergency Regulation and how it will be applied.

Two main types of surface water rights constitute the vast majority of surface water diversions in California: riparian rights and appropriative rights. A riparian water right (riparian right) generally provides a right to use the natural flow of a water body to which the land is riparian. Broadly speaking, riparian land is land that touches a lake, river, stream, or creek. Water can only be diverted under a riparian right when that water is used on the riparian parcel on land that drains back to the lake, river, stream, or creek from which the water was taken. Riparian rights remain with the property when it changes hands, although parcels severed from the adjacent water source generally lose their right to the water. Only the natural flow of water can be diverted under a riparian right. Water that is imported into a watershed from another river, stream, or creek cannot be used under a riparian right. Water cannot be stored during a wet time for use during a drier time under a riparian right. Neither can water released from an upstream storage reservoir be used by a downstream user under a riparian right. Riparian rights generally have a senior (higher relative priority) right to natural flows as against appropriative rights, and water must be available to fulfill the needs of all riparian rights before an appropriator may divert. This is not always the case, however, depending on whether an appropriation that predates the patent date of riparian lands was initiated on public or private land, and whether the appropriative diversion was upstream or downstream of the relevant riparian parcel. The priorities of riparian right holders are correlative vis-à-vis each other; during a drought all share the shortage among themselves. Because a riparian right only allows the use of natural flow, it is possible to have water available under a riparian right during wetter years or months and not during drier years or months when natural flows are no longer available, including cases where stream flow is being supported by releases of previously stored water. This is particularly the case in dry years.

On the other hand, an appropriative water right is generally needed for water that is diverted for use on non-riparian land or to store water for use when it would not be available under natural conditions. An appropriative water right holder can use natural flow, and non-natural flows like imported water from other watersheds, or irrigation return flows. Prior to 1914, appropriative water rights were acquired by putting water to beneficial use. The exact priority date of a pre-1914 appropriation can vary depending on the circumstances but depends on either posting notice under the then-applicable procedures of the Civil Code or otherwise clearly initiating the means necessary to divert or actually diverting. An appropriative water right that was acquired before 1914 is called a pre-1914 appropriative water right and is not subject to the permitting

authority of the State Water Board. Appropriative water rights obtained after 1914 require a water right permit and subsequently a license issued by the State Water Board or its predecessors. Similar to pre-1914 water rights, the seniority of post-1914 water rights is based on a first-in-time concept with the date of seniority typically established by the date of the application for the permit. A water right permit confers the State Water Board's (or its predecessor's) authorization to develop a water diversion and use project. The right to use water is obtained through actual beneficial use of water within the limits described in the permit. A water right license is issued once full beneficial use of water has been made and other conditions of a water right permit are met and constitutes the confirmation by the State Water Board (or its predecessor) of the water right. As between appropriators, junior water right holders may only divert where there is sufficient water to completely fulfill the needs of more senior appropriators.

When the amount of water available in a surface water source is not sufficient to support the needs of existing water right holders, junior appropriators must cease diversion in favor of more senior rights. However, it is not always clear to a junior diverter whether there is sufficient flow in the system to support their diversion and senior water uses downstream. It can also be difficult to determine whether releases of stored water are abandoned flows that may be diverted or whether those flows are not available for diversion because they are being released for downstream purposes. Similarly, it can be difficult for a riparian to know if water is natural flow or if it is stored or imported water and whether, when and to what extent correlative reductions in water use are needed due to the need to share limited supplies amongst riparian rights. As part of administrating water rights, the State Water Board may adopt regulations to curtail water diversions under any water right type to protect more senior rights.

For groundwater diversions, case law recognizes overlying and appropriative rights to groundwater, analogous to riparian and appropriative rights to surface water. (*City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224, 1240; see also *Katz v. Walkinshaw* (1903) 141 Cal. 116, 135-136.) An overlying groundwater right is analogous to a riparian right to surface water. (*City of Pasadena v. City of Alhambra*, 33 Cal.2d 908, 925.) An overlying right attaches to land overlying a groundwater basin and is correlative to the rights of other overlying users to the safe yield of the groundwater basin. A water right permit from the State Water Board is not required to exercise an overlying right to groundwater, and like a riparian right, an overlying right to groundwater is not lost for non-use. The rights of overlying groundwater users are correlative, consisting of an equitable share of the available supply.

Like appropriative rights to surface water, appropriative rights to groundwater are governed by the principle of first in time, first in right, and allow use of water outside of the groundwater basin. The State Water Board does not have permitting jurisdiction over most groundwater, so an appropriative groundwater right can be obtained simply by extraction and beneficial use and does not require a permit from the state. Water may be appropriated for beneficial uses subject to the rights of those who have a lawful priority. Any water not needed for the reasonable beneficial uses of those having prior rights is excess or surplus water. Surplus water can be appropriated for non-overlying

uses such as sale, public use or exportation beyond the groundwater basin or watershed. (*City of Pasadena v. City of Alhambra*, *supra*, 33 Cal.2d, 925-926; *Leavitt v. Lassen Irrigation Co.* (1909) 157 Cal. 82.)

Where groundwater and surface waters are interconnected, such as in the Scott and Shasta watersheds, the "common source" doctrine applies, integrating the water rights and applying priorities without regard to whether the diversion is from surface water or groundwater. (*Hudson v. Dailey* (1909) 156 Cal. 617, 627–628.) "[I]t has been recognized by California decisions that a percolating groundwater supply, although not part of the flow of a stream, may nevertheless be hydrologically connected with it, with the result that the extraction of water from either source diminishes the amount of water in the other. In such a situation, the percolating groundwater and the stream are regarded as one common water supply …." (*United States v. Fallbrook* (S.D.Cal. 1958) 165 F.Supp. 806, 847 [internal citations omitted].) "Because these basins are interconnected, some of the surface inflow to one basin is outflow from another. The groundwater and surface water within the entire Mojave River Basin constitute a single interrelated source." (*City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224, 1234.)

Article X, section 2 of the California Constitution requires that all water in the state be used reasonably and not wasted, and that it be put to beneficial uses to the fullest extent possible, in light of the importance of water to the state. It further provides that rights to the use of water are limited to such water as is reasonably required for the beneficial use served, and does not extend to the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of the water. The State Water Board has continuing authority under Water Code sections 100 and 275 to enforce the requirements of the California Constitution, Article X, section 2.

The reasonable use doctrine applies to the diversion and use of both surface water and groundwater, and it applies irrespective of the type of water right held by the diverter or user. (*Peabody v. Vallejo* (1935) 2 Cal.2d 351, 366-367.) What constitutes a reasonable use, method of use, or method of diversion depends on the facts and circumstances of each case. (*People ex rel. State Water Resources Control Board v. Forni* (1976) 54 Cal.App.3d 743, 750.) Under the reasonable use doctrine, water right holders may be required to endure some inconvenience or to incur reasonable expenses. (*Id*. at pp. 751-752.) In applying the reasonable use doctrine, the Board must consider the demands of both instream uses (such as fisheries habitat, navigation, and recreation) and off-stream uses (such as irrigation, domestic use, and commercial use). (*National Audubon Society v. Superior Court* (1983), 22. Cal.3d 419, 443-444.) The State Water Board may determine particular uses not to be reasonable by regulation, including by exercising the emergency authority under Water Code section 1058.5 to adopt minimum drought emergency flows to protect critical fisheries, and to establish that diversions for most uses that interfere with meeting such flows are unreasonable. (*Stanford Vina Ranch Irrigation. Co v. State of California* (2020) 50 Cal.App.5th 976*)*

1.6 NEED FOR PROPOSED EMERGENCY REGULATION

Although the watersheds received above average precipitation in WY 2022-2023, the Scott and Shasta watershed and fisheries present in and returning to the watersheds are still suffering from the long-term impacts of severe drought. The Klamath River watershed, which includes the Scott River and Shasta River watersheds, remains under a drought emergency proclamation (Newsom, 2023) and the region faces an uncertain hydrologic future, particularly in light of the ongoing long-term drought. To continue the protection of the anadromous fisheries and effectively manage the available water, immediate action is needed to adopt this proposed Emergency Regulation with minimum fisheries flow requirements in the Scott River and Shasta River watersheds, and to continue effectively and efficiently administer and enforce the State's water rights system to meet those flows in light of severely limited water availability in the watersheds during the current drought. Immediate action is also needed to ensure continued reasonable use of water in light of limited water availability and fluctuating drought conditions. In the absence of the Drought Emergency Regulation (SWRCB, 2021, 2022b), there are no other regulations that provide for bare minimum fisheries flows in the Scott River and Shasta River watersheds, and the watersheds have not consistently met these minimum flows absent regulation. The State Water Board may need to restrict water diversions when it determines flows are likely to be reduced below the proposed drought emergency minimum flows so that water is available for minimum flows for migration, rearing, and spawning of fall-run Chinook and SONCC coho salmon in the Shasta River and Scott River watersheds. The Emergency Regulation is also needed to provide for minimum health and safety needs and minimum livestock watering needs.

To implement the water rights priority system more effectively in the Scott River and Shasta River watersheds under water limitations and in uncertain hydrologic conditions, the State Water Board may need access to better and more current information regarding water rights, water use, water needs, and procedures that allow the State Water Board to obtain and use the best available information quickly. The State Water Board needs to adopt an enforceable mechanism to collect information related to surface water and groundwater diversions and uses of water in the watersheds to inform water demand estimates and the curtailment process. Additional information may also be needed regarding the basis of right and priority date for some water rights and claims to inform curtailment decisions.

On May 23, 2023, the State Water Board received a Petition for Rulemaking seeking a permanent regulation establishing minimum flows in the Scott River (Karuk Tribe et al., 2023) for fishery protection. At an August 15, 2023, hearing on the petition, the State Water Board directed Division of Water Rights staff to move forward with a proposed Emergency Regulation for both the Scott River and Shasta River watersheds.

1.6.1 Need for Emergency Minimum Instream Flows for Fall-Run Chinook Salmon, Steelhead, and SONCC Coho Salmon in Scott River and Shasta River Watersheds

In these watersheds, application of the reasonable use doctrine requires consideration of the benefits of continued diversions of water from the identified waterbodies for current uses and the potential for harm to SONCC coho salmon, steelhead, and fall-run Chinook Salmon from such diversions under the current drought conditions.

The purpose of the Proposed Emergency Regulation is to protect commercially significant and culturally important fall-run Chinook Salmon (See Trihey & Associates, 1996; SWRCB, 2020), the culturally important steelhead (SWRCB, 2020) and the ESA-listed SONCC coho salmon affected by the drought in the Scott and Shasta watersheds by maintaining minimum streamflow for adult salmon migration, rearing, spawning, and out-migrating juvenile fish.

1.6.1.1 Scott River Watershed Need for Emergency Minimum Flows

In a July 20, 2023, letter to the State Water Board, CDFW (2023e) recommended the State Water Board adopt the following minimum flow recommendations, shown in Table 3, as interim flows to improve conditions in the Scott and Shasta watersheds to support key populations of coho salmon, Chinook Salmon, and steelhead. The minimum flow recommendations are the same as CDFW (2022b) recommended the State Water Board adopt for, and were adopted in, the 2022 Drought Emergency Regulation (SWRCB, 2022b).

Table 3. Scott River emergency daily minimum flow recommendations. cfs = cubic feet per second.

River Gage	Daily Minimum Emergency Flow Recommendation (cfs)												
	Jan	Feb	Mar	Apr	May	Jun 1-23	Jun 24-30	Jul	Aug	Sep	Oct	Nov	Dec
Scott River at Fort Jones (USGS gage no. 11519500)	200	200	200	150	150	125	90	50	30	33	40	60	150

In a June 15, 2021, letter to the State Water Board, CDFW provided emergency drought minimum flow recommendations for the Scott River to support salmon survival through the current drought emergency (CDFW, 2021d). These flow requirements were adopted in the 2021 Drought Emergency Regulation (SWRCB, 2021). In an April 20, 2022, letter to the State Water Board, CDFW recommended continuing the previous

emergency drought minimum flow recommendations, with the update of ramp-down flows in June to avoid stranding (CDFW, 2022b). These modified flow requirements were adopted in the 2022 Drought Emergency Regulation (SWRCB, 2022b) and are proposed for re-adoption in the proposed Emergency Regulation.

The flow recommendations were developed in consultation with NMFS, pertain specifically to hydrologic conditions in the Klamath River basin that triggered the May 10, 2021, drought declaration, and provide minimum flows to support all life stages of fall-run Chinook and SONCC coho salmon during the current drought emergency. CDFW notes the flow recommendations are not intended to set the stage for long-term management considerations, nor are they to be construed to provide adequate protections for salmon over extended periods of time. They only provide drought emergency minimum flow recommendations for all life stages of salmon during the current drought emergency. The proposed emergency minimum flow requirements are intended to enable salmon in the Scott and Shasta Rivers to survive. The minimum flows are also informed by the experiences of fall 2020 salmon runs where, as mentioned previously, the entire year's cohort of migrating coho salmon nearly failed to reach key spawning areas in the Scott River watershed (CDFW, 2021d, 2022b).

The flow recommendations that CDFW (2022b) recommended for drought emergency are significantly lower than the recommended flow regime that CDFW (2017) developed for the Scott River. CDFW (2017) developed a flow regime using an estimated fish passage flow needs equation, Q_{fp} (R2 and Stetson, 2008), and Hatfield and Bruce (2000)'s instream flow incremental methodology and component microhabitat model, physical habitat simulation (PHABSIM) for spawning and rearing. CDFW (2017) then used Tessman's adaptation of the Tennant Method (Tessman, 1980) to ensure the flow regime is consistent with Scott River watershed hydrology. CDFW (2017) integrated the flow numbers with salmonid life stage periodicity and selected the highest semi-monthly flow.

The Scott River Adjudication assigned first priority instream flow rights to the United States Forest Service that are intended to provide bare minimum protections for fish during dry years in the mainstem's Klamath National Forest (KNF) reach, as measured at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500; Siskiyou County Superior Court, 1980). CDFW's Scott River minimum flow recommendations are strongly influenced by the KNF first priority adjudicated right, with minor amendments that take migration observations from more recent dry years into account (e.g., CDFW 2021bcde). The Scott River Adjudication (Siskiyou County Superior Court, 1980) deemed the first priority KNF flow amounts necessary:

> *to provide minimum subsistence-level fishery conditions including spawning, egg incubation, rearing, downstream migration, and summer survival of anadromous fish and can be experienced only in critically dry years without resulting in depletion of fisheries resources*.

CDFW (2021d) noted that implementation of these minimum flows might be adjusted if CDFW and NMFS subject matter experts agree that the reference drought emergency

minimum flows are more than may be necessary to benefit relevant life stages (e.g., migration ends early). This option was exercised during implementation of the 2021 and 2022 Drought Emergency Regulations (e.g. CDFW, 2022b). This flexibility was adopted into the previous Drought Emergency Regulations (SWRCB, 2021, 2022b) and is included in the proposed Emergency Regulation.

CDFW or NMFS may notify the Deputy Director that the pertinent life stage(s) of the pertinent species the flows are crafted to protect is not yet, or is no longer present at the time anticipated, or may notify the Deputy Director that lower, alternative flows at the USGS Scott River gage at Fort Jones (USGS gage no. 11519500), or alternative flows at a different point or points in the watershed, provide equal or better protection for the pertinent species' relevant life stages.

On May 23, 2023, the State Water Board received a Petition (Karuk Tribe et al., 2023) to establish permanent stream flow requirements on the Scott River based on a California Department of Fish and Wildlife (CDFW) 2017 report. (CDFW 2017) The Petitioners state that the decades-long decline in fish populations, and the infrequency that minimum flows are met regardless of water year type, require that Emergency Regulations be implemented even after the revocation of the drought Executive Order. The minimum flow requirements recommended in the 2017 report (CDFW 2017) are significantly higher than those deemed appropriate for a drought emergency and included in the proposed Emergency Regulation.

On July 20, 2023, CDFW submitted a comment letter regarding the Petition for permanent streamflow requirements on the Scott River. In the letter, CDFW indicated that during the fall of 2022, 93% of the adult Chinook run spawned in the Scott River canyon downstream of the CDFW video counting weir due to instream flows insufficient to provide passage to the Scott River Valley. Following this, there was a considerable amount of snow accumulation during the winter, and spring runoff flows were high. CDFW rotary screw trap crews had been trapping an unusually high amount of Chinook sac fry in the spring of 2023, indicating redd scour had occurred, presumably from the Scott River canyon. This underscores the importance of maintaining sufficient late summer/fall flows to allow adult Chinook Salmon to pass through and upstream of the Scott River canyon into the Scott River Valley for spawning, thereby protecting redds from potential high winter/spring runoff (CDFW 2023e). The letter additionally supported setting interim backstop flows for the Scott River. The anticipated benefits of establishing interim flows for the Scott River included increased west side tributary habitat for coho salmon juveniles, increased groundwater elevation, and increased surface flows and stream connectivity during adult Chinook, coho, and steelhead migration (CDFW, 2023e).

On August 15, 2023, the Board held a hearing in response to the Petition. The hearing was expanded to include the Shasta River watershed. At the hearing, in light of the petition and comments thereon, the State Water Board directed Division of Water Rights staff to further engage with experts and community members on the basis for and implementation of prior emergency regulations to inform a proposed Emergency Regulation for the Scott River and Shasta River watersheds for Board consideration. The Board emphasized that urgent action was required to address grave fishery

conditions and to be prepared for the risk of dry conditions in the upcoming irrigation season, and that it was necessary to maintain continuing baseline protection for fisheries even as more permanent longer-term recovery-focused efforts continued. The State Water Board also directed Division of Water Rights staff to identify and initiate the scientific work needed to pursue long-term flows in both the Scott and Shasta watersheds.

On October 6, 2023, waterboard staff held a public workshop regarding emergency regulation efforts in the Scott River and Shasta River watersheds. The workshop focused on technical items related to the recently expired emergency regulation for the Scott River and Shasta River watersheds: minimum flow requirements, the state of the fisheries, data, and local cooperative solutions. Staff invited parties to present, answer specific staff questions, and engage in further discussion to deepen the information and discourse. During the workshop, staff were informed on the low fish numbers and dire state of the fisheries, the cultural and economic impacts to the tribes and commercial fishing, the need for minimum instream flows to protect the populations from extinction, in depth description of watershed hydrology and geomorphology, feedback on LCS and ways to improve the process and assessment. The Nature Conservancy stressed the importance of these minimum flows, and every drop counts when in a drought emergency.

1.6.1.2 *Shasta River Watershed Need for Emergency Minimum Flows*

In a July 20, 2023 letter to the State Water Board, CDFW (2023e) recommended the State Water Board adopt the following minimum flow recommendations, shown in Table 4, as interim flows to improve conditions in the Scott and Shasta watersheds to support key populations of coho salmon, Chinook Salmon, and steelhead. The minimum flow recommendations are the same as CDFW (2022b) recommended the State Water Board adopt for, and were adopted in, the 2022 Drought Emergency Regulation (SWRCB, 2022b).

CDFW (2021d) noted that implementation of these minimum flows might be adjusted if CDFW and NMFS subject matter experts agree that the reference drought emergency minimum flows are more than may be necessary to benefit relevant life stages (e.g., migration ends early). This option was exercised during implementation of the 2021 and 2022 Drought Emergency Regulations (e.g. CDFW, 2022b).

Table 4. Shasta River emergency daily minimum flow recommendations. Cfs = cubic feet per second.

River Gage	Daily Minimum Emergency Flow Recommendation (cfs)													
	Jan	Feb	Mar 1-24	Mar 25-31	Apr	May	Jun	Jul	Aug	Sep 1-15	Sep 16-30	Oct	Nov	Dec
Shasta River near Yreka (USGS	125	125	125	105	70	50	50	50	50	50	75	105	125	125

gage no. 11517500)														

In a June 15, 2021, letter to the State Water Board, CDFW (2021d) provided minimum flow recommendations for the Shasta River to support salmon survival through drought emergency and were adopted in the 2021 Drought Emergency Regulation (SWRCB, 2021). The flow recommendations were developed in consultation with NMFS, pertain specifically to hydrologic conditions in the Klamath River basin that triggered the May 10, 2021, drought declaration (Newsom, 2021b), and provide minimum flows to support all life stages of fall-run Chinook and SONCC salmon during the current emergency. In light of additional evidence, CDFW submitted a letter to the State Water Board which recommended reduced winter flows for the Shasta River and ramping flows to reduce stranding potential (CDFW, 2022b). The reduced winter flows were deemed sufficient to provide survival-level habitat for salmon and steelhead and minimize superimposition of redds (redds placed on top of redds) (CDFW, 2022b), while making more water available for storage. These modified flow requirements were adopted in the 2022 Drought Emergency Regulation (SWRCB, 2022b) and are proposed for re-adoption in the proposed Emergency Regulation.

CDFW's June 15, 2021, letter notes the flow recommendations are not intended to set the stage for long-term management considerations, nor should they be construed to provide adequate protections for salmon over extended periods of time. They only provide drought emergency minimum flow recommendations for all life stages of specific salmonids during drought emergency. The flow recommendations were intended to enable salmon in the Scott River and Shasta River watersheds to survive drought conditions (CDFW, 2021d).

The waterboards staff have reviewed comments that the Shasta flow numbers in the canyon reach are incorrect, being either too high or low. The Shasta River flow recommendations are informed by recommended flows for dry conditions from McBain and Trush Shasta River Canyon Instream Flow Needs Assessment (2014), and CDFW's understanding of available base flows and historical water use. The study model and analyses took into consideration the temperature thresholds CDFW defined for salmon suitability, but the model did not thoroughly cover all the aspects for streamflow-water temperature relationship and quotes "analyses does not address many facets of the streamflow-water temperature relationship" (McBain and Trush, 2014). This includes the addition of cold-water springs into the canyon reach that may help it maintain cooler temperatures. The study acknowledges this in their findings and states it's a conservative approach to identifying instream flows needs. The recommendations deviate from referenced values only when CDFW considered other factors such as the current emergency drought conditions, field notes, and the professional judgment of CDFW and NMFS subject matter experts. Because of this conservative approach the recommended flows for Shasta River are equal to or lower than the flows recommended for dry conditions in McBain and Trush (2014).

Flow-habitat results from the three sites in the McBain and Trush Shasta River Canyon Instream Flow Needs Assessment (2014) were composited to calculate spawning habitat availability during a critically dry water year winter-flow scenario on the Shasta River. Based on this modeled scenario, 105 cfs represents approximately 83% of the maximum habitat value available in a critically dry water year. For this reason, 105 cfs provides an appropriate amount of early season spawning habitat for Chinook salmon in this drought emergency (October). The overall flow-habitat relationships display a relative peak of spawning habitat at 125 cfs in a critically dry water year. The increase from 105 cfs in October to 125 cfs in subsequent months should minimize superimposition of redds.

Redd dewatering is influenced by redd and tail spill depth. The minimum depth of a redd is typically 0.5 foot, and the tailspill depth is typically 0.3 foot less than the redd depth. Accordingly, a drop or rise of more than 0.2 foot in water surface elevation would be expected to change tailspill depths and available spawning habitat. Rating curves in McBain and Trush (2014) demonstrate that fluctuations between 105 and 125 cfs would result in approximately a 0.18-foot change in water surface elevation. Assuming two (2) months from spawning to fry emergence, flows could be dropped to 105 cfs in late March without causing redd dewatering.

While adequate flows are necessary to support fish, another vital and related component of the aquatic habitat necessary to protect salmonids is cold water. It is important to note the correlation of low flows with lethal water temperatures for salmon. In the spring of 2021, CDFW recorded unprecedented high temperatures at its rotary screw trap, which is located near the USGS Shasta River gage near Yreka (USGS gage no. 11517500). In order to ensure fish are not harmed, CDFW only operates the rotary screw trap when water temperatures are below 21 degrees Celsius (70 degrees Fahrenheit). In 14 years of the 20-year rotary screw trap record, Shasta River water temperatures have allowed CDFW to operate the screw trap until the end of June. In 2021, the temperature threshold was reached in mid-May, approximately a month earlier than ever before. In the 20 years of records prior to 2021, the earliest day the temperature threshold was met was June 17. The 2022 juvenile salmonid outmigrant study for the Shasta River states that temperatures greater than 20.3 degrees Celsius can be detrimental to juvenile salmonid growth and survival. In the 2022 screw-trapping season, this temperature was first reached on May 17 and 28 days were logged with temperatures above that threshold between then and the last day of operations on June 29. For those days when the 20-degree water temperature threshold was reached, the average duration at that temperature was 12 hours.

The outmigrant rotary screw trap in the Shasta River canyon was still catching salmonids on June 30, 2023. Nonetheless, the rotary screw trapping operation ended on this date due to water temperatures exceeding safe levels for the salmonids. Snorkel surveys continued, however, and Chinook Salmon were observed almost through the end of July. Subsequently, and with the end of the drought regulation, no juvenile Chinook Salmon were observed in the canyon (Harris, 2023a).

On June 16, 2022, a memo prepared by Michael Podlech was submitted to the State Board presenting an interpretation of temperature modeling contained in McBain and Trush (2014), arguing that the summertime flow target of 50 cfs would result in adverse instream temperatures not supportive of juvenile salmonid survival. The memo included an alternative flow target of 30 cfs between June 1 and September 15, followed by a ramped increase in flow from 30 cfs to 50 cfs by September 16, followed by another ramped increase in flow to 75 cfs by September 30. The recommendation was based on the information contained in McBain and Trush (2014) but did not fully assess the differences between the modelling parameters used in that report and the implementation of curtailment in the Shasta River by order of priority. Importantly, McBain and Trush (2014) modeled the change in temperature under different flow regimes by increasing the volume of water in stream, assuming a uniform temperature based on data collected in the Shasta River canyon. This approach does not take into account the temperature of the source water flowing into the Shasta River canyon caused by changes in water management that may result in increased flow from cold water springs. Big Springs Irrigation District is one of the lower priority water rights holders in the Shasta River, being an appropriative groundwater right holder, and diverts water from the Big Springs Complex, a geologic feature that supplies significant cold-water springs and the important cold water tributaries Big Springs Creek and Little Springs Creek. Big Springs Irrigation District was curtailed for much of the time the curtailments were in effect, resulting in a measurable increase in cold water flow from the Big Springs Complex into Big Springs Creek, Little Springs Creek, and eventually into the Shasta River.

Analysis conducted by North Coast Regional Water Board staff showed that this increased flow of cold water from the Big Springs Complex into the Shasta River, as occurred through curtailment in order of water right priority under the Drought Emergency Regulation, reduced temperatures by nearly 2° C during early July 2022 when compared to early July 2021. The Regional Water Board also assessed instream temperatures in early July 2018 where flows were close to 30 cfs. Instream temperatures during this period were warmer than July 2022, despite comparable atmospheric temperature, providing evidence that flows of 50 cfs, when cold water spring flows were increased from curtailment of appropriative groundwater users consistent with water right priority, provide better water quality conditions than flows of 30 cfs in the Shasta River canyon. Subsequent juvenile surveys in the Shasta River canyon conducted by CDFW in July 2022 and in July 2023 showed the presence of salmonids in the canyon, utilizing habitat. A subsequent juvenile survey conducted after the emergency regulation ceased on July 30, 2023, showed most of the juvenile salmonids had vacated the canyon as flows decreased. These field observations provide additional evidence of the efficacy of 50 cfs minimum flows supporting juvenile habitat utilization and survival in the Shasta River canyon, when the source water supporting these flows is of sufficient quality.

In addition, fishery managers have been concerned with flow and temperature conditions in the Shasta River during the early weeks of the fall migration during many prior years. As a result, over the past decade, resource agencies and local landowners

have tried to coordinate to provide adequate flows in the Shasta River during the critical month of September to support fall-run Chinook Salmon migration.

1.6.2 Changes in Proposed Emergency Regulation Compared to 2022-2023 Emergency Regulation

1.6.2.1 Groundwater Local Cooperative Solutions

At an October 6, 2023 staff workshop, State Water Board staff invited experts to answer questions and make recommendations regarding the groundwater LCS program under the 2021 and 2022 Drought Emergency Regulations. The invited parties expressed both critiques of and support for the groundwater local cooperative solution program, with some parties indicating that it should be extended to include surface water and pointing to the importance of the program in enabling agricultural businesses to survive under the Drought Emergency Regulation. Others suggested that failures of local cooperative solution program in structure or implementation were responsible for the significant period of low flows on the Scott River in 2022, that the program should be made more stringent or eliminated, and that the program was insufficient to protect all businesses from failure. The invited parties recommended a range of specific actions, including that the State Water Board increase oversight of implementation, simplify and standardize the enrollment process, add flexibility for different water year types, improve water use measurement and monitoring throughout the irrigation season, ensure that actions result in increased flow, enhance opportunities for public review of local cooperative solution proposals, help water users acquire financial aid to complete water use efficiency upgrades, and increase outreach. State Water Board staff received similar comments and recommendations during meetings and as part of other engagements with Tribes, water users, Siskiyou County representatives, nongovernmental organizations, and other interested parties.

Based on information presented at the State Water Board's October 6, 2023, workshop, new analyses (Riverbend Sciences, 2023), Scott Valley Integrated Hydrologic Model modeling data (Harter et. al., 2023ab), and discussions with other parties regarding the overlying and adjudicated groundwater local cooperative solution program, the groundwater local cooperative solution portion of the proposed regulation is modified to both improve and expand the program. Goals of the original and modified groundwater local cooperative solution program include softening the economic impact of curtailment by allowing users to plan for and implement specific groundwater use reductions; incentivizing high priority water right users to adopt cutting-edge and known changes in agricultural equipment or measures that will have both immediate and long-term benefits to water conservation; reducing non-consumptive losses (e.g., evaporation); ensuring and improving verification and quantification of water conservation measures; and structuring the groundwater local cooperative solutions to provide a simpler path for those that proactively implemented the most efficient irrigation practices in advance of the regulation.

Individual overlying groundwater local cooperative solutions must now be submitted no later than April 15th and must be implemented during the entirety of the irrigation

season, including during their pendency of approval, to ensure irrigators have planned and are implementing the local cooperative solutions throughout the irrigation season. During implementation of the 2022 local cooperative solution program, the State Water Board received local cooperative solution proposals as late as September 2022, and there was some confusion whether pre-approval implementation was required.

Additionally, under the proposed regulation, the overlying groundwater local cooperative solutions must include groundwater metering, which is designed to ensure actual groundwater use is known. This requirement address criticism regarding unknown baseline water use during implementation of the 2022 groundwater local cooperative solution LCS program, as well as ongoing uncertainty about the amount of applied water use associated with different crops and soil types throughout the watershed. As many commenters have noted, this represents a significant amount of effort and it is foreseeable that some wells may not be metered before the start of – and possibly before the end of – the irrigation season. The likelihood of a delay in meter installation may result from a variety of factors, including delays in reaching out to acquire and install meters or possibly limits on available equipment and qualified installers. The State Water Board likely has funding and staff available to assist with constraints related to the availability of equipment and installers and expects diverters to be working diligently to meet the metering requirement in advance of the irrigation season. But, if a diverter is unable to install a meter prior to the start of the irrigation season, the diverter must provide information supporting the effort the diverter took to get a meter installed and a time schedule for meter installation. If metering for all of a diverter's wells is not feasible prior to the start or end of the irrigation season, despite diligent efforts, a time schedule for continued meter installation should be provided for the event that the drought emergency continues. Water use must be documented by meter measurements daily and reported monthly to the coordinating entity and/or State Water Board. The Deputy Director may approve exceptions to the metering requirement if a groundwater well irrigates less than 30 acres, installation of the meter is infeasible, or if the diverter was unable to get a meter installed prior to submittal of the proposal and the proposal includes documentation of substantial efforts to procure a meter and a time schedule for installation and use of the meter.

Additionally, coordinating entities must meet minimum oversight requirements and affirm that those inspecting and approving local cooperative solutions do not have an interest in the oversight and overall participation of a diverter in the local cooperative solution. The regulation also expands the role for State Water Board involvement in overlying groundwater local cooperative solutions, allowing coordinating entities to be optional and being available as support oversight of local cooperative solutions to meet inspection requirements.

Finally, in order to avoid potential conflict with efforts to benefit groundwater and minimum instream flows in later parts of the year, the regulation provides that using surface water in lieu of groundwater does not per se bar participation in an overlying groundwater local cooperative solution.

The regulation also explicitly clarifies that an overlying groundwater local cooperative solution may be proposed for a portion of a water users' lands, in light of community concerns on the matter. In considering approval of such a proposed local cooperative solution for a portion of irrigated land or affecting only certain diversions exercised by a diverter, the Deputy Director can require assurance that water use is not increased on lands outside the local cooperative solution in a manner that undermines the groundwater reductions achieved through the local cooperative solution. For example, the Deputy Director may consider whether increasing groundwater pumping on lands outside the area proposed will provide increased run-off to lands that otherwise would have reduced water application or consider whether a proposed local cooperative solution presents a water savings beyond that achieved by a standard grain rotation. These provisions are designed to ensure the local cooperative solutions provide for overall reductions in groundwater that support flows.

Overlying groundwater local cooperative solutions may be crafted or amended to allow for enhanced use of valid surface water rights as compared to previous years, in light of the potential for groundwater recharge benefits. Such local cooperative solutions must include support for an anticipated improvement in groundwater elevations and/or instream benefits and may require monitoring for evaluation of benefits to groundwater elevation and/or instream conditions for evaluation.

The level of uncertainty regarding precise effects of groundwater LCS's is acceptable for several reasons. First, the effect on instream flows from curtailing groundwater pumping is generally less immediate than the effect of curtailing surface-water diversions. While ceasing pumping from some groundwater wells may have rapid effects on surface flows, the effects associated with other wells may be considerably more remote. This means that earlier reductions in groundwater use (e.g., before instream flows are depleted to baseline minimum levels) tends to result in comparatively later contributions to flows (e.g., in contributions later in the irrigation season when flows are lower and contributions from groundwater are more valuable to support attainment of the flow requirements). This also means that curtailing groundwater use in order of priority to protect baseline minimum flows tends to be comparatively less effective at the time flows are not being achieved than curtailment of surface flows. Earlier conservation tends to provide more water at the time the rivers have the greatest shortfall, which is also the time at which flow-based groundwater curtailment is less directly effective.

Second, even if a precise contribution to surface flows from individual farming actions were possible to determine, it is not possible to determine in advance the precise amount of water or flows that are needed in any given water-year (i.e., unable to predict amount and form of precipitation and how that will translate to flow, which varies between and within water year types). Yet, farmers must make planting decisions early in the season, including related decisions on hiring, loans, and equipment. Thus, certainty at the beginning of the year has manifold benefits, particularly on smaller farms and ranches common in the Scott and Shasta valleys that do not have as much capital

to weather a sudden loss of revenue associated with significant curtailment and the associated loss of crop production.

Third, while there is uncertainty regarding the degree of contribution to instream flows that will occur under local cooperative solutions, there is substantial evidence that the local cooperative solutions that result in less water use and/or earlier shut off will support flows at the times when they tend to be most constrained. Both the 30 percent and the Graduated Early Cessation Local Cooperative Solutions require a reduction in groundwater pumping, and the Best Management Practices option requires early cessation of pumping in the driest years. As discussed above, modeling indicates that these actions will result in increased flow. Additionally, Riverbend Science indicates that low elevation spray application (LESA) and low energy precision application (LEPA) systems provide significant evaporation savings, and that cessation of pumping, as required under the Graduated Early Cessation and Best Management Practices local cooperative solutions reduces consumptive use associated with evapotranspiration.

Fourth, the overlying groundwater local cooperative solutions provide an incentive for the most senior water users in the watersheds to be part of contributing to flows, thus reducing impacts on other users, without harm to other legal users of water.

Finally, the overlying groundwater local cooperative solution program has benefits that extend even beyond a particular drought year, both contributing towards immediate needs should this severe drought continue and assisting long-term efforts to balance the needs for a thriving fishery and a thriving agricultural community. For example, the overlying groundwater local cooperative solution program supports development of creative local solutions that can support immediate, mid-term, and long-term sustainability in agricultural operations. Staff have heard from community members that water-saving practices first implemented in Scott Valley, like non-irrigation of corners and shortened wheel line times, have proven to be workable in many instances. Further, it supports infrastructure investments for water use reduction even in uncertain drought years, when farmers facing potential curtailment may hesitate to invest in infrastructure like pivots, LESA and LEPA-systems, soil moisture-sensors, and meters. Local cooperative solutions also support development of information that will feed into short-, mid-, and long-term water management actions, across multiple forums (for example: SGMA programs, future State Water Board regulation, future water development projects, grant applications, or individual farm operations and/or permitting).

Prior to approval, pending local cooperative solutions will generally be posted on the State Water Board's Scott-Shasta Drought website for a minimum of seven days, thereby providing interested parties with an opportunity to review the proposals and provide comments or feedback for the State Water Board to consider in its evaluation and consideration of the proposals prior to a decision. The Board received no comments on previous posted local cooperative solutions for overlying groundwater, all of which were posted on the website prior to a final decision. However, considerable interest and discussion regarding these LCS's arose when 2022 flows in the Scott River did not meet drought emergency minimum levels in late summer and fall, and, in

particular following an evaluation of the overlying groundwater local cooperative solutions water savings (Riverbend Sciences, 2023). Tribes and environmental organizations, in particular, have specifically requested greater access to the local cooperative solution proposals prior to a final decision.

1.6.2.1.1 Percent Reduction Overlying Groundwater Local Cooperative Solution

The percent reduction overlying local cooperative solution option is similar to the overlying groundwater local cooperative solution adopted in 2021 and 2022 with new requirements and options for determining the volume of water applied in baseline and current years. The 2020, 2021, 2022, or 2023 irrigation season may be used as a baseline year; however, the proposed regulation sets standards for applied water by crop type, which cannot be exceeded without explicit approval from the Deputy Director. These amounts of applied water by crop type are:

- 33 inches per acre per year for alfalfa;
- 30 inches per acre per year for pasture; and
- 14 inches per acre per year for grain.

A percent reduction overlying groundwater local cooperative solution proposal may receive approval from the Deputy Director for a higher rate than the above values after providing justification. Specifically, the proponent must make an additional showing that a higher base rate number is an appropriate comparison in light of relevant information that can include, but is not limited to, multi-year practices, soil type, and irrigation methods. This flexibility is appropriate where studies regarding applied water needs use watershed-wide averages, and that applied water needs may vary considerably within the watershed based on geomorphology and soil types.

1.6.2.1.1.1 Overlying Groundwater Local Cooperative Solution Baselines Must Reflect a Reasonable Amount of Applied Water

Setting standards for applied water is necessary considering that the 2022 Scott River groundwater local cooperative solutions reported a 2020 average baseline that was between 46% and 95% higher than values reported in literature (Table 5). Nine irrigators reported 2020 baselines of over 60 inches of water per acre per year, which is well over double the amount of water that the higher estimates of literature report.

Irrigators should not be able pump and apply unreasonable amounts of water under an overlying groundwater local cooperative solution when the groundwater well would otherwise be curtailed. The changes implemented are to ensure that the overlying groundwater local cooperative solution applied water baselines are based on reasonable rates by crop type.

1.6.2.1.1.2 Determining an Applied Water Standard for the Overlying Groundwater Local Cooperative Solution Baselines Numbers

State Wate Board staff released a preliminary draft emergency regulation on November 7, 2023, to solicit comments. This version of the regulation used the University of California, Merced publication *Siskiyou County: Agricultural Economic Analysis Considering Groundwater Regulation* (Cole et al., 2021) for the applied water standard. State Water Board staff used these applied water figures as the standard because these numbers were the values in the latest hydrologic models used in SGMA implementation for the Scott and Shasta watersheds.

Comments on the November 7, 2023, preliminary draft emergency regulation from the Siskiyou County Farm Bureau, Scott Agricultural Water Alliance, and Siskiyou County Board of Supervisors stated that the values in 2021 University of Merced publication are too low and do not reflect actual water use (Scott Valley Agriculture Water Alliance, 2023; Siskiyou County Board of Supervisors, 2023; Siskiyou County Farm Bureau, 2023b). In the Scott River watershed, the average applied water values in 2021 University of Merced publication are approximately 45 percent lower than the 2020 overlying groundwater local cooperative solution average baseline (see Table 5, All Irrigated Lands column). Table 5 provides a summary of estimates of applied water in the Scott River watershed.

Table 5. Summary of Applied Water Estimates for Scott River Watershed (inches/acre/year)

Source	Alfalfa	Pasture	Grain	All Irrigated Lands*	Notes	Reference
California Water Code Section 1004		Max of 30			Statutorily establishes that irrigation of uncultivated land at more than 30 inches does not constitute a beneficial or useful purpose	Wat. Code, § 1004
DWR Agricultural Land and Water Use Estimates (2011-2015)	29	32.2	11.4	29.0	Averages of applied water for the Scott Valley for 2011-2015	CDWR (2018)
SVIHM Final Report 2013	33.1	29.7	14.9	30.3*	*Calculated with weighted average based on land acreage	Foglia et al. (2013b)

Source	Alfalfa	Pasture	Grain	All Irrigated Lands*	Notes	Reference
SVIHM Update 2018	21.5	26.0	10.3	22.6*	*Calculated with weighted average based on land acreage	Foglia et al. (2018)
SGMA Agricultural Economic Analysis – Siskiyou County	23.6	27.6	12.96	24.3*	Calculated with weighted average based on land acreage. Reflects latest estimates from SVIHM and Shasta Valley Integrated Hydrologic Model.	Cole and MedellÍn-Azuara (2021)
2020 LCS Average Baseline				44.1		Riverbend Sciences (2023)
2022 LCS Average Targeted Use				29.2		Riverbend Sciences (2023)

* All irrigated lands refer to the weighted average of applied water for all major crops in the valley, considering the irrigated area for each crop.

Applied water amounts can vary considerably depending on in-season precipitation, in-season evapotranspiration, soil type, irrigation method, farming practices (soil moisture monitoring, length of irrigation season, etc.). Baseline applied water values used in the 2020 overlying groundwater local cooperative solution proposals were estimated two years after the irrigation season and often were calculated based on reference values of irrigation equipment rather than direct measurements. Accordingly, while variability within applied water estimates is expected at the farm scale, the estimates should not diverge so broadly on the watershed scale.

The SVIHM used to use a value of 33.1 inches per ace for alfalfa as an applied water figure, but it was updated to 21.5 (Foglia et al., 2018) or 23.6 (Cole and MedellÍn-Azuara, 2021) based on feedback from groundwater pumpers and a three-year study of eight fields in the Scott River watershed (Foglia et al., 2018).

“The initial SVIHM (Scott Valley Integrated Hydrology Model) estimated an average applied irrigation of 33 inches per year on (mostly sprinkler) irrigated alfalfa. However, landowners in the Scott Valley reported irrigation equipment to be set up for only about 20 to 24 inches per year” (Foglia et al., 2018).

“A 3-year field research project was launched in cooperation with local growers to measure evapotranspiration, irrigation water applications and deep soil moisture profiles in eight alfalfa fields distributed across representative locations in Scott Valley. The

study established a new, slightly lower Kc value of 0.9. For alfalfa, the soil water profile from 5 feet to 8 feet was found to generally decline in soil water content throughout the irrigation season. Thus, alfalfa was found to be effectively deficit irrigated, that is, the application efficiency was 100%" (Foglia et al., 2018).

Based on the values submitted for the 2022 overlying groundwater local cooperative solutions, it appears that most irrigation equipment is no longer set up for 20 to 24 inches per year. It also appears that based on the comments from Siskiyou County Farm Bureau, Scott Agricultural Water Alliance, and Siskiyou County Farm Bureau, the water uses on these eight fields studied is not reflective of the applied water practices in the Scott Valley. Dr. Harter's comment letter to the State Water Board on the preliminary draft version of the proposed emergency regulation notes that the "measured irrigation amounts reflect irrigation systems that are highly efficient" (Harter, 2023).

State Water Board staff recommend the use of the applied water rate values within Foglia et al., 2013, as an applied water standard for the regulation. These rates are similar to CDWR's California Land and Water Use Data for WY 2011-2015 (CDWR, 2018) and are also similar to measured evapotranspiration rates in the Scott Valley of 37 inches per acre per year for alfalfa. These applied water values serve as a presumptive maximum baseline for the 30 percent reductions in overlying groundwater use. An overlying groundwater local cooperative solution applicant must provide justification and receive approval from the State Water Board to use applied water rates greater than the applied water standard.

Understanding applied water amounts in the Scott Valley is crucial to understanding the water balance, developing accurate hydrologic models, and ensuring reasonable use of water. State Water Board staff believe that widespread metering of groundwater pumping is the best way to determine an accurate applied water amount for the watershed.

1.6.2.1.2 Best Management Practices Local Cooperative Solution

This overlying groundwater local cooperative solution option encourages the most efficient water conservation practices, when feasible. Overlying groundwater local cooperative solutions under the proposed emergency regulation must have the following elements:

- Use of a low-energy precision application (LEPA) system (Figure 16) on all irrigated acreage, including no irrigation of corners after June 15 and no use of end guns;
- Use of soil moisture sensors to inform irrigation timing, with records available for inspection; and
- In years with a snow pack of 80 percent or less of the Department of Water Resources' California Data Exchange Center's first May snow water equivalent station average (or the average of the first April measurement if May snow pack measurements are not gathered in the irrigation year) in the Scott River

watershed, or with a water year determination of dry or very dry in the Shasta River watershed, as determined under Table 2 of the March 2021 Montague Water Conservation District water operation plan (MWCD,2021), cessation of irrigation on 90 percent of irrigated acreage by August 31, with a maximum of two (2) inches of water/acre to be applied to the remaining 10 percent of irrigated acres for existing alfalfa fields and grain, or four (4) inches of water/acre for pasture or new alfalfa plantings, during the remainder of the irrigation season.

Figure 16. Types of pivot irrigation methods. Mid-elevation spray application (MESA) uses a pivot system where nozzles are spaced about 7.5 feet to 20 feet apart, 3 feet to 6 feet above the ground, and have a wetting diameter of 20 feet to 75 feet. Water is delivered above the crop canopy. MESA has 78 percent water efficiency. Low elevation spray application (LESA) uses a pivot system where nozzles are 4.5 feet to 5 feet apart, 1 foot to 3.5 feet above the ground, and have a wetting diameter of 12 feet to 30 feet. LESA has 88 percent water efficiency. Low energy precision application (LEPA) uses a pivot system with sprinklers or bubblers that are spaced 2.5 feet to 3.5 feet apart and are about 1 foot to 2 feet above the ground. LEPA has 95 percent water efficiency (Holt et al., 2021). Image source: Bayer (2019).

A similar set of scenarios from the Scott Valley Groundwater Sustainability Plan (GSP) Management Scenario Results (Kouba, 2021) that most closely approximate the proposed “Best Management Practices Local Cooperative Solution” are the scenarios that consider improvements in irrigation efficiency. A 20 percent improvement in irrigation efficiency, with no other improvement in practices, regularly yields a flow of 40 cfs at the USGS Fort Jones gage about one to two weeks earlier than under the baseline scenario.

Implementation of the Best Management Practices overlying groundwater local cooperative solution requires use of the most efficient irrigation practices as well as early cutoff in the driest years to decrease water use and support instream flows. This option addresses criticisms regarding raised during the previous regulations that the 30 percent overlying groundwater local cooperative solution was significantly harder to achieve for diverters that moved to more efficient irrigation systems years ago on their own accord and therefore had fewer options available for a 30 percent reduction, even though the impact of their pumping per acre was significantly lower.

1.6.2.1.3 Graduated Cut-off Overlying Groundwater Local Cooperative Solution

The Graduated Cut-off overlying groundwater local cooperative solution requires irrigators to reduce their groundwater irrigated acreage by ceasing groundwater diversions and irrigation according to one of two cut-off schedules proposed by the Siskiyou County Farm Bureau in an October 27, 2023, letter to the State Water Board (Siskiyou County Farm Bureau (2023a). Per this option, irrigation of a minimum specified percentage of acreage must cease by the specified dates. The flow benefit of this type of local cooperative solution is supported, conceptually, by the Scott Valley Groundwater Sustainability Plan (GSP) Management Scenario Results (Kouba, 2021) and UC Davis Scott Valley Drought project funded by the State Water Board. A summary of related findings of those studies is provided below.

A scenario from the GSP work that most closely represents the proposed "Graduated Overlying Groundwater Diversion Cessation Schedules" are the "curtailment on a specific date" scenarios. These scenarios simulate curtailment of all surface water and groundwater diversions on specific dates that are repeated during each year of the SVIHM simulation. The SVIHM found that cutting off all groundwater pumping for alfalfa irrigation by August 1 would improve September through November streamflow at the USGS Fort Jones gage by 60 percent compared to the baseline irrigation scenario (Kouba, 2021). The SVIHM simulations showed that a July 10 cutoff date would improve September through November streamflow by 86 percent compared to the baseline irrigation scenario. These are the greatest improvements of any on-farm actions examined by the various modeling scenarios. In the scenario of August 15 cutoff, September through November streamflow would improve by 33 percent compared to the baseline irrigation scenario.

In his presentation to the State Water Board on October 6, 2023 (Harter et al., 2023b), Dr. Harter's presented SVIHM results that demonstrate an improvement of September through November streamflow associated with early irrigation curtailment on July 15 compared to an August 15 curtailment.

A SVIHM model scenario run that simulates 2022 hydrologic conditions under the emergency regulation in place at the time (i.e., surface water curtailments occur on the first date on which Scott River flows at the USGS Fort Jones gage fall below the required flows through the end of the irrigation season, and groundwater pumping is reduced by 30 percent for the entire season) in all years between 1991 and 2018 except wet years of 1993, 1995, 1998, 1999, 2003, 2006, 2011, and 2017 shows that fall flows exceeded 40 cfs approximately one month earlier than under base case conditions in all but the two driest years (Harter, 2023).

The dates proposed for the two graduated cut-off overlying groundwater local cooperative solution options are not specifically derived from the model to support a particular amount of flow improvement. The precise amounts of irrigation reduction that would occur from these options is not known, nor is the precise effect on streamflow. The uncertainty is heightened because the reductions associated with these options are likely different on each farm, whereas the model uses watershed-wide assumptions. To

address this gap, proponents must demonstrate that the proposals constitute a farm-specific reduction in irrigation. Conceptually though, requiring 50 percent of irrigation to cease mid-August, with 90 percent of all irrigation ending mid-September, should result in flow improvements in key low-flow months, despite the uncertainty. Additionally, implementation should be easily confirmed by onsite inspections. The option was proposed by the Siskiyou County Farm Bureau (Siskiyou County Farm Bureau, 2023a).

1.6.2.2 Scott Flow Requirements (NF)

Clarification has been added to the Scott River flow requirements. The minimum flow requirements for the Scott River are the natural flows, up to the flow requirements. As discussed by the Nature Conservancy in the October 6th workshop, when flows are at levels below the baseline levels necessary to support fish in the most extreme drought situations, every increment of water is important to the species. When hydrologic conditions do not allow the minimum flow requirements to be met, even with curtailments under the emergency regulation, this clarification provides that all available natural flow is required (Stanford, 2023).

1.6.2.3 Human Health and Safety Exception

Based on concerns raised by the American Civil Liberties Union and Asian Law Caucus on behalf of the Hmong and Chinese communities in Siskiyou County, there are updates to the provisions regarding exceptions to curtailment for minimum human health and safety. Specifically, the updates provide for alternative ways for claiming a human health and safety exception such that the party benefiting from the water (or a representative thereof) could submit the required forms claiming an exception or certify that other water sources were sought. Additional changes provide further streamlining of the prior regulation and remove unnecessary provisions. For example, it eliminates language requiring that individuals not subject to a conservation plan or policy affirm that they are implementing all applicable conservation measures. This term proved difficult for some individuals to interpret after receipt of the 2021 curtailment orders, and, in light of the 55 gallon per person per day limit on diversions, is not expected to result in appreciable water savings. The Proposed Emergency Regulation has updated language allowing the claimant or a representative to also file a petition to increase the daily minimum human health and safety amounts. In previous versions of the regulation, the water diverter was the only person able to submit an exception.

1.6.2.4 Inefficient Livestock Watering

The Proposed Emergency Regulation's prohibition on inefficient diversions for livestock watering is modified as compared to the 2022 Drought Emergency Regulation, based on the experience of lifting the prohibition at higher flows, community requests for increased certainty on what measures are protective of competing fishery uses at this time, and a desire for increased clarity. The changes maintain the prohibition, but set forth exceptions for diversions under specific conditions that minimize interference with competing fishery needs, rather than relying solely on later exceptions to the prohibition.

While any aquifer recharge from winter stockwatering through unlined ditches remains unquantified and uncertain, these changes will also allow for increased incidental benefits to the aquifer as compared to the prior 2022 Drought Emergency Regulation.

Diversions for inefficient livestock watering are allowed between September and March, if certain flow requirements related to connectivity, emergency minimum flows, redd protection, salmon migration and bypass requirements are met. The requirements are designed to protect fish resources in the tributaries and mainstem. Division of Water Rights and CDFW staff have coordinated regarding such conditions. CDFW staff additionally consulted with internal subject-matter experts, the National Marine Fisheries Service, Quartz Valley Tribe, Karuk Tribe, and Yurok Tribe regarding such conditions.

More specifically, diversions are allowed if the following conditions are met. First, drought emergency instream flows are met in the applicable watershed without active curtailments. Second, the diversions may not be initiated in the fall until CDFW has found that there has been sufficient flow to stimulate the fall-run Chinook salmon migration. Third, after November 1, diversions may not occur until CDFW has found that sufficient flow to stimulate coho salmon migration, including in an applicable tributary, has occurred. For example, if sufficient flow to stimulate the Chinook salmon migration occurs on October 10, and all other diversion conditions are met, then diverters may use inefficient means of livestock watering throughout the rest of the month, but must stop again on November 1 unless sufficient flow to stimulate the coho migration has also occurred. Fourth, for tributary diversions, the relevant tributary must be connected to the mainstem, and remain so. Requirement four does not apply in Moffett Creek in the Scott River Watershed, as this creek does not generally maintain connectivity except in the wettest conditions. Fifth and Sixth, any diversion must bypass 90% of flow (or 80% of flow in defined high flow conditions), or bypass greater amounts to avoid disturbing redds. As described in Subdivision (d) of Section 875.7, requirements four through six do not apply upstream of Dwinell Dam in the Shasta watershed.

As provided for in the 2022 Drought Emergency Regulation, diversions for inefficient livestock watering that would otherwise be prohibited may be allowed under tributary-wide local cooperative solutions based on a finding by CDFW that the action will adequately protect fishery resources.

1.6.2.4.1 Reduced Bypass Requirements Under High Flow Conditions

The regulation allows bypass requirements for inefficient livestock diversions to reduce from 90% to 80% during specific high flow events, as measured by the USGS Fort Jones gage and the USGS Yreka gage for the Scott River and Shasta River watersheds, specifically. In the Scott River watershed, these flows are those noted for the specific timeframes in CDFW's 2017 *Interim Instream Flow Criteria for the Protection of Fishery Resources in the Scott River Watershed*, which are the recommended minimum flows to provide habitat requirement for rearing fish in the Scott River watershed (CDFW, 2017). In the Shasta River watershed, diversions for

inefficient livestock watering are allowed if flows at the USGS Yreka gage are 220 cfs or greater, which will ensure that flows remain above the minimum flows and meet fishery needs, particularly when combined with the 20 percent limitation on individual diversions (SWRCB, 2023c).

After Year 2000, the average number of days in September, October 1-15, October 16-to 31, November, December, January, February, and March with average daily flows at USGS Fort Jones gage above the threshold of 62 in September; 134 from October 1-15; 139 from October 16-31; 266 in November; 337 in December; 362 cfs in January and February, and 354 cfs in March, have been 1, 0, 2, 4, 11,18,19, and 25 days, respectively.

After Year 2000, the average number of days in September, October, November, December, January, February, and March with average daily flows at USGS Yreka gage above the threshold of 220 cfs, have been 0, 0, 1, 6, 11, 11 and 13 days, respectively.

1.6.2.5 Removed Penalty of Perjury Language from Certifications

The requirements of the previous regulations requiring curtailed water rights holders to submit certifications that their use continues under an exception is modified to remove the requirement that such certification occur “under penalty of perjury.” Multiple parties had expressed that this was a barrier to vital uses continuing and caused community concern about being punished for errors or good faith estimates. The language is not needed to support compliance or enforcement as it does not change the substantive requirements of the certifications.

1.6.3 Description and Effect of Proposed Emergency Regulation

1.6.3.1 Proposed Emergency Regulation Section 875

The State Water Board has determined that the flows that CDFW recommended in 2022 after, consultation with NMFS and that the Board adopted in 2022 are the appropriate, scientifically-supported drought emergency minimum flows to support a minimum level of protection for salmonids in the Scott and Shasta watersheds. The only change from the 2022 Drought Emergency Regulation is clarification that when hydrologic conditions do not allow for the minimum flow requirements on the Scott River to be met even with curtailments, then the flow requirement is for the full natural flow of the river, including its tributaries. Section 875, subdivision (c) adopts the recommended drought emergency minimum flows for fall-run Chinook salmon, steelhead, and SONCC coho salmon species protection in the Scott River and Shasta River watersheds. The description and rationale for the flows is detailed above in the section titled *Need for Emergency Minimum Instream Flows for Fall-Run Chinook Salmon, Steelhead and SONCC Coho Salmon in Scott River and Shasta Watersheds*. The proposed emergency minimum flows are intended to enable salmonids in the Scott and Shasta watersheds to successfully survive but do not represent optimal flows for salmon.

Recognizing the dynamic, and at times, localized and context-specific nature of information development and the variation in fish behavior and population over different years, Section 875, subdivisions (c)(1)(B) and (c)(2)(B) provide for CDFW, in coordination with NMFS, to provide the Deputy Director with information regarding fish presence and/or alternative flow needs, based on new scientific information. The Deputy Director can then use that information in issuing or lifting curtailment orders, as occurred under the 2021 and 2022 Drought Emergency Regulation.

Section 875, subdivision (b) provides for the Deputy Director to issue enforceable curtailment orders, in order of water right priority, to ensure that these emergency minimum flows are met. In order to allow for rapid communication and the ability to act dynamically as conditions change, changes to curtailment orders after the initial order will be noticed electronically (Section 875, subdivision (d)(2)).

Section 875, subdivision (f) also provides for alternative methods of compliance with the Proposed Emergency Regulation through LCSs that provide benefits to fisheries resources or develop alternative methods to contribute to fishery flows. The next few paragraphs describe the modified LCS framework in the Proposed Emergency Regulation, its reasoning and effect.

Significant efforts in prior years have established that voluntary efforts on an individual or group level in the watershed can result in benefits to the fishery through more flexible means than straightforward implementation of the water rights priority system, although they have not yet proven sufficient on a watershed-wide scale.

The Scott River and Shasta River watersheds have a long history of voluntary efforts aimed at improving fisheries conditions. Voluntary actions in the Scott River watershed prior to adoption of the Drought Emergency Regulation (SWRCB, 2021) included temporary and long-term water leasing through CalTrout and the Scott River Water Trust, safe harbor agreements, and coordination with private landowners, the Watermaster, CDFW, and NMFS to provide targeted flows to protect redds and juvenile fish in critical spawning and rearing watersheds. Some of these efforts resulted in, or are in the process of becoming, dedicated instream flows pursuant to Water Code 1707. Note that instream flow dedications are often specifically intended to contribute flows in addition to any required flows, at the discretion of the petitioner. A water diverter may elect to have 1707 flows contribute to a required flow.

Pre-regulation voluntary efforts have produced some measurable success but have also been thwarted to some extent due to a lack of comprehensive management of water diversions in these watersheds. Often, flows increased in one reach have simply been diverted farther downstream, limiting the effectiveness of flow efforts to a small, localized area. Water use in the Shasta River is particularly difficult to manage due to the number of riparian diversions and groundwater pumping that are not accurately represented in the outdated Shasta River Adjudication (Siskiyou County Superior Court, 1932). The Proposed Emergency Regulation provides a more comprehensive framework for managing water transactions and incentivizing more participation in

voluntary efforts. Section 875, subdivision (f) provides the regulation's framework to build on existing efforts.

The Proposed Emergency Regulation allows for alternative compliance methods at the watershed, tributary, and individual level that establish binding, enforceable alternative methods to meeting the minimum flow requirements, or to other fishery protection goals that provide equivalent or greater fishery benefits. Such measures have the potential to increase certainty for planting, hiring, and other resource determinations for farmers, and have the potential to generate voluntary efforts that will improve community resilience and response to drought in this and future dry years.

Section 875, subdivision (f) provides that local cooperative solutions by individuals or groups may be proposed by petition to the Deputy Director as an alternative means of reducing water use to meet or preserve drought emergency minimum flows, or to provide other fishery benefits (such as cold-water refugia, localized fish passage, or redd protection), in lieu of curtailment. Petitions to implement local cooperative solutions may be submitted to the Deputy Director at any time. The Deputy Director may approve a petition to implement cooperative solutions for: (A) a watershed-wide cooperative solution that will provide sufficient assurance that the flows in subdivision (c)(1) or (c)(2) are achieved; (B) tributary-wide cooperative solutions in two situations – first, if sufficient information allows the Deputy Director to identify the appropriate contribution of the tributary to the flows identified in subdivision (c)(1) or (c)(2), and the Executive Director makes a finding that a local cooperative solution is sufficient to provide the pro-rata flow for that tributary or second, if the trustee fisheries agencies find that the cooperative solution provides benefits to anadromous fish are equal to or greater than the protections provided by their contribution to flow; (C) individual cooperative solutions for any type of diversion in two situations – first, if there is binding agreement under which water users have agreed to cease diversions in a specific timeframe or second, if fisheries agencies recommend an exemption to curtailment based on an assessment that the benefits to anadromous fish are equal to or greater than the protections provided by their contribution to flow; (D) overlying groundwater diversions for irrigated agriculture that results in a net reduction of 30 percent in the Scott River watershed and 15 percent in the Shasta River watershed; that commits to graduated overlying groundwater diversion cessation schedule; or that commits to best management practices for efficient irrigation, combined with early cutoff of corner irrigation and of all irrigation in the driest years; and (E) comparable reduction in use of a users' more senior right in favor of continuing diversion under her more junior right otherwise subject to curtailment under certain circumstances.

Petitions to implement watershed-wide, tributary, and individual local cooperative solutions may be submitted to the Deputy Director at any time. As described in Section 875(f)(4)(D), petitions for overlying or adjudicated groundwater local cooperative solutions are due by April 15 of the irrigation season and must be implemented for the duration of the irrigation season.

Under the Proposed Emergency Regulation, after approval of a petition for a local cooperative solution, the Deputy Director will not issue curtailment orders or shall

suspend, rescind or modify, as applicable, such orders already issued, affecting those rights relevant to the proposed cooperative solution, so long as the Deputy Director finds that any continued diversions under the local cooperative solution are reasonable and do not result in unreasonable harm to other legal users of water. Approval of a petition may be subject to appropriate conditions, including monitoring and reporting requirements, and approval may be rescinded if monitoring or other reliable information indicates that parties are not meeting their obligations under the cooperative solution, if the agreement is not providing the benefits to anadromous fish outlined in the cooperative solution, or based on an objection filed under (f)(2). Section 875, subdivision (f)(4)(D), has well metering and reporting requirements for local cooperative solutions.

Under Section 875, subdivision (f)(4)(B), in the Scott River watershed, information to determine a tributary's pro-rata tributary contribution could include but is not limited to instream flow measurement information, Foglia et al. (2013a), Foglia et al. (2013b), Foglia et al. (2018), The Nature Conservancy California Natural Flow Database (CEFWG, 2021), information developed for the Sustainable Groundwater Management Act (SGMA) process, and available hydrologic models. In the Shasta River watershed, information to determine a tributary's pro-rata tributary contribution could include but is not limited to instream flow measurement information, Watercourse Engineering (2007), The Nature Conservancy California Natural Flow Database (CEFWG, 2021), information developed for the SGMA process, and available hydrologic models.

The proposed emergency regulation supports continued development and implementation of binding local cooperative solutions among water right holders and claimants in the Scott River and Shasta River watersheds.

Under Section 875(f)(4)(D)(v), a percent reduction local cooperative solution allows overlying or adjudicated groundwater diverters to reduce water use by 30 percent in the Scott River watershed and 15 percent in the Shasta River watershed. The percent reduction volumes were determined to be reasonable for this voluntary option based on the information described below and in the changes in proposed emergency regulation compared to the 2022-23 emergency regulation section above.

The SVIHM developed by UC Davis (Foglia et al., 2018; Harter, 2021ab) indicates that ceasing groundwater pumping for alfalfa irrigation by July or August within the Scott River groundwater basin in dry years would result in improved instream flow conditions at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) during October through December. As shown in the SVIHM, during the dry season when stream reaches are dry due to low groundwater levels, stream flows cannot recover until groundwater levels rise due to reduced groundwater pumping or significant rain. In evaluating forecasted shortfalls, State Water Board determined that there may be a need to curtail all priorities of surface water diversions and some or all water pumped by groundwater users in order to achieve the proposed drought emergency minimum flows. As shown in the demand analysis of Fiscal Impact Statement, groundwater pumping for irrigation during August through December is approximately 30 percent of the annual groundwater pumping for irrigation. For the voluntary pathways in the regulation

described above, the volume of the 30 percent reduction of groundwater pumping may be allowed to be spread over the entire irrigation season instead of full pumping curtailment during August through December, with that percent required in the late summer and fall when flows are generally lowest in the Scott River watershed. This is a plausible scenario based on previous years, and actions under the expired Drought Emergency Regulation indicate that such a reduction is feasible (if difficult) for water users. In light of this and of uncertainty regarding the water year, and modifications to the option discussed in Section 1.6.2.1.1, re-adoption of the 30 percent pathway is warranted.

For the Shasta River, projected curtailments do not indicate the same level of curtailment impact to overlying groundwater pumping primarily because the lower priority demands are typically large enough to cover the projected curtailments. Even in the record-setting dry period from 2020- 2022, it was not necessary to curtail overlying groundwater users to meet instream flows. However, curtailments may need to be higher than what can be estimated from available supply and demand information because of uncertainty in the Shasta River watershed related to reported and unreported water demand, actual inflows to Dwinnell Reservoir, streamflow depletion losses, and potential dry stream segments in some parts of the watershed and wet stream segments in other parts of the watershed. It is anticipated that overlying groundwater curtailments needed to meet the drought emergency minimal flows would be much lower in the Shasta River watershed compared to the Scott River watershed, if needed at all. However, overlying groundwater users may still wish to have certainty that curtailment will not be imposed, or may wish to be part of a broader solution in the Shasta River watershed. Governor Newsom's July 2021 Executive Order N-10-21 called on Californians to voluntarily reduce their water use by 15 percent. Therefore, for the groundwater voluntary pathways in the Shasta River watershed the water use reduction target is 15 percent if overlying groundwater users decide to pursue this voluntary pathway.

Section 875, subdivision (f)(4)(D)(vi) allows for a graduated cut-off local cooperative solution in which overlying or adjudicated groundwater diverters reduce water use by ceasing groundwater diversions on one of two schedules if the petitioner demonstrates that irrigation during the current irrigation season will be meaningfully decreased compared to standard practices. Option 1 requires that irrigation cease on 15 percent of acres by July 15, 50 percent of acres by August 15, and 90 percent of acres by August 31. For the remainder of the irrigation season, a maximum of 8 inches of water may be applied on the remaining 10 percent of irrigated acreage. Option 2 requires that irrigation cease on 20 percent of acres by July 20, 50 percent of acres by August 20, and 95 percent of acres by September 5. For the remainder of the irrigation season, a maximum of 6 inches of water may be applied on the remaining 5 percent of irrigated acreage. Additional information related to this provision is described in the *Changes in Proposed Emergency Regulation Compared to the 2022-23 Emergency Regulation* section above.

Section 875, subdivision (f)(4)(D)(vii) allows for a best management practices local cooperative solution in which overlying or adjudicated groundwater diverters may continue to irrigate if the petitioner does all of the following: (a) uses a low-energy precision application (LEPA) system on all irrigated acreage; (b) does not irrigate corners after June 15, and does not use end guns; and (c) uses soil moisture sensors to inform irrigation timing and keeps records available for inspection. Additionally, in drier years, the petitioner agrees to cease irrigation on 90 percent of irrigated acreage by August 31 with limits on the amount of water that may be applied to the remaining 10 percent of irrigated acreage. Additional information related to this provision is described in the *Changes in Proposed Emergency Regulation Compared to the 2022-23 Emergency Regulation*.

Section 875, subdivision (f)(1)(G) defines coordinating entities as those with the expertise and accountability mechanism to serve such a role and includes requirements to avoid conflicts of interest and require reporting to the State Water Board.

1.6.3.2 Proposed Emergency Regulation Section 875.1

Section 875.1 provides an exception to curtailment in order of priority for non-consumptive diversions. Because such uses do not decrease downstream flows, curtailing such diversions would not help achieve minimum flows or provide additional water for senior rights. In order to provide sufficient information on the diversions to demonstrate that they are truly non-consumptive and can continue without harming other diverters of equal or more senior priority, diverters must provide the Deputy Director with evidence that the diversion and use would not decrease downstream flows. The regulation specifically identifies certain types of non-consumptive uses to provide clarity for diverters who may qualify.

1.6.3.3 Proposed Emergency Regulation Section 875.2

Section 875.2 provides that diversions for minimum human health and safety needs may be authorized to continue after receipt of a curtailment order. This provision recognizes that certain water diversions provide directly for individual human health needs, such as those typically provided through indoor domestic water use. It also recognizes that water plays a more indirect, but still vital, role in providing for human health and safety, such as uses for fire protection and recovery, air quality protection, and electrical grid reliability. When providing water for any of these purposes is not feasible with an alternate supply, and when the water is not being used for non-health and safety needs, continued use under a water right that has received a curtailment order is permitted. This is a narrow exception to the order of priority that protects human health and safety and furthers the human right to water expressed in Water Code section 106.3 and adopted as a core value in State Water Board Resolution No. 2016-0010.

The section includes the process for certification of up to 55 gallons per person per day of human health and safety water use, and also provides for a petition process for health and human safety uses requiring more than 55 gallons per person per day or that

cannot be measured in gallons per person per day. The section allows for a governmental or non-profit organization to submit the necessary certifications or petitions in certain circumstances.

1.6.3.4 Proposed Emergency Regulation Section 875.3

Section 875.3 allows for limited diversions to occur for minimal livestock watering, after receipt of a curtailment order. This limited exception to the order of priority is established in light of several factors: the limited amount of water required for livestock watering; the inability of livestock to withstand long periods without drinking water; state law requirements regarding humane treatment of animals; and the important role that livestock – particularly cow-calf operations – play in the economy of the Scott and Shasta Valleys specifically and the larger Klamath region as a whole. Necessary minimum diversions that meet the reasonable livestock-watering amounts described in California Code of Regulations, title 23, section 697, may continue under self-certification to the Deputy Director.

In recognition of livestock's increased water needs during heat waves, limited diversions may be increased up to twice the amount in section 697 to support minimum livestock water needs. The trigger for the use of an such a change to exceedance of 90 degrees is based on the increased water needs of livestock at temperatures above 90 degrees (Stull et al., 2012) (Meehan et al., 2021). To avoid barriers to providing sufficient water to livestock, there is no specific certification process for these additional diversions.

The purpose of setting reasonable livestock watering amounts is not to limit the amount of water that livestock drink, but to require that water diverted is delivered and used efficiently, and that an allowance for continued diversion when others are curtailed is limited. For situations in which livestock require more water than the amounts described in section 697, the current regulation allows for diverters to file a petition supporting the increased need. A proposed minor amendment to Section 875, subdivision (d) allows for the Deputy Director to approve a petition for efficient conveyance systems with minimal amounts of seepage.

The Deputy Director may deny certificates or petitions that fail to demonstrate that they meet the requirements of certification or the requirements for increased water use.

1.6.3.5 Proposed Emergency Regulation Section 875.5

Section 875.5 subdivisions (a) and (b) set forth categories of water right holders in order of priority for curtailments in the Scott and Shasta watersheds. Curtailment orders, as required to meet drought emergency minimum fisheries flows, would be issued in groupings, according to water right priority, from lowest to highest priority, including groundwater.

For the Scott River, the priority groupings are based primarily on those set forth in the Scott River Adjudication (Siskiyou County Superior Court, 1980). The Scott Adjudication itself incorporates the French Creek and Shackleford Adjudications

(Siskiyou County Superior Court, 1950, 1958), placing their priorities along those of other tributaries to the Scott River. Most water rights in the Scott River Adjudication are placed into five separate schedules. Water rights within Schedule A, B, C, and D water rights are considered independent of water rights in other schedules, with the exception of “surplus class rights.” Water rights in Schedule E, on the other hand, are integrated (Siskiyou County Superior Court, 1980).

In order to meet the drought emergency minimum flows at the downstream end of the Scott River, all the water right schedules must be integrated because all users in the system are required to contribute to the drought emergency minimum flows. In determining how to integrate these schedules, the State Water Board reviewed files from the Scott Adjudication proceedings. A State Water Board staff memorandum, “Principles for the Scott Adjudication” assessed the evidence presented in light of water rights law, and set forth several principles relevant here. The memorandum describes that (1) tributary rights are superior to rights on the mainstem, due to prescription; (2) the priority of the five mainstem schedules decreases from upstream to downstream reaches, due to prescription and (3) interconnected groundwater rights are superior to all surface water rights, due to reasonableness (SWRCB, 1976, ¶s 1, 4, 5). This memo is the best available interpretive tool for integrating the various schedules in the adjudication, and the Board adopts its principles for the limited purpose of establishing the priorities in section 875.5 (a) (1) (A) for enabling implementation of drought emergency minimum fisheries flows. This interpretation does not limit the State Water Board in future proceedings, such as any adoption and implementation of long-term flow requirements or if the Scott River Adjudication is reopened and referred to the Board for additional recommendations.

Applying the general water law principles of appropriative and overlying use, section 875.5 also recognizes the junior status of appropriative surface water and groundwater rights developed after the Scott River Adjudication, and for overlying groundwater rights developed outside the adjudicated zone or after completion of the Scott River Adjudication (Siskiyou County Superior Court, 1980).

In the Shasta River watershed, curtailment orders would be issued first for appropriative diversions initiated after the Shasta Adjudication (inclusive of surface water and groundwater appropriations), then for post-1914 and pre-1914 appropriative water rights in accordance with the priority set forth in the Shasta Adjudication or based on appropriative groundwater use date, then last for riparian and overlying groundwater diversions (Siskiyou County Superior Court, 1932).

Section 875.5 subdivision (c) clarifies that de minimis groundwater users are a group that may be excluded from curtailment. There are numerous small groundwater diversions in the Scott River and Shasta River watersheds, that are primarily used for domestic uses, firefighting ponds, and other uses closely related to human health and safety and minimum livestock watering needs. The Deputy Director may determine not to curtail such diversions of less than two acre-feet per annum in light of their de minimis impact on flows and the considerable effort required on the part of diverters and

of State Water Board staff to issue and respond to curtailment orders, and to file, review, and act on appropriate minimum use petitions.

1.6.3.6 Proposed Emergency Regulation Section 875.6

Section 875.6 establishes the reporting requirements for water users or water right holders that are issued a curtailment order. This provision requires water users or water rights holders to provide information that will allow the State Water Board to understand who has curtailed water use and who continues to use water under an exception provided for in the regulation or under a different water right. This information will help the State Water Board prioritize its efforts to oversee implementation of the regulation and better understand where and how much water is being used outside of water rights priority. This includes minimum water needs allowed for in the regulation, including minimum amounts of water for human health and safety and livestock. Subdivision (a) requires that all water users or water right holders who are issued a curtailment order are required, within seven (7) calendar days, to submit a certification of the actions they are taking in response to the curtailment order.

Subdivision (b) describes that water users and water right holders who are issued a curtailment order and continue to divert out of order of priority established in section 875.5, as authorized in sections 875.2, 878.1, or 875.3, must submit information to the State Water Board on a schedule established by the Deputy Director as a condition of certification or petition approval. Examples of information that may be required include but are not limited to: water right information, well information, how the diverter complies with any conditions of continued diversion, planned conservation and efficiency efforts, efforts to obtain alternate water sources, diversion amounts and other related information. Subdivision (c) provides the Deputy Director with authority to request additional information that is reasonably necessary to assess compliance. Any person receiving an order under subdivision (c) must provide the requested information within the time specified by the Deputy Director, which shall not be less than five (5) days. This provides recipients with a minimum timeframe for compliance but allows for additional time to provide information that is less time-sensitive or more difficult to provide.

1.6.3.7 Proposed Emergency Regulation Section 875.7

Subdivision (a) of Section 875.7 defines inefficient livestock watering as the diversion of more than 10 times the amount of water the livestock need to drink, with reference to the reasonable water quantities set forth in California Code of Regulations, Article 5, section 697. Subdivision (b) of Section 875.7 broadly prohibits inefficient livestock watering during September through March, unless certain conditions listed in subdivision (b)(1) through (b)(6) are met. Absent these conditions, the competing water needs for fisheries and the availability of alternatives make this inefficient method of diversion generally unreasonable. September to March is a critical period when fall-run Chinook and coho salmon must migrate from the mainstem Klamath River into the Scott and Shasta River watersheds to find safe places to spawn and rear. Most of this period

coincides with reduced irrigation requirements, but flow remains a limiting factor in dry years, and is anticipated to continue be so in this ongoing drought emergency.

Subdivision (b)(1) through (b)(6) of Section 875.7 describe the conditions under which inefficient diversion for livestock are not generally barred in the September through March period. First, drought emergency minimum flows must be met without any active curtailment orders in the relevant watershed. Second, the diversions may not occur in the fall until there has been sufficient flow to stimulate fall-run Chinook salmon migration. Third, for diversions that occur after November 1, a similar flow sufficient to stimulate coho salmon migration, including in an applicable tributary, must occur. CDFW makes the determinations for the second and third requirements. Fourth, for tributary diversions, the relevant tributary must be connected to the mainstem, and remain so. Requirement four does not apply in Moffett Creek in the Scott River Watershed, as this creek does not generally maintain connectivity except in the wettest conditions. Fifth and Sixth, any diversion must bypass 90% of flow (or 80% of flow in defined high flow conditions), or bypass greater amounts to avoid disturbing redds. As described in Subdivision (d) of Section 875.7, requirements four through six do not apply upstream of Dwinell Dam in the Shasta watershed.

Subdivision (c) of Section 875.7 provides that diverters must e-mail notification to the Board of the intent to divert under the conditions in subdivision (b), including a description of the anticipated point and amount of diversion and how compliance with the conditions in subdivision (b) will occur. It further requires diverters to maintain records of those diversions and provide them to the Board upon request.

As described in the *Supporting Technical and Cost Information Related to Limitation on Inefficient Livestock Watering* section, there are several alternatives to inefficient livestock watering that are commonly employed in the Scott and Shasta watersheds, including use of groundwater and pipes, as well as the potential to haul water on a temporary basis. Additionally, funding to install such systems has been provided for many years, and likely remains available for the upcoming year. Cessation or significant reduction of highly inefficient livestock watering has the potential to significantly address the anticipated shortfalls in the fall migration season of this drought emergency, including on both a tributary and watershed-wide basis. As such, during September through March, use of surface water for extremely inefficient livestock watering is not reasonable in light of available alternatives and fishery needs.

Subdivision (e) of Section 875.7 clarifies that otherwise-prohibited inefficient livestock diversions may continue if approved under a local cooperative solution, and provides specific findings for the basis of a local cooperative solution that focuses on connectivity, migration, rearing and redd dewatering.

Subdivision (f) of Section 875.7 provides for the Deputy Director to suspend the prohibition for a particular user in the event of failure of an alternative watering system.

1.6.3.8 Proposed Emergency Regulation Section 875.8

Section 875.8 establishes the methodology and requirements for information orders. In order to more effectively implement curtailments through the water rights priority system in the Scott and Shasta watersheds under current drought conditions, the State Water Board needs access to better and more current information regarding water rights, water use, water needs, and procedures that allow the State Water Board to obtain and use the best available information quickly. The State Water Board needs an enforceable mechanism to collect information related to surface water and groundwater diversions and uses of water in the Scott and Shasta watersheds to inform water demand estimates and the curtailment process. Additional information is also needed regarding the basis of right and priority date for some water rights and claims to inform curtailment decisions.

In more detail, subdivision (a) of the proposed section establishes that the Deputy Director may issue information orders to some or all landowners, diverters, or other water right holders in the Scott and Shasta watersheds, requiring them to provide additional information related to water use. The subdivision describes that information orders will be prioritized by size or impact, and efforts will be taken to reduce duplicative collection of information. The subdivision establishes the types of information that may be requested. Subdivision (b) establishes that any party receiving an information order will have at least five (5) days to respond, and requests for additional time will be considered. Subdivision (c) defines new diversions for purposes of their applicability to the proposed section.

1.6.3.9 Proposed Emergency Regulation Section 875.9

Section 875.9 describes the penalties for failure to comply with a curtailment order issued under this regulation. It is important that the public understand that the State Water Board has enforcement authority to ensure the Emergency Regulation is implemented in accordance with its provisions and can take appropriate enforcement actions for failure to comply with the regulation. It is also important for diverters with multiple rights to understand how to comply with receipt of multiple curtailment orders.

Subdivision (a) addresses a situation in which a diverter receives more than one curtailment order and is subject to more than one set of requirements either under separate curtailment orders or under multiple conditions for approval of petitions for continued diversion. This subdivision clarifies that the diverter is to comply with the most stringent requirements, to the extent of any conflict. Subdivision (b) describes the enforcement mechanisms and associated potential penalties. Subdivision (c) clarifies that subdivision (b) is explanatory, rather than limiting.

1.6.4 Watershed Descriptions

1.6.4.1 Scott River Watershed Description

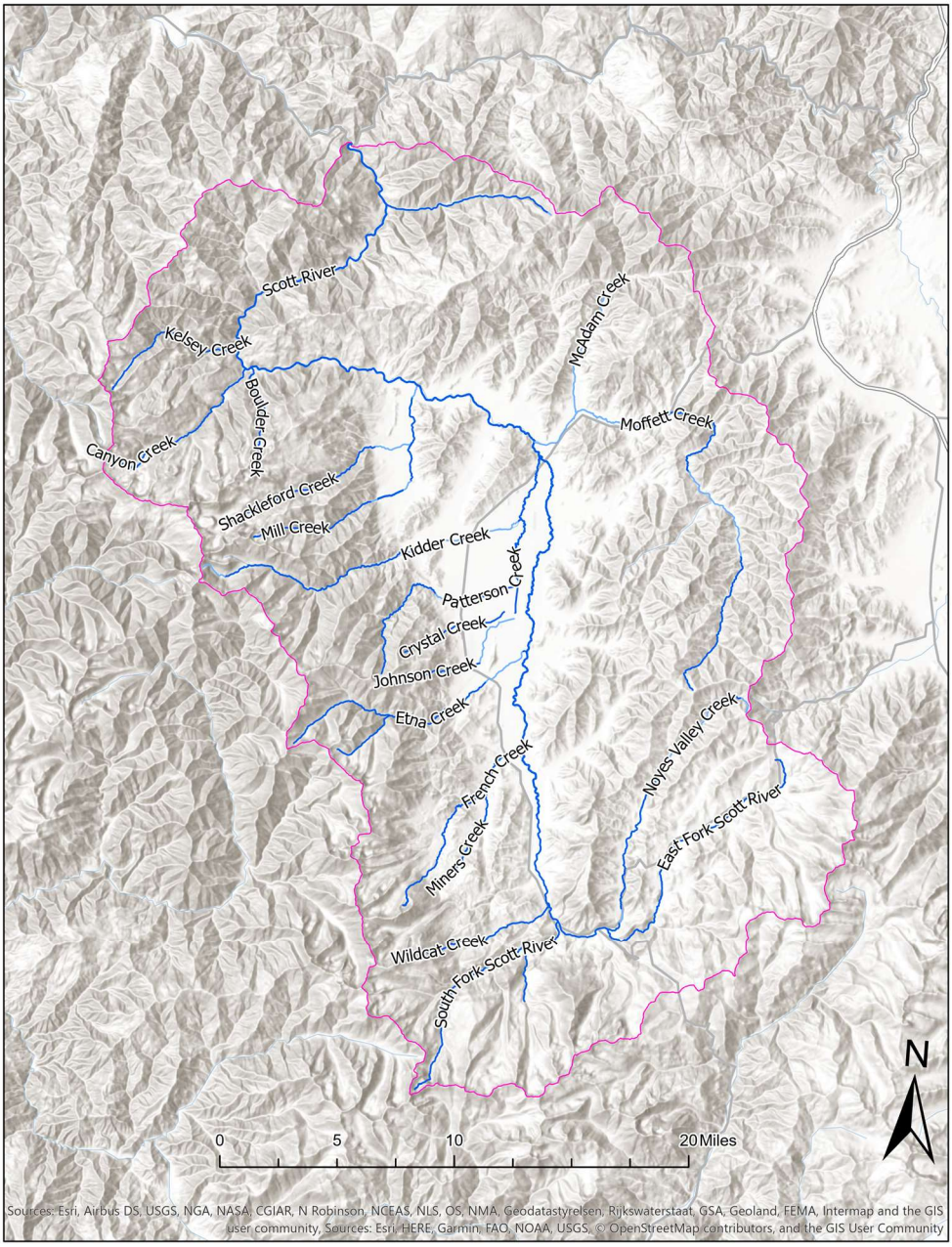


Figure 17. Scott River watershed.

The Scott River watershed (Figure 17) is approximately 813 square miles (NCRWQCB, 2023). The mainstem Scott River can be divided into two major reaches. The Canyon Reach stretches from the confluence of the Scott River and the Klamath River at RM 0 to RM 21 and flows mostly on bedrock, confined in a steep-sided, rocky canyon with a

gradient that ranges from 45-55 feet/mile (ft/mi). The Valley Reach stretches from RM 21 to about RM 50 and flows through the relatively flat, open, agricultural valley floor of Scott Valley with a river gradient ranging from 4-8 ft/mi. The upstream end of the Valley Reach is dominated by remnant tailings from past placer gold mining operations, where flow seasonally disconnects in most years. Upstream of the Valley Reach, the East Fork of the Scott River and the South Fork of the Scott River flow from the Scott Mountains and join to form the mainstem Scott River just upstream of the tailings, near the town of Callahan. Elevations in the Scott Valley range from 8,532 feet above mean sea level (msl) at China Mountain at the south end of the Scott Valley down to 2,500 to 3,000 feet above msl at the floor of the Scott Valley. Downstream of Scott Valley, the Scott River joins the Klamath River at 1,600 feet above msl (NCRWQCB, 2005).

Scott Valley hydrology depends largely on precipitation stored as snow at higher elevations in the mountains to the south and west of Scott Valley, where annual total precipitation, including rain fall and snow water equivalent depth, ranges from 60-80 inches (NCRWQCB, 2005). Streams leaving the mountains from the west enter the valley and recharge the high-capacity aquifer of sand and gravel that underlies the valley at a thickness of up to 400 feet. These west-side tributaries (including Shackleford Creek, Kidder Creek, Patterson Creek, French Creek, Miner's Creek, Crystal Creek, Sugar Creek), as well as the East Fork Scott River and the South Fork Scott River provide critical cold-water habitat that facilitates rearing of juvenile salmonids. The Scott River populations of SONCC Coho and fall-run Chinook Salmon in the Klamath Basin rely on spawning grounds in the Scott River and its tributaries – including French Creek, Miner's Creek, Shackleford Creek, Crystal Creek, Sugar Creek, the South Fork Scott River, and the East Fork Scott River (NMFS, 2014). In particular, Scott River population of coho salmon is considered a core, functionally independent population by NMFS and is important to the overall survival of the species (NMFS, 2014). Functionally independent populations are those with a high likelihood to persist in isolation over a 100-year time scale and are not substantially altered by exchanges of individuals with other populations.

Predominant land use in the Scott Valley includes cow-calf production, alfalfa production, grain production, timber, and forest resources (NCRWQCB, 2005). Surface water is diverted from the Scott River and its tributaries primarily to support agricultural and municipal uses. Groundwater is extracted primarily for domestic and agricultural uses. Surface water rights in the Scott River watershed were adjudicated in three separate adjudications: Shackleford Creek Adjudication (Siskiyou County Superior Court, 1950), French Creek Adjudication (Siskiyou County Superior Court, 1958), and the Scott River Adjudication (Siskiyou County Superior Court, 1980). In addition to surface water rights, the Scott River Adjudication also included some groundwater rights that are within a geographic boundary defined in the Scott River Adjudication. Water rights in the Scott River Adjudication are divided into 48 sub-schedules, and the Scott River Adjudication lists the relative priorities of the surface water rights in each schedule. Currently, only water rights in French Creek and Wildcat Creek are under Watermaster service. Oro Fino Creek, Sniktaw Creek, and Shackleford Creek were previously under Watermaster service but are no longer watermastered. The rest of the

Scott River watershed (including the mainstem Scott River) has never been watermastered. Thirty-seven percent of the watershed is owned by federal resource management agencies (NMFS, 2014).

Surface water and groundwater diversion can result in insufficient flows for adult salmon migration to suitable spawning habitat, particularly during drought years (NMFS, 2014). Insufficient flows can also affect the ability for salmon juveniles to emerge and redistribute into refugial streams that can support their development. Enhancing instream flows and limiting diversions are both identified by NMFS in its recovery strategy as being among the highest priority recovery actions for the Scott River watershed (NMFS, 2014). Various other actions are described in the recovery plan to support increases in instream flow, including but not limited to securing additional Water Code section 1707 instream flow dedications, improving irrigation efficiency, lining and piping ditches, increasing water-mastering service to better manage surface water diversion, studying instream flow needs and establishing instream flow targets, and developing and implementing groundwater recharge plans focused on increasing summer base flow and connectivity. Adequate streamflow during salmon migration periods will support the survival of adult coho and fall-run Chinook Salmon by increasing critical passage riffle depth and reducing water temperatures in the Scott River.

1.6.4.1.1 Scott River Temperature and Sediment TMDLs Summary

The Scott River watershed has been listed as impaired with relation to sediment since 1992, and impaired with relation to temperature since 1998, pursuant to Section 303(d) of the Clean Water Act (NCRWQCB, 2005). On December 7, 2005, the North Coast Regional Water Board adopted the *Action Plan for the Scott River Sediment and Temperature Total Maximum Daily Loads* (TMDLs), which were subsequently approved by the United States Environmental Protection Agency (USEPA) on September 8, 2006 (NCRWQCB, 2018). The TMDLs identify the following sensitive beneficial uses impacted by excessive sediment loads and elevated temperatures:

- Cold freshwater habitat;
- Rare, threatened, and endangered species;
- Migration of aquatic organisms; and
- Spawning, reproduction, and/or early development of fish.

In the TMDL for temperature, five factors were identified that have affected or have the potential to affect stream temperatures. These factors include:

1. Stream shade,
2. Stream flow via changes in groundwater accretion,
3. Stream flow via changes in diversion,
4. Channel geometry, and
5. Microclimate.

According to the TMDL, groundwater accretion affects temperature by both directly supplying cold water instream and by changing flow volume and transit time. Extraction

of groundwater can reduce these accretions by lowering the water table relative to stream bed elevation and reducing the amount of surface water gained instream through groundwater-surface water interactions. Similarly, surface diversions of tributary stream flow can lead to adverse temperature conditions that impact beneficial uses when the diverted volume is large relative to total tributary stream flow. Many of these smaller tributaries with surface diversions host high densities of spawning coho and Chinook Salmon (NMFS, 2014). The remaining factors relate to physical, non-flow processes that impact temperature conditions.

1.6.4.1.2 Interconnected Groundwater and Surface Water

In the Scott River watershed, surface water and groundwater are strongly connected. As noted above, closely connected surface and groundwater are managed under the "common source" doctrine. The Scott Valley Groundwater Sustainability Plan (GSP) simplifies the watershed's geology into two major geologic components, alluvial deposits in the valley that comprise the aquifer and the underlying impermeable or semipermeable bedrock. The aquifer is recharged by infiltration from the Scott River and its tributaries, snowmelt, precipitation, and water used for irrigation. Recharge affects the groundwater levels, which determine if sections of the Scott River and its tributaries are gaining or losing streams (Siskiyou County, 2022a). The Scott Valley GSP (Siskiyou County, 2022a) acknowledges the watershed's interconnectedness of surface water and groundwater, stating:

> *because the water table in many parts of Scott Valley can be relatively shallow, the Scott River surface water network contains many miles of stream channel that are connected to groundwater. The direction of flow exchange (i.e., gaining vs losing stream reaches) varies over both space and time, and simulated rates of stream leakage or groundwater accretion to tributaries and the Scott River can vary by orders of magnitude …*
>
> *The Scott River and its major tributaries…are therefore all considered part of a single interconnected surface water system in the basin. The interconnected surface water system supports significant fish habitat and riparian vegetation.*

The interconnectedness of surface water and groundwater in the Scott River watershed has also been legally recognized. For example, Water Code section 2500.5, subdivision (b), which defines groundwater as part of the Scott River stream system:

> *The Legislature finds and declares that by reasons of the geology and hydrology of the Scott River, it is necessary to include interconnected ground waters in any determination of the rights to the water of the Scott River as a foundation for a fair and effective judgment of such rights, and that it is necessary that the provisions of this section apply to the Scott River.*

Other reports that indicate interconnectedness of surface water and groundwater in the Scott watershed include but are not limited to: Foglia et al. (2013a), Foglia et al. (2013b), Foglia et al. (2018), Harter (2021a), Kouba (2021), and Tolley et al. (2019).

1.6.4.2 Shasta River Watershed Description

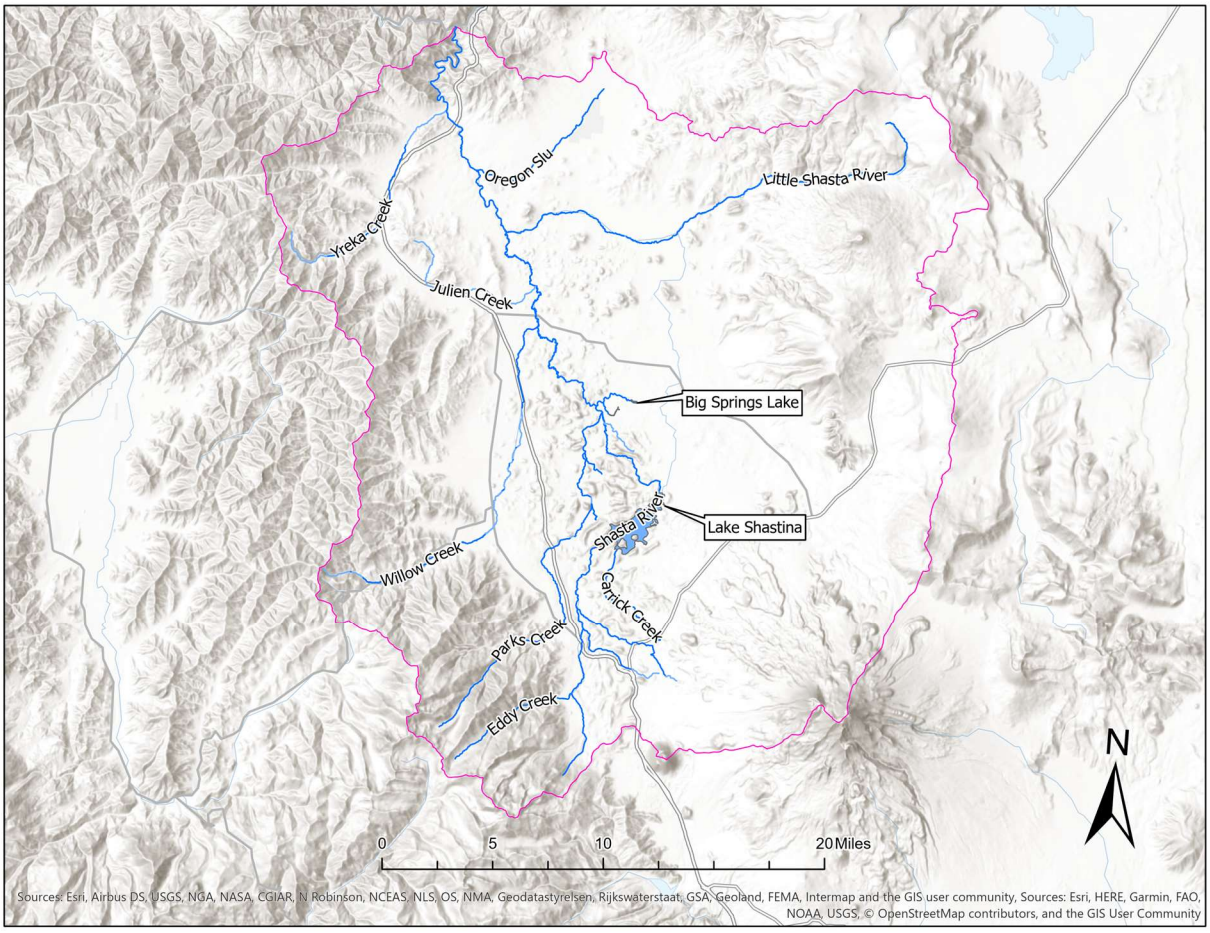


Figure 18. Shasta River Watershed.

The Shasta River watershed (Figure 18) spans approximately 795 square miles. The Shasta River begins on the north slope of Mt. Eddy in the southwestern part of the watershed and flows mostly northward until meeting the Klamath River. The Shasta River has a canyon reach that ends at the confluence of the Shasta River and Klamath River. The canyon reach extends seven miles upstream from the confluence, with an average gradient around 52 ft/mi (NCRWQCB, 2023). Legacy impacts from historic mining operations in the canyon reach continue to negatively impact habitat quality in the canyon reach (NMFS, 2014). Upstream of the canyon reach, the Shasta River flows northward for 33 miles through the low-gradient Shasta Valley, a groundwater basin comprised of alluvial and volcanic aquifers (NCRWQCB, 2006; Siskiyou County, 2022b). At RM 40.6, Dwinnell Dam impounds the Shasta River, forming Lake Shastina. The lower Shasta River is an approximately 40-mile reach of the river that begins below Dwinnell Dam and ends at the confluence with the Klamath River. Major tributaries to the Shasta River are Parks Creek (RM 35), Big Springs Creek (RM 34), Willow Creek

(RM 26), Little Shasta River (RM 16), and Yreka Creek (RM 8) (USFWS, 2013; SWRCB, 2018). The Shasta Valley contains hillocks that were deposited during a massive avalanche and debris flow over 300,000 years ago (NCRWQCB, 2006). Mountains surround the Shasta Valley on four sides, with the Klamath Range on the west, the Siskiyou Range to the north, the Cascade Range to the east, and Mt. Shasta and Mt. Eddy to the south. Elevations in the Shasta River watershed vary from 14,200 feet above msl at the summit of Mt. Shasta to 2,020 feet above msl at the confluence of the Shasta River with the Klamath River (NCRWQCB, 2006).

The Shasta River watershed is predominantly a low rainfall, high desert environment characterized by cool winters and hot dry summers (SWRCB, 2018). The Shasta Valley is in the rain shadow of the Klamath Mountains and receives little precipitation, about 12-18 inches per year (NMFS, 2014). Shasta Valley hydrology depends on surface flow from precipitation-driven streams in the southwest, south, and east areas of the watershed and significant cold-water springs in the central Shasta Valley (NCRWQCB, 2006; SWRCB, 2018). Annual mean precipitation in the watershed ranges widely from 8 to 125 inches, though average precipitation in the mountains can range from 45 or 85 inches to 125 inches (NCRWQCB, 2006; PRISM Climate Group, 2023; SWRCB, 2018). Precipitation falling below 5,000 feet is usually rain, while snow usually accumulates above this elevation. Most precipitation falls between October and March, providing rainfall runoff or snowmelt to streams in the western and southwestern headwater tributaries to the Shasta River. Due to the watershed's volcanic geology, precipitation that falls in the watershed's volcanic uplands infiltrates and enters the Shasta Valley's volcanic aquifers (SWRCB, 2018). In the southern and eastern watershed, groundwater springs emanating from volcanic aquifers provide continuous discharge to the Shasta River and its tributaries (NMFS, 2014).

Development of water resources in the Shasta River watershed has led to changes in the hydrologic behavior of the river (Jeffres et al., 2010), and to reductions in the quantity and quality of cold-water habitats available to rearing coho salmon throughout the Shasta River watershed (Willis et al., 2013; Stenhouse et al., 2012; SWRCB, 2018). In its recovery plan for coho salmon, NMFS ranks impaired water quality and altered hydrologic function as 'very high' key limiting stresses to juvenile coho salmon and ranks agricultural practices and dams/diversions as 'very high' key limiting threats (NMFS, 2014; SWRCB, 2018). Excess tailwater from flood irrigation can discharge hot water into the Shasta River and tributaries (NCRWQCB, 2006; Aqua Terra Consulting, 2011; SWRCB, 2018).

Surface water diversions in the Shasta watershed are subject to a statutory adjudication that resulted in a judgment and decree approved by the Superior Court of the State of California in Siskiyou County in 1932 (*In the Matter of the Determination of the Relative Rights Based on Prior Appropriation, of the Various Claimants to the Use of the Water of the Shasta River and its Tributaries in Siskiyou County, California*, Case No. 7035) (Siskiyou County Superior Court, 1932). The court recognized that the water supply of the stream system is inadequate for all agricultural needs throughout the irrigation system. When the watershed was adjudicated, there were approximately 40,000 acres

of irrigated agriculture. Today, there are over 50,000 acres of irrigated agriculture, presumably from additional diversions under riparian rights and groundwater pumping, which are not subject to the Shasta River Adjudication. The Shasta River Adjudication contains no requirements for the protection of instream beneficial uses (Siskiyou County Superior Court, 1932; SWRCB, 2018).

The Shasta River watershed includes numerous dams, wells, and diversions from the Shasta River and its major tributaries. Water use in the watershed consists principally of agricultural supply for crop irrigation and livestock watering, but municipal, industrial, fish and wildlife also play substantial roles in the overall water resources development and use (Willis 2013; SWRCB, 2018). Agricultural water demands are met with direct diversion of surface water from the Shasta River and its tributaries, diversion of surface water stored in Lake Shastina and other reservoirs, pumping from groundwater, and re-use of applied irrigation water (Willis et al., 2013). Four irrigation districts make up the primary water rights holders in the watershed, with approximate irrigation season diversions totaling 227 cfs (USFWS, 2013; SWRCB, 2018). Primary municipal water users in the watershed include the communities of Yreka, Montague, and Weed, along with several small hamlets with populations of less than 100 (SWRCB, 2018).

The Shasta Valley is a 217,980-acre groundwater basin comprised of alluvial deposits and volcanic rock aquifers. The Shasta Valley's aquifers are the watershed's primary source of groundwater. The volcanic aquifers are comprised of lava flows from the High Cascades and Western Cascades volcanic series. The lava flows exhibit an internal complexity originating from how the lava flows erupted, flowed, and solidified. Some groundwater wells tap productive lava tubes, underground voids that once insulated and channelized flowing lava and now feature flowing water. Other groundwater wells tap pockets of water and sediment that fill cracks or crevices in the lava rock (Mack, 1960; Siskiyou County, 2022b). In the southeastern Shasta Valley, near Big Springs, groundwater pumping from the Pluto's Cave basalt, a volcanic formation in the High Cascades volcanic series, produces water for irrigation, stock, and domestic uses. In the eastern Shasta Valley, groundwater pumping from lava flows of the Western Cascades volcanic series, supply water for irrigation, livestock, and domestic uses (Mack, 1960; Siskiyou County, 2022b).

In the southern and central parts of the Shasta Valley, numerous productive groundwater springs emerge from the highly permeable basalt flows of the High Cascades volcanic series, especially the Pluto's Cave basalt. In the spring, once snowmelt and rainfall precipitation end for the season, groundwater springs become the primary source of baseflow to the Shasta River and its tributaries for the remainder of the spring, summer, and fall (Nichols, 2008; Nichols et al., 2010; Jeffres et al., 2008). During dry seasons, groundwater springs in the Big Springs Complex provide an estimated 95 percent of baseflow to the lower Shasta River via the Big Springs Creek tributary (Nichols et al., 2010). Jeffres et al. (2009) reported that during the irrigation season, irrigation diversions and groundwater pumping reduce baseflows in Big Springs Creek by 35 percent. Following the end of the irrigation season, baseflows in Big Springs Creek rapidly rebound (Nichols et al., 2010). Another study found that

during April 1 to April 12, 2008, streamflow at the Shasta River gage near Montague (USGS gage no. 1151700) decreased by approximately 70 percent, from 143 cfs to 43 cfs. The authors concluded that the onset of surface water diversions and groundwater pumping for irrigation caused the swift and significant reduction of groundwater-fed baseflows throughout the Shasta River basin (Nichols et al., 2010).

1.6.4.2.1 Shasta River Temperature TMDL Summary

Elevated water temperatures and low dissolved oxygen levels in the Shasta River watershed have impaired designated beneficial uses of water and the non-attainment of water quality objectives, primarily associated with cold-water fish. Impaired beneficial uses include the migration, spawning, and early development of cold-water fish such as coho salmon, coho salmon and Chinook Salmon (*O. tshawytscha*). The Shasta River watershed was listed as impaired with relation to organic enrichment and low dissolved oxygen in 1992 and temperature in 1994, pursuant to Section 303(d) of the Clean Water Act (NCRWQCB, 2006). In 2005, the North Coast Regional Water Board adopted the *Action Plan for the Shasta River Dissolved Oxygen and Temperature TMDL*, which was subsequently approved by USEPA in 2006. Water quality modeling conducted during development of the Shasta River TMDL found depletion of streamflow to be a primary cause of high summer water temperatures in the Shasta River and its tributaries (NCRWQCB, 2006).

NCRWQCB (2006) relied on the Tennessee Valley Authority's River Modeling System (RMS) as its primary analytical tool to develop the temperature TMDL. The RMS depicts inflows from Big Springs Creek, Parks Creek, and Yreka Creek to the Shasta River as discrete inputs. The compliance scenario modeled by the RMS relied on modifying the boundary conditions associated with inputs from Parks Creek and Big Springs Creek to account for reductions in stream temperature that could occur based on increased shade. In addition to shade, the RMS was used to analyze six different flow scenarios by systematically increasing flow by 50 percent at six locations in the Shasta River: Dwinnell Dam, downstream of Big Springs Creek, Grenada Irrigation District, Highway A12, Montague-Grenada Road, and Anderson Grade Road. The temperature assigned to the increased flow was equal to the baseline temperatures at the corresponding river location. These flow increases were modeled using observed atmospheric conditions between August 29, 2002, and September 4, 2002. Compliance points were set at three locations in the Shasta River where juvenile salmon rearing was known to occur: Highway A-12 (RM 24.1), Montague-Grenada Road (RM 15.5), and an area known as Salmon Heaven in the Shasta River Canyon (RM 5.6). The modelling effort resulted in the following conclusions:

- Maximum stream temperatures are reduced from baseline condition at all locations downstream of where the flow increases were applied for all six modelled scenarios.
- The largest reduction in maximum stream temperature is associated with a 50 percent flow increase downstream of the Big Springs Creek confluence.

- The temperature of water (e.g. warm tailwater compared to cold spring water) associated with the 50 percent flow increase greatly influences the stream temperature results.
- The Big Springs Creek 50 percent flow increase simulation resulted in maximum stream temperature reductions of approximately 1°C to 2°C, with the largest reduction of 2.2°C at Yreka Agar Road (RM 10.9). At RM 5.6, an important location for summer rearing, the maximum stream temperature is reduced by approximately 1.8°C from baseline.
- The Big Springs Creek 50 percent flow increase simulation resulted in minimum stream temperature increases of approximately 0.2°C to 2°C

The 50 percent flow increase downstream of the Big Springs Creek confluence is attributed to a 45 cfs increase in flow from the Big Springs Creek Complex, resulting in a total flow of 112 cfs from Big Springs Creek. This total flow is within estimates of pre-diversion flow from the Big Springs complex. As such, the temperature TMDL recommends an additional 45 cfs of cool water to improve water temperature conditions (NCRWQCB, 2006; SWRCB, 2018). In total, the water quality compliance scenario in the temperature TMDL includes the following:

- Increased riparian shade according to modeled site potential riparian conditions.
- Modified temperature regime of irrigation tailwater return flows such that the return flows do not cause heating of the receiving waters.
- Big Springs Creek temperatures reduced by 4°C from baseline.
- Parks Creek temperatures reduced by 2°C from baseline.
- 50 percent increase in Shasta River flows downstream of the Big Springs Creek confluence, which is an increase of 45 cfs of cold water and provides for a total flow of approximately 112 cfs from Big Springs Creek.

1.6.4.2.2 Interconnected Groundwater and Surface Water

In the Shasta River watershed, surface water and groundwater are strongly connected. As noted above, closely connected surface and groundwater are managed under the “common source” doctrine.

The Shasta Valley aquifer is a hydro-geologically complex system of alluvial and volcanic formations. Volcanic aquifer formations include lava tubes, porous volcanic deposits, and sediment-filled pockets within the volcanic deposits. The juxtaposition of these differing aquifer formations creates preferential pathways for groundwater discharge. In Shasta Valley, the Pluto Cave Basalt formation occupies the eastern part of the Shasta Valley from Dwinnell reservoir to Rabbit Hill (Montague Irrigation District, 1963). Springs occur where groundwater discharges to the surface rather than into less-conductive aquifer materials or where head levels are close to or exceed the ground level (Siskiyou County, 2022b).

In the southern and central parts of the Shasta Valley, numerous productive groundwater springs emerge from the highly permeable basalt flows of the High Cascades volcanic series, especially the Pluto’s Cave basalt. The most notable of these

is Big Springs Complex (Montague Irrigation District, 1963). Multiple studies have shown that in the spring, once snowmelt and rainfall precipitation end for the season, groundwater springs become the primary source of baseflow to the Shasta River and its tributaries for the remainder of the spring, summer, and fall (e.g., Nichols, 2008; Nichols et al., 2010; Jeffres et al., 2008).

The Shasta Valley GSP acknowledges interconnectedness of surface and groundwater in the watershed (Siskiyou County, 2022b), stating:

> *The link between surface water and groundwater is based on historic reports (Mack 1960) as well as continued summer baseflow within the Shasta River. Because the water table in many parts of the basin can be relatively shallow, the Shasta River contains many miles of stream channel that are connected to groundwater. The Shasta River and its major tributaries are all considered part of the [interconnected surface water] system in the Basin…*
>
> *With respect to the functional flows of the Shasta River, depletion of surface water due to groundwater pumping affects the timing of the late spring recess, the amount of summer baseflow, and the onset of the fall flush flow.*

The historic report referred to in the Shasta Valley GSP (Siskiyou County, 2021a) is the USGS Water-Supply Paper 1484 (Mack, 1960). Mack (1960) concluded groundwater discharge in Shasta Valley occurs principally by seepage into streams, including discharge from springs, stating:

> *Little Shasta River and other streams along the east side of Shasta Valley derive most of their flow from springs and seeps issuing from the volcanic rocks of the high Cascades…From about Weed northward the [groundwater level] contours intersect the channels of the major streams, indicating that ground-water discharge supplements the surface-water flow in the Shasta River system…In Little Shasta Valley the water table locally intersects the land surface and ponds and meadows occupy the depressions.*

Mack (1960) estimated groundwater discharge into streams within the from Shasta Valley for WY 1953. Included in these estimates were 70,000 acre-feet discharged into the Shasta River plus 30,000 acre-feet discharged from Big Springs.

Multiple recent analyses based on geologic conceptual interpretation, scientific literature, modeling studies, and data analysis exist on the hydrologic connectivity between groundwater and surface water in the Big Springs area of Shasta Valley (e.g., Bedekar, 2022a; Bedekar, 2022b; Scott, 2022a; Scott, 2022b; Worth, 2022a; Worth, 2022b; Worth 2022c).

Since groundwater is interconnected with surface water, groundwater pumping impacts the quality and quantity of surface water. For example, Scott (2022) demonstrated a strong correlation between the cessation of groundwater pumping in the Big Springs area and water quality at Big Springs Lake, including increase in depth measured at the monitoring station Big Springs West (BSW), decrease in temperature measured at the

monitoring station Big Springs East (BSE), and the decrease in pH reading measured at BSW. Figure 19 shows the Big Springs West (BSW) stage height and the number of Big Springs Irrigation District (BSID) pumps actively pumping. Figure 20 demonstrates a similar correlation between Big Springs Creek flow and BSID pump status.

Other reports that indicate interconnectedness of surface water and groundwater in the Shasta Watershed include but are not limited to Buck (2013), SWRCB (2018), Watercourse Engineering (2007), and Willis et al. (2013).

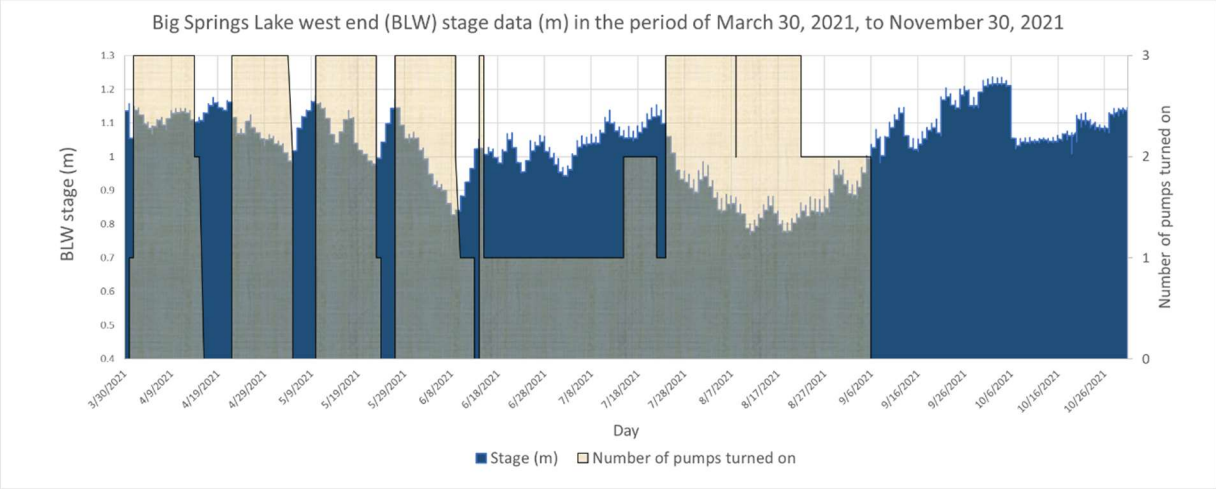


Figure 19. Big Springs Lake west with Big Springs Irrigation District pumping information for 2021. Big Springs Lake west end = BLW. Source: Scott (2022b).

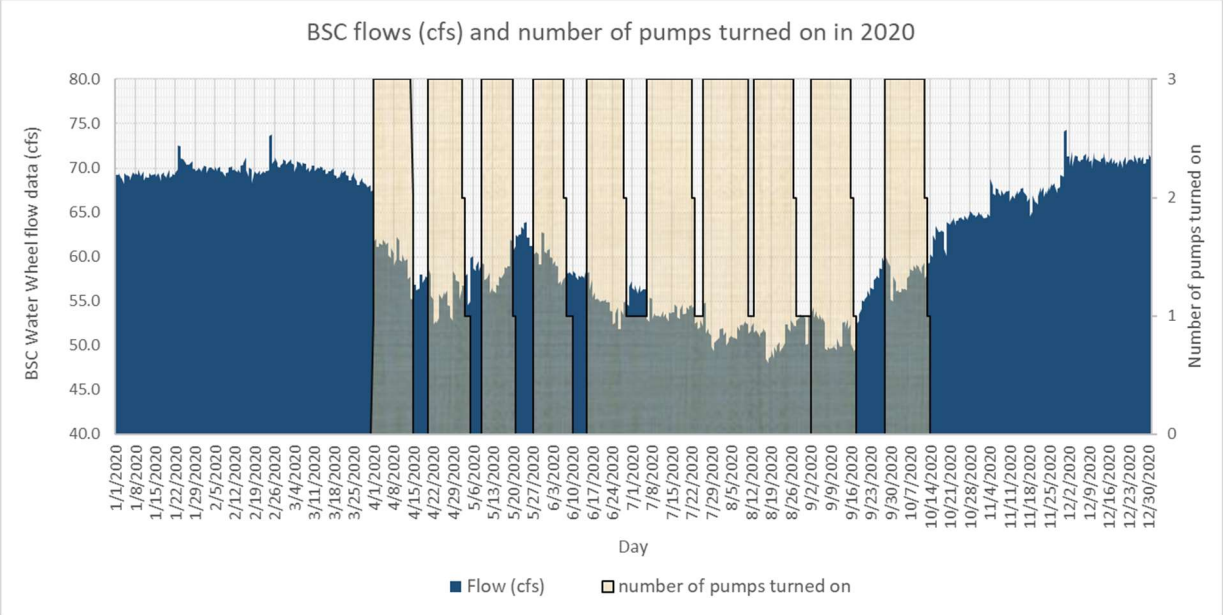


Figure 20: Big Springs Creek flow with Big Springs Irrigation District pumping information for 2020. Big Springs Lake west end = BLW. Source: Worth (2022b).

1.6.5 Supporting Technical and Cost Information Related to Limitation on Inefficient Livestock Watering

What follows is a brief description of livestock watering, ditch losses, and factors that cause ranchers to divert much more water than livestock can drink.

Irrigation generally ceases in the Scott and Shasta watersheds by October, although specific dates vary depending on weather, water source, crop type, water right, and business practices. When irrigation ceases for the growing season, some ranchers continue to divert surface water to provide water for livestock. When the surface water is conveyed using gravity-fed earthen ditches, ranchers divert much more water than their livestock can drink due to seepage, freezing (more water in the ditch helps prevent the water from freezing), and to ensure hydraulic function of the ditch. State Water Board staff estimates that at ranches with the largest livestock diversions, less than one percent of the water diverted is ultimately consumed by livestock, as described below.

In the Scott River and Shasta River watershed, livestock watering is the largest source of surface water demand during the winter months as the irrigation season and practices are not active.

State Water Board staff analyzed the Reports of Water Diversion and Use of the eight largest November 2020 diversions in the Scott River watershed. It is assumed that these November diversions are solely for the purpose of livestock watering, as they occur outside the irrigation season. These eight diversions reported that approximately 758 acre-feet of water was diverted for livestock watering for 3,100 to 4,100 cows. Using a 15 gallon per day per cow estimate[1], cows drank approximately 5.7 acre-feet of the 758 acre-feet of water diverted in November 2020. This equates to 0.75% of the water diverted being consumed by livestock. These diversions occurred when water was not broadly available in the Scott River and when coho salmon were unable to access spawning grounds due to insufficient flow.

State Water Board staff analyzed weekly diversion data received from the major surface water diverters in the Scott River watershed for February 2022 to June 2022. Based on the reported diversions from the major diverters for Winter (January through March) and information received from the Scott River and Shasta River Watermaster about the monthly diversions for French Creek, Wildcat Creek, and Miners Creek (which report to the Watermaster not the Water Board), and considering a margin for not-reported

[1] The 15 gallons per day estimate is the amount of diversion that is considered reasonable for a head of beef cattle per Title 23, Article 5, section 697 of the California Code of Regulations. This is largely consistent with recommended watering amounts by UC Davis School of Veterinary Medicine (Stull et al., 2012) and North Dakota State University Extension livestock and veterinary specialists (Meehan et al., 2021).

diversions, livestock water diversion in the Scott River watershed is estimated to be up to 45 cfs.

Less data is available on livestock watering diversions in the Shasta Watershed because most large diversions in the Shasta River watershed are under Watermaster service. Diversions that are managed by the watermaster report less frequently than diversions outside watermaster jurisdiction. The conveyance systems and livestock watering practices in the Shasta Watershed are similar to the practices in the Scott Watershed, so it is expected that losses due to inefficient livestock watering are similar.

A 1975 Division of Water Rights study measured irrigation ditch losses in 66 different ditches in the Scott Valley. Losses varied from 6 percent to 97 percent (generally smaller ditches had the largest percentage of losses), while the median and mean ditch losses were 52 percent and 50 percent. Figure 21 shows the distribution of these losses (SWRCB, 1974).

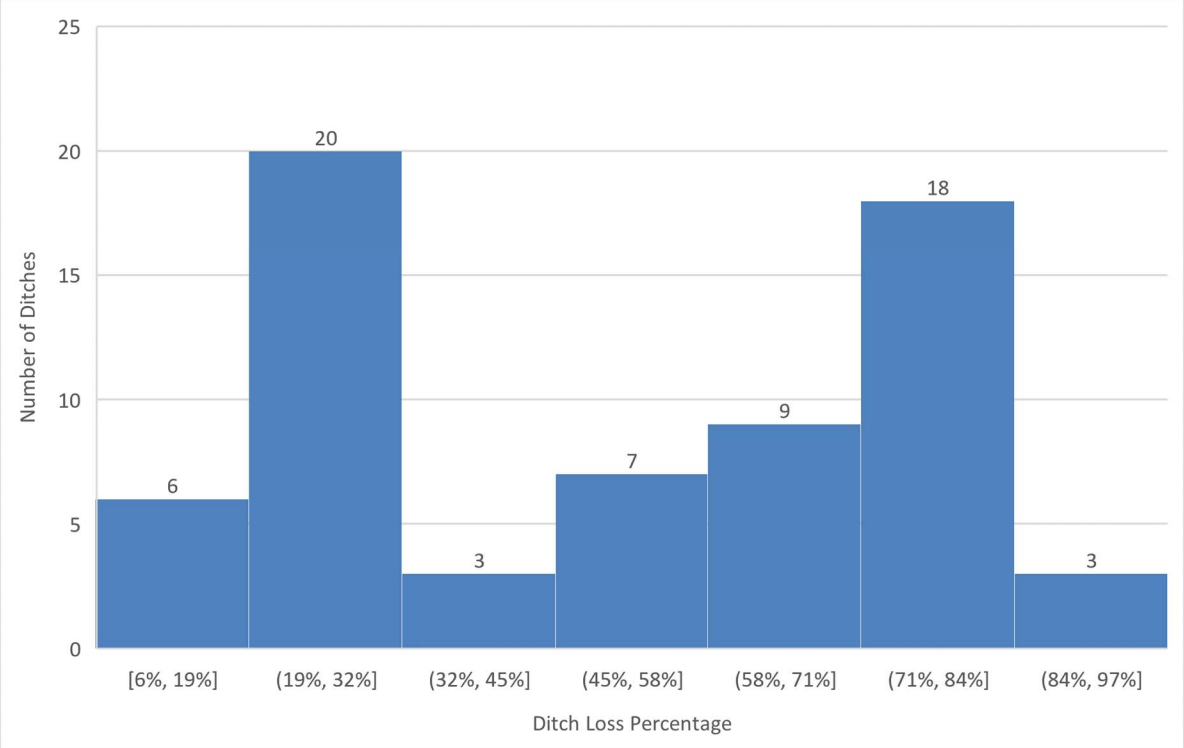


Figure 21. Scott watershed ditch losses.

While ditch losses can be immense, some ranchers choose to divert surface water because it avoids energy costs required to pump the water from a well, the water is always available to the livestock, and flowing water typically does not freeze.

For properties issued curtailments or when the operation of an inefficient ditch is prohibited under the Proposed Emergency Regulation, there are several alternatives available. Permanent troughs can be installed that are connected to small solar powered wells that continuously maintain water levels in the trough. These types of solutions can cost $20,000 to $40,000 (NMFS, 2021b).

For properties that do not have or do not wish to install permanent troughs, aluminum or plastic troughs can be purchased for $400-$600 (Tractor Supply Company, 2021). If a property has a well on site, then the well can be used to source water to fill the troughs. Additional costs may occur due to purchasing conduits to convey water from the well to the troughs or portable tanks that can help transport the water to the troughs. With this type of setup, the rancher would need to check on the troughs at least daily to fill and or ensure that the troughs have water in them and that the water surface is not frozen. When ice forms, the rancher would need to break up the ice or install a heating element. If a property has multiple pastures with cattle on them, each pasture would need access to troughs.

There are a large number of wells in the area, and reliance on groundwater for some water uses is common. For properties that do not have access to wells or cannot divert from surface water in reasonable quantities, water may need to be purchased and

delivered. Water hauling costs are estimated to be $200 per delivery (ABC 30 Action News, 2014) (CNBC, 2015). A delivery could be between 3500-5000 gallons of water (CNBC, 2015). The frequency, number, and duration of deliveries required depends on the number of livestock that must be watered. A property with 100 cattle may require 34 deliveries (assuming a 4,000-gallon capacity water truck) over a three-month period. The cost of these deliveries could amount to $6,750.

Grant funding is available for alternative livestock watering systems, installing pipe, and reimbursement of costs associated with transporting water to livestock due to drought, as further detailed in the "Funding Resources" section at the end of this document.

The Proposed Emergency Regulation finds that it is unreasonable to divert water for livestock at loss rates of greater than 10 times the amount needed for livestock. Diversions of greater than an order of magnitude more than the presumptively reasonable amount set forth in California Code of Regulations, title 23, section 697 are unreasonable because: the need for the additional flow is high in this drought emergency; and more efficient alternatives are available and commonly used in the area. The availability of grant funding provides additional support for the unreasonableness finding of the Proposed Emergency Regulation and associated limitation on inefficient livestock watering practices.

The Proposed Emergency Regulation includes California Code of Regulations, title 23, section 875.7, which generally provides that, in the months of September through March, diversions in the Scott River and Shasta River watersheds for livestock watering must meet a threshold of efficiency for reasonable uses under Article X, Section 2 of the California Constitution.

1.7 INFORMATIVE DIGEST

This section provides additional information required under Government Code, section 11346.5, subdivision (a)(3). For the policy statement normally included in this section, please see the above section **Policy Overview and Effect of Proposed Emergency Regulation.**

1.7.1 Summary of Existing Laws and Regulations

A general description of the following is set forth above, in Water Rights Framework: existing law governing water rights, the water right priority system, and the constitutional prohibition against the waste, unreasonable diversion, unreasonable method of diversion, or unreasonable use of water. More specifically regarding water rights in the Scott and Shasta watersheds, both of these watersheds are adjudicated, meaning that a court has issued a far-reaching decree establishing the rights of various claimants to

water in the watershed. These adjudications are the: Shasta River Adjudication[2], Shackleford Adjudication[3], French Creek Adjudication[4], and the Scott River Adjudication.[5] These adjudications form the backbone of understanding the water rights in each watershed – including information on the priorities, uses, points of diversions, seasons of diversion, places of use, and water rights holders.

However, none of the adjudications address all water use in the Scott and Shasta watersheds. The Shasta Adjudication does not address riparian diverters or groundwater use (Siskiyou County Superior Court, 1932). The Shackleford and French Creek Adjudications do not address groundwater, and the Scott River Adjudication addresses groundwater diversions only in part (Siskiyou County Superior Court, 1950, 1952, 1980). None of these adjudications set forth the reasonable flow minimums necessary to protect the critical needs of SONCC coho, KMP steelhead, and fall-run Chinook salmon in a drought emergency or establishes the mechanism to curtail diversions when such flows are not being met. The Shasta, Shackleford and French Creek adjudications do not assign any instream flow determinations. The Scott River Adjudication does determine that the United States Forest Service holds certain instream flow rights for fisheries protection purposes, including flows in the mainstem reach near the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) that are very close to the emergency instream flows set forth in the Emergency Regulation. However, the Scott River Adjudication specifically notes that it does not make reasonable determinations regarding the instream flows or other allocations. Further, because it sets forth tributary, upstream mainstem and groundwater diversion schedules as generally as independent from lower mainstem flows, the Scott River Adjudication does not establish a legal mechanism from which to address diversions

---

[2] The Judgement and Decree entered on December 29, 1932 in Siskiyou County Superior Court Case No. 7035, *In the Matter of the Determination of the Relative Rights, Based Upon Prior Appropriation, of the Various Claimants to the Waters of Shasta River and its Tributaries in Siskiyou County, California*, and all supplements thereto (Siskiyou County Superior Court, 1932).

[3] The Decree entered on April 3, 1950 in Siskiyou County Superior Court Case No. 13775. *In the Matter of the Determination of the Rights of the Various Claimants to the Waters of Shackleford Creek and its Tributaries in Siskiyou County, California*, and all supplements thereto. Shackleford Creek is a tributary to the Scott River (Siskiyou County Superior Court, 1950).

[4] The Judgement entered on July 1, 1959 in Siskiyou County Superior Court Case No. 14478, *Mason v. Bemrod*, and all supplements thereto. French Creek is a tributary to the Scott River (Siskiyou County Superior Court, 1959).

[5] The Decree entered on January 30, 1980 in Siskiyou County Superior Court Case No. 30662, *In the Matter of Determination of the Rights of the Various Claimants to the Waters of Scott River Stream System, Except Rights to Water of Shackleford Creek, French Creek, and all Streams Tributary to Scott River Downstream from the U.S. Geological Survey Gaging Station, in Siskiyou County, California*, and all supplements thereto (Siskiyou County Superior Court, 1980).

that unreasonably interfere with these lower mainstem minimum flows. While adjudicated water users in the Shasta River watershed and French Creek and Wildcat Creek have enrolled in Watermaster services, many adjudicated areas elected to not engage in Watermaster services. Also, Watermaster services are not available for unadjudicated areas. Thus, there is not an existing entity with the authority to effectively manage all diversions in this extreme drought in the Scott and Shasta watersheds.

Under existing law, the State Water Board may take enforcement action to prevent unauthorized diversions of water or violations of the terms and conditions of water rights permits and licenses. Diverting water when it is unavailable under a water right holder's priority of right, or in violation of water right permit and license terms, constitutes an unauthorized diversion and a trespass against the state. Violations are subject to an Administrative Civil Liability (ACL) under the Water Code. (Wat. Code, § 1052.) An ACL order for an unauthorized diversion may impose liability of up to $1,000 a day, plus $2,500 per acre foot of water that is illegally diverted for violations during the current drought. Administrative cease and desist orders and court injunctions may also be issued to require that diversions stop. (Wat. Code, § 1831.) For the State Water Board to require cessation of diversions of water when it is unavailable under a water right holder's priority of right, each diversion may be investigated and charged, generally on the basis of a complaint, and water right holders may request a full evidentiary hearing on issues that include availability of water under the water right holder's priority. This process is not well suited to drought management, as it does not afford interim relief, and an enforcement hearing would extend past any single irrigation season.

Under existing law, the State Water Board also may initiate administrative proceedings to prevent the waste or unreasonable use of water. (Wat. Code, § 275.) The State Water Board lacks authority, however, to take efficient enforcement action against the waste or unreasonable use of water. The State Water Board must first determine whether a given diversion or use is unreasonable, either in a State Water Board order or decision or in a regulation, and direct the diverter or user to cease the unreasonable diversion or use. In the event that the State Water Board has issued an order or decision, the State Water Board may issue a cease and desist order to enforce the order or decision. (Wat. Code, § 1831, subd. (d)(3)). If the cease and desist order is violated, the State Water Board may impose an ACL. (Wat. Code, § 1845, subd. (b)(1).) This process is also not well suited to drought management, as it does not afford interim relief, and an enforcement hearing would extend past any single irrigation season. In the event that the State Water Board has adopted a regulation under section 1058.5, the State Water Board may issue a cease and desist order and simultaneously impose an ACL in response to violations of the regulation. (Wat. Code, §§ 1058.5, subd. (d), 1846, subd. (a)(2).)

Currently, the Water Code provides for measurement and periodic reporting for surface water diversions (and limited groundwater diversions), but this reporting is not at the level of specificity necessary in a severe drought to adequately track usage and project water availability. For example, diverters file, on an annual basis by April 1 or July 1

based on the water right type, their aggregated monthly water use for the prior calendar year. Moreover, with limited exceptions not applicable in the Scott and Shasta watersheds, these requirements are for surface water diversions, which are insufficient in these watersheds in which groundwater and surface water are closely interconnected.

Water Code section 106.3, establishes a human right to sufficient, affordable water to meet basic needs for human consumption and sanitation. Penal Code, section 597 establishes a requirement for livestock owners to provide sufficient water for their animals. Neither of these statutes articulates a specific amount of water for meeting these needs. However, California Code of Regulations, section 697, sets forth general reasonable quantities for a range of water uses in the state, for the purposes of assisting the public in determining how much water is reasonable to seek in a water right application. The uses described include for various domestic uses, and livestock watering.

1.7.1.1 Comparable Federal Statutes and Regulations

There is no comparable federal statute or regulation. The proposed Emergency Regulation is not inconsistent or incompatible with existing state regulations.

1.7.2 Data and Methodology for Issuing, Suspending and Rescinding Curtailments

The following subsections describe the data that may be used to support the issuance of curtailment orders pursuant to sections 875 of the regulation and for the suspension, reinstatement, or rescission of curtailment orders.

1.7.2.1 Summary of Water Supply Information

The proposed Emergency Regulation establishes the proposed emergency minimum flows as requirements at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) and the USGS Shasta River gage near Yreka (USGS gage no. 11517500). These gages will be used to determine compliance with the proposed emergency minimum flows except as otherwise specified in the proposed Emergency Regulation.

When issuing curtailments, other water supply information may be considered. Knowing whether or not water is physically available for specific diversions helps inform how deep in the water rights priority system curtailments must be made to achieve the proposed drought emergency minimum flows at the gages. Understanding when and where there is water available, or not, for specific diversions can be informed by using multiple sources of available information as listed below. Uncertainty regarding supply, demand, and groundwater losses may also support issuing and rescinding curtailments as an iterative process. For example, curtailments can be issued to diverters in a more junior grouping of water right priorities, and if the proposed drought emergency minimum flows are still not achieved at the compliance gage, then additional curtailments would be required for the next, more senior priority grouping of water right

holders. Water supply information used to inform curtailments may include but is not limited to:

- Forecast estimates of precipitation and streamflow;
- Historical information from periods of comparable flow conditions and hydrology;
- Historic reported water use during similar dry years;
- Streamflow gage data;
- Information in Division of Water Rights records on the extent to which flows are protected under Water Code section 1707;
- Groundwater levels;
- Reservoir levels;
- Hydrologic models;
- Visual observations of stream reaches being dry versus wet; and
- Other sources of water supply data

Projections of flow at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) and the USGS Shasta River gage near Yreka (USGS gage no. 11517500) are very uncertain due to the unknown future climate in forthcoming months. Water year 2023-2024 is predicated to be an El Niño year. El Niño is expected to persist and peak in winter, but without a clear impact on weather in the Scott River and Shasta River watersheds. As of December 6, 2023, snow water equivalent at Scott Mountain, in the Scott River watershed, shows a snow deficit for the region meaning lack of snowpack storage to contribute to the future flows (NWCC, 2023). Snow conditions will continue to evolve throughout winter. At this time in the season, recovery from snow drought can be rapid but recovery from snow drought in late winter and early spring can be more difficult. (NWCC, 2023). Flow forecast at the USGS Scott River gage near Fort Jones (USGS gage no. 11519500) and the USGS Shasta River gage near Yreka (USGS gage no. 11517500 will be more certain for April to September 2024, when a good estimation of annual snow budget of the Scott River and Shasta River watersheds becomes available early April 2024. The best alternative for the expected flows of WY 2023-2024 could be the average of historical flows with fall base flows similar to the current November flow (latest available monthly data to represent fall base flows), after Water Year 1999-2000 (to represent the current average flows, due to the land use and climate change)

1.7.3 Summary of Water Demand and Water Right Priority Information

Implementing curtailments requires information on water rights priorities and projected water demands.

1.7.3.1 Water Rights Priority

The water rights priority groups in the Scott and Shasta River watersheds are outlined in section 875.5 of the proposed Emergency Regulation. Within each water rights priority group there can be relative priorities that are based on the priority date of each specific water right or other determination methods for priorities set forth in an adjudication. The

information used to develop relative priorities for unadjudicated surface water comes from the State Water Board's Division of Water Rights records.

In California, groundwater rights have right categories similar to surface water rights. Overlying groundwater rights have a priority and characteristics equivalent to surface water riparian rights. Groundwater appropriations have a priority date from when the well was constructed and/or water first used for appropriative use, and have characteristics analogous to surface appropriative rights. An appropriative groundwater right is distinguished from an overlying groundwater right when the diverter: 1) does not own land overlying the basin; 2) owns overlying land but uses the water on non-overlying land; or 3) sells or distributes the water to another party. Some groundwater users may exercise both overlying and appropriative rights, and depending on the depth of curtailment, may only need to curtail the appropriative right. Some groundwater rights in the Scott watershed have been adjudicated, and these rights have priorities as set forth in the Scott River Adjudication (Siskiyou County Superior Court, 1980). For other groundwater diversions in the Scott and Shasta watersheds, information on when wells were first constructed and water first used for groundwater appropriations is typically obtained from the California Department of Water Resources (CDWR) or Siskiyou County. Siskiyou County reviews, permits, and inspects agricultural, domestic, and monitoring groundwater wells, and exploratory borings, to maintain a safe water supply. Siskiyou County maintains a record of well permits and well completion reports that were issued in the county since 1991. The CDWR Northern Region office maintains records for well permits issued before 1991 and maintains well information that Siskiyou County transmits to CDWR for post-1991 records.

1.7.3.2 Water Rights Demand

Water demand factors into the process of issuing curtailments. For example, knowing if the most junior water rights priority grouping in the watershed is diverting 1 cfs, 10 cfs, or 100 cfs factors in to how many water right priority groupings need to be curtailed if there is a flow shortfall of 23 cfs at the gage, for example. There are different sources of demand data. For example, permitted, licensed or adjudicated water rights generally have a maximum volume or rate of water that is allowed to be diverted, which is referred to as the face value of the water right. Additionally, water users with all types of surface water diversions are required to report their monthly water use to the Division of Water Rights on an annual basis. However, not all water right holders provide their annual water use data, and the data are often incorrect (e.g., incorrect units, etc.). When reported water use data is available, it is often more useful than the maximum allowable diversion (face value) for determining how much water that right holder could be expected to divert during a similar dry year. A potentially better source of demand information can be gathered from the information orders described in the proposed Emergency Regulation. Using information provided through responses to information orders, the State Water Board can better understand projected water use for individual water users, which can be useful to determine with more precision how deep curtailments need to go into the water rights priority system to achieve the minimum flow requirement under different water supply conditions. The use of such information

over the past year has been helpful in more carefully tailoring curtailment orders as flows have approached the drought emergency minimum flow requirements. What can create challenges for curtailment purposes, is that in some cases a water right holder may report accurate data, and in other cases a different water right holder may report less accurate and unreliable data. Therefore, multiple sources of data are useful as no single source of information may be considered the most reliable source.

For purposes of the Proposed Emergency Regulation, the State Water Board uses the following sources of water demand information, if available, for surface water rights. They are listed in order of what is typically most useful.

- Surface Water Right Demand Data:
    - Information Order reported water use or projected water use;
    - Annual water use reporting by water right holders to the State Water Board's eWRIMS database (SWRCB, 2023b), to the Watermaster (e.g. Watermaster 2014, 2016, 2017ab, 2021b), and to the State Water Board's eAR database (SWRCB, 2023a); and
    - Adjudication and other legal records establishing the face value of individual water rights (Siskiyou County Superior Court, 1932, 1950, 1952, 1980).

Other sources of information like remote sensing of crop water use can be used to validate demand information related to water rights records and water use reporting.

Additionally, for watermastered areas, more real-time demand information can be extremely useful. The State Water Board has contracted with the Watermaster to support such coordination.

Groundwater rights are not licensed and permitted by the State Water Board the same way that surface water rights are, and this leads to different types of groundwater right records. For groundwater rights in the Scott and Shasta watersheds, the information that is available is listed below in order of what is typically most useful.

- Groundwater Rights Demand Data:
    - Water supplier information reported to the State Water Board's eAR database (SWRCB, 2023a);
    - County and CDWR records of wells; and
    - Studies that delineate which fields are irrigated by groundwater and related remote sensing data that estimates how much water those fields use.

Each of the available data sources contain uncertainty. Therefore, no single source of data can be used for every situation. When issuing curtailments, the State Water Board will use the priority groups as described in the proposed Emergency Regulation, as well as available records as described above. The State Water Board will also use the best available demand information to inform how many water rights need to be curtailed to achieve the minimum flow requirements.

1.7.3.3 *Stream Flow Gains and Losses*

Stream systems are dynamic and contain losing and gaining reaches. Gaining stream reaches gain water from inflow of groundwater through the streambed. Losing stream reaches lose water to groundwater through the streambed. The losing or gaining nature of a stream reach can be influenced by geology, groundwater levels, evaporation, and evapotranspiration. These potential gains and losses affect the ability to curtail exactly the right amount of water to achieve the minimum flow requirements. For this reason, the issuance, suspension, reinstatement, or rescission of curtailment orders may be an iterative process. Additionally, it is important to consider that curtailing 10 cfs of water may not translate to exactly 10 cfs of flow at the gage. In some cases, more water will need to be curtailed than what is needed at the compliance gage to achieve the minimum flow requirements.

Because of uncertainty related to reported and unreported surface water demand, natural streamflow losses, streamflow losses due to groundwater diversions, and potential dry stream segments in some parts of the watershed and wet stream segments in other parts of the watershed, curtailments may need to be higher than what can be estimated from available supply and demand information.

1.7.4 Suspension of California Environmental Quality Act

Paragraph 9 of Executive Order N-5-20 suspended the California Environmental Quality Act (CEQA) as applied to the State Water Board's adoption of an emergency regulation to ensure critical instream flows for species protection through emergency minimum drought instream flow regulations.

1.7.5 Mandate on Local Agencies or School Districts

The proposed Emergency Regulation does not impose a mandate on local agencies or school districts because it does not mandate a new program or a higher level of service of an existing program. The regulation is generally applicable to public and private entities and is not unique to local government. No state reimbursement is required by part 7 (commencing with section 17500) of Division 4 of the Government Code.

1.7.6 Fiscal Cost Estimate

The fiscal effects incurred by state and local government agencies as a result of the proposed Emergency Regulation include the following: (1) revenue losses for municipal water supply agencies; (2) revenue losses for non-municipal water supply agencies (water for agriculture); (3) state and county tax revenue losses; (4) reporting costs to complete and submit initial compliance certification forms and ongoing diversion reporting in response to a curtailment order; and (5) reporting costs to complete and submit the information required by an information order, including supporting documentation.

The State Water Board estimated fiscal impacts under three different water year scenarios: an expected-range scenario, an extreme-drought scenario, and above-average precipitation scenario.

The State Water Board estimates the total cost to all state and local agencies (including city, county, schools, and publicly owned water suppliers) due to the proposed Emergency Regulation as $1,377,940 for the expected-range scenario, $2,042,755 for the extreme-drought scenario, and $322,628 for the above-average scenario. The total revenue loss for municipal water supply agencies is estimated to be $666,202 for the expected-range scenario, $846,218 for the extreme-drought scenario, and $249,471 for the above-average scenario. Total revenue loss for non-municipal water supply agencies is estimated to be $ 263,445 for the expected-range scenario, $485,550 for the extreme-drought scenario, and $6,630 for the above-average scenario. Total county and state agricultural tax revenue losses are estimated to be $391,713 for the expected-range scenario, $654,407 for the extreme-drought scenario, and $9,947 for the above-average scenario. The total reporting costs for all state and local agencies to complete and submit initial compliance certification forms, ongoing diversion reporting for the curtailment order, and complete and submit the information required by an informational order is estimated to be $56,580, the same amount for each of the three scenarios.

1.7.7 Funding Resources

The following opportunities provide funding for habitat restoration, water efficiency, ditch lining, instream flow dedications, fish passage, and other project types. Project types that could support local cooperative solutions (referenced in multiple sub-sections of section 875) or improve the efficiency of livestock water conveyances (referenced in section 875.7) may be eligible for some of the funding sources listed below.

- **California Department of Food and Agriculture (CDFA): State Water Efficiency and Enhancement Program (SWEEP)**
  - Provides financial assistance to farmers and ranchers who implement irrigation practices that improve water efficiency and reduce greenhouse gas emissions
  - Contact: cdfa.sweeptech@cdfa.ca.gov
  - Webpage: CDFA - OEFI - State Water Efficiency & Enhancement Program (ca.gov)
- **CDFW: Fisheries Restoration Grant Program (FRGP)**
  - Example project types: fish passage, instream habitat or upslope watershed restoration, bank stabilization, fish screens for diversions, water conservation measures, flow monitoring, water diversion measuring devices, project design, etc.
  - Webpage: https://wildlife.ca.gov/Grants/FRGP
- **CDFW: Natural Community Conservation Planning, Habitat Conservation Plans, and Local Assistance Grants**
  - Example project types:
    - Land acquisition, planning, and management
    - Design and implementation of biological monitoring
    - Development and implementation of management plans
  - Webpage: https://wildlife.ca.gov/Conservation/Planning/NCCP/Grants
- **CDFW: Proposition 1 Restoration Grant Program**
  - Example project types:
    - Modernizing stream crossings, culverts, and bridges
    - Installing or improving fish screens
    - Fish passage improvement
    - Acquisitions from willing sellers
  - Webpage: https://wildlife.ca.gov/conservation/Watersheds/Prop-1
- **CDFW: Proposition 68 Grant Program**
  - Example project types:
    - Habitat enhancement or restoration
    - Water conservation, temporary water transfers, water acquisition
    - Rotational fallowing, ditch lining, etc.
  - Webpage: https://wildlife.ca.gov/Conservation/Watersheds/Prop-68
- **CDFW: SB 170, Section 51, Biodiversity Conservation Program**
  - Eligible uses include water purchases for wildlife, protection of instream flows, and building water conservation projects.
  - Contact: Robert.Hawkins@Wildlife.ca.gov

    - Webpage: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/cdfw_drought_funding_presentation.pdf
- **California Department of Water Resources: SB 170, Section 80, Small Community Drought Relief**
    - Eligible uses related to small drinking supply system reliability
    - Contact: SmallCommunityDrought@water.ca.gov
    - Webpage: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/cdfw_drought_funding_presentation.pdf
- **Environmental Lab Accreditation Program: Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program**
    - Example project types:
        - Costs of transporting water to livestock due to drought
        - Honeybee feed and hive losses
        - Can cover eligible costs associated with wildfire and other weather events
    - Webpage: fsa.usda.gov/ELAP
- **United States Bureau of Reclamation: WaterSMART Program**
    - Example project types:
        - Canal lining/piping,
        - Water Use Efficiency improvements
    - Webpage: www.grants.gov
- **U.S. Fish and Wildlife Service: Endangered Species Recovery Land Acquisition Grant Program (Non-traditional Section 6)**
    - Example project types:
        - Land acquisition
    - A CDFW grant lead is required
    - Webpage: https://wildlife.ca.gov/Grants/Land-Acquisition
- **Wildlife Conservation Board: Proposition 1 Funding**
    - Example project types:
        - Water transactions: instream flow dedications, forbearance agreements, conservation easements, purchase or long-term transfer of water
        - Water conservation projects: off-channel water storage, changes in timing or rate of diversion, livestock watering systems, agricultural tailwater management systems
        - Other project types: changing points of diversion, groundwater storage and conjunctive use, habitat restoration to enhance stream flow, streamflow gaging, scientific studies, etc.
    - Webpage: https://wcb.ca.gov/Programs/Stream-flow-Enhancement
- **Wildlife Conservation Board: SB 170, Sections 53, 54**
    - Eligible uses include aquatic or riparian habitat improvements, projects that provide water to fish and wildlife, acquisition of water or land with water rights, restoration projects and projects to protect listed species.
    - Contact: Shannon.Lucas@wildlife.ca.gov

- Webpage: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/cdfw_drought_funding_presentation.pdf

1.8 INFORMATION RELIED UPON

ABC 30 Action News. 2014. "With wells drying up residents turn to water trucks". Accessed August 11, 2021 at: https://abc30.com/with-wells-drying-up-residents-turn-to-water-trucks/218373/

Abrams, J. "SWRCB Hearing on Minimum Flow Requirements for the Scott and Shasta rivers". United States: Department of Commerce: National Oceanic and Atmospheric Administration: National Marine Fisheries Service. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Aqua Terra Consulting. 2011. "Shasta River Tailwater Reduction Plan". Prepared by Aqua Terra Consulting, Mt. Shasta, CA for the Shasta Valley Resource Conservation District, Yreka, CA.

Bayer, 2019. "Innovations in Center Pivot Irrigation". Website. Published March 4, 2019. Accessed: October 27, 2023. URL: https://www.vegetables.bayer.com/hu/hu-hu/resources/growing-tips/innovations-in-center-pivot-irrigation.html

Bedekar, V. 2022a. Decl. of Vivek Bedekar, Ph.D., in Support of SWRCB's Response to BSID's Suppl. Br. (CVCV 22-317). May 3, 2022.

Bedekar, V. 2022b. Decl. of Vivek Bedekar, Ph.D., in Support of SWRCB's Further Response (CVCV 22-317). June 12, 2022.

Belchik, M. 2023. "Status of the Klamath River Fishery". Yurok Tribe. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Bisson, P.A., K. Sullivan, J.L. and Nielsen. 1988. "Channel Hydraulics, Habitat Use, and Body Form of Juvenile coho salmon, Steelhead, and Cutthroat Trout in Streams". Transactions of the American Fisheries Society, 117: 262-273.

Buck, C.R. 2013. "Managing Groundwater for Environmental Stream Temperature". Dissertation. California: University of California, Davis.

California Department of Fish and Wildlife (CDFW). 2017. "Interim Instream Flow Criteria for the Protection of Fishery Resources in the Scott River Watershed, Siskiyou County". California: Natural Resources Agency: Department of Fish and Wildlife. February 6, 2017.

CDFW. 2020a. “2020 Scott River Salmon Studies”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA.

CDFW. 2020b. “2020 Shasta River Juvenile Salmonid Outmigrant Study”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA.

CDFW. 2020c. “Shasta River Salmonid Monitoring 2020, Siskiyou County, CA”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA.

CDFW. 2021a. “Scott River Best Available Scientific Information for Instream Flow Criteria and Potential Next Steps”. Correspondence from the California: Natural Resources Agency: Department of Fish and Wildlife, Sacramento, CA to the California: Environmental Protection Agency: State Water Resources Control Board. May 3, 2021.

CDFW. 2021b. “Memorandum: Influence of Scott River in-stream flow on the distribution and migration timing of fall Chinook Salmon and coho salmon”. California: Natural Resources Agency: Department of Fish and Wildlife, Sacramento, CA.

CDFW. 2021c. “2020 Scott River Salmon Studies Final Report”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project. May 19, 2021.

CDFW. 2021d. “Minimum Flow Recommendations for the Shasta and Scott Rivers to Inform the 2021 Drought Emergency Regulations”. Correspondence from the California: Natural Resources Agency: Department of Fish and Wildlife, Redding, CA from to the California: Environmental Protection Agency: State Water Resources Control Board. June 15, 2021. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/swb_2021_shasta_scott_drought_emergency_final.pdf

CDFW. 2021e. “Subject: Supplemental Information Supporting the California Department of Fish and Wildlife Drought Emergency Minimum Flow Recommendations”. Correspondence from the California: Natural Resources Agency: Department of Fish and Wildlife, Redding, CA to the Correspondence to the California: Environmental Protection Agency: State Water Resources Control Board, June 29, 2021.

CDFW. 2021f. “Klamath River Project Adult Fish Counting Facility In-season Update”. California: Natural Resources Agency: Department of Fish and Wildlife. December 17, 2021.

CDFW. 2021g. “2021 Scott River Juvenile Salmonid Outmigrant Study”. Prepared by California: Natural Resources Agency: Department of Fish and Wildlife, Yreka, CA and Americorps Watershed Stewards Program, Fortuna, CA. 2021.

CDFW. 2021h. “2021 Shasta River Juvenile Salmonid Outmigrant Study”. Prepared by California: Natural Resources Agency: Department of Fish and Wildlife, Yreka, CA and Americorps Watershed Stewards Program, Fortuna, CA. 2021.

CDFW. 2022a “2021 Shasta River Salmonid Monitoring Siskiyou County, CA”. California: Natural Resources Agency: Department of Fish and Wildlife. January 21, 2022.

CDFW. 2022b. “Subject: Re-adopt Drought Emergency Regulation on the Shasta and Scott Rivers with Modified and Additional Recommendations”. Correspondence to the California: Environmental Protection Agency: State Water Resources Control Board. California: Natural Resources Agency: Department of Fish and Wildlife, Redding, CA. April 20, 2022. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/shasta-scott-drought-emergency.pdf

CDFW. 2022c. “2021 Scott River Salmon Studies Final Report. California Department of Fish and Wildlife. Northern Region. Klamath River Project.” May 2, 2022.

CDFW. 2022d. “Scott and Shasta River Juvenile Salmonid Outmigration Monitoring In-Season Update”. California: Natural Resources Agency: Department of Fish and Wildlife. June 10, 2022.

CDFW. 2022e. “2022 Scott River Juvenile Salmonid Outmigrant Study”. California: Natural Resources Agency: Department of Fish and Wildlife, Yreka, CA. 2022.

CDFW. 2022f. “2022 Shasta River Juvenile Salmonid Outmigrant Study”. California: Natural Resources Agency: Department of Fish and Wildlife, Yreka, CA. 2022.

CDFW. 2023a. “Ocean Salmon Sport Fisheries in California Closed for April through Mid-May 2023”. Website. California: Natural Resources Agency: Department of Fish and Wildlife. March 10, 2023. URL: https://wildlife.ca.gov/News/Archive/ocean-salmon-sport-fisheries-in-california-closed-for-april-through-mid-may-2023#gsc.tab=0

CDFW. 2023b. “Recreational Ocean, In-River Salmon Fisheries in California to Close for Remainder of 2023”. Website. California: Natural Resources Agency: Department of Fish and Wildlife: Office of Communications, Education, and Outreach. May 19, 2023. URL: https://wildlife.ca.gov/News/Archive/recreational-ocean-in-river-salmon-fisheries-in-california-to-close-for-remainder-of-2023#gsc.tab=0

CDFW. 2023c. “2022 Scott River Salmon Studies Final Report”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA. July 7, 2023.

CDFW. 2023d. “Shasta River Salmonid Monitoring 2022, Siskiyou County, CA”. California: Natural Resources Agency: Department of Fish and Wildlife: Klamath River Project, Yreka, CA. July 20, 2023.

CDFW. 2023e. “Subject: Notice of Opportunity to Comment and of Public Hearing on a Petition for Rulemaking to Set Minimum Flows on the Scott River”. Correspondence to the California: Environmental Protection Agency: State Water Resources Control Board. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region, Redding, CA. July 20, 2023.

CDFW. 2023f. “Shasta and Scott River Juvenile Salmonid Outmigration Monitoring In-Season Update”. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA. July 21, 2023.

CDFW. 2023g. “Klamath River Project Adult Fish Counting Facility In-Season Update.” California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA. December 4 , 2023.

CDFW. 2023h. “Fish Periodicity in the Shasta River - Draft”. Correspondence to the California: Environmental Protection Agency: State Water Resources Control Board. California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath River Project, Yreka, CA. December 2023.

California Department of Tax and Fee Administration (CDTFA). 2023. “California Sales and Use Tax Rates by County and City”. Operative July 1, 2023. California: Government Operations Agency: Department of Tax and Fee Administration, Sacramento, CA. Accessed October 20, 2023 at URL: https://www.cdtfa.ca.gov/formspubs/cdtfa95.pdf

California Department of Water Resources (CDWR). 2018. “California Land and Water Use Data, WY 2011-2015”. California: Natural Resources Agency: Department of Water Resources. Accessed December 12, 2023. URL: https://water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Agricultural-Land-And-Water-Use-Estimates

CDWR. 2021a. “Water Use Efficiency”. California: Natural Resources Agency: Department of Water Resources. URL: https://water.ca.gov/wateruseefficiency/

CDWR. 2021b. “2016 and 2018 Crop and Water Use Data”. Personal communications with California: Environmental Protection Agency: State Water Resources Control Board and North Coast Regional Water Quality Control Board. California: Natural Resources Agency: Department of Water Resources. July 13, 2021.

CDWR. 2023a. “Land Use Surveys”. Website. California: Natural Resources Agency: Department of Water Resources. URL: https://water.ca.gov/programs/water-use-and-efficiency/land-and-water-use/land-use-surveys

CDWR. 2023b. “Snow Course Measurements for April 1, 2023”. Website. California: Natural Resources Agency: Department of Water Resources: California Data Exchange Center. Accessed: October 2023. URL: https://cdec.water.ca.gov/reportapp/javareports?name=COURSES.

California Environmental Flows Working Group (CEFWG). 2021. “California Natural Flows Database: Functional flow metrics v1.2.1”. URL: https://rivers.codefornature.org/

California Fish and Game Commission (CFGC). 2023. “Finding of Emergency and Statement of Proposed Emergency Regulatory Action”. California: Fish and Game Commission, Sacramento, CA. May 31, 2023.

CNBC. 2015. “California’s four-year drought starts a ‘water truck’ boom”. Website. Published April 8, 2015. Accessed August 11, 2021. URL: https://www.cnbc.com/2015/04/08/californias-four-year-drought-starts-a-water-truck-boom.html.

Cole, S. A., and J. Medellín-Azuara. 2021. "Siskiyou County Agricultural Economics Analysis Considering Groundwater Regulation." California: University of California: Merced, CA. September 2, 2021. URL: https://www.co.siskiyou.ca.us/sites/default/files/fileattachments/natural_resources/page/28347/appendix_5-d._siskiyou_county_agricultural_economics_analysis_considering_groundwater_regulation.pdf

Cook, B.I., J.E Smerdon, E.R. Cook, A.P. Williams, K.J. Anchukaitis, J.S. Mankin, K. Allen, L. Andreu-Hayles, T.R. Ault, S. Belmecheri, S. Coats, B. Coulthard, B. Fosu., P. Grierson, D. Griffin, D.A. Herrera, M. Ionita, F. Lehner, C. Leland, K. Marvel, M.S. Morales, V. Mishra, J. Ngoma, H.T.T. Nguyen, A. O’Donnell, J. Palmer, M.P. Rao, M. Rodriguez-Caton, R. Seager, D.W. Stahle, S. Stevenson, U.K. Thapa, A.M. Varuolo-Clarke, and E.K. Wise. 2022. “Megadroughts in the Common Era and the Anthropocene”. Nature Reviews: Earth & Environment. 3. 741-757. URL: https://doi.org/10.1038/s43017-022-00329-1

Davids Engineering. 2020. “Technical Memorandum: Estimation of Historical Surface Water Diversions in the Shasta Valley”. Prepared for Larry Walker Associates, Davis, CA.

Foglia, L., A. McNally, and T. Harter. 2013a. ”Coupling a spatio-temporally distributed soil water budget with stream-depletion functions to inform stakeholder-driven management of groundwater-dependent ecosystems”. Water Resources Research, Volume 49.

Foglia, L., A. McNally, C. Hall, L. Ledesma, R. Hines, and T. Harter. 2013b. “Scott Valley Integrated Hydrologic Model: Data Collection, Analysis, and Water Budget – Final Report”. Prepared for California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA.

Foglia, L., J. Neumann, D.G. Tolley, S.B. Orloff, R.L. Snyder, and T. Harter. 2018. "Modeling guides groundwater management in a basin with river–aquifer interactions". California: University of California, Davis, CA.

Harris, M. 2023a. "Scott and Shasta River Fish Population Update". California: Natural Resources Agency: Department of Fish and Wildlife: Northern Region: Klamath Watershed Program. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Harris, M. 2023b. "Shasta Scott Emergency Drought Instream Flows Recommendations". Department of Fish and Wildlife: Northern Region: Klamath Watershed Program. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023.

Harris, M. 2023c. "Scott and Shasta River Local Cooperative Solutions". Department of Fish and Wildlife: Northern Region: Klamath Watershed Program. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Harter, T. 2021a. "Scott Valley Stream Depletion Computation with SVIHM". Personal communication with the California: Environmental Protection Agency: State Water Resources Control Board. June 9, 2021.

Harter, T. 2021b. "Discuss use of SVIHM to inform emergency regulations". Personal communication with California: Environmental Protection Agency: State Water Resources Control Board and North Coast Regional Water Quality Control Board. July 6, 2021.

Harter, T. 2023. "Subject: Comment Letter on the November 7, 2024, Preliminary Draft Emergency Regulation for the Scott River and Shasta River Watershed". Correspondence with the California: Environmental Protection Agency: State Water Resources Control Board. November 16, 2023.

Harter, T., C. Kouba, and L. Foglia. 2023a. "SVIHM Scenario Modeling: Historic – Annual Curtailments – "Unimpaired" (2 Possible Bookends)". Presentation at Meeting of California: Environmental Protection Agency: State Water Resources Control Board. August 15, 2023.

Harter, T., L. Scantlebury, C. Kouba, J. Pyschik, L. Foglia. 2023b. "EMERGENCY FLOWS: Some third parties characterize the existing Scott Valley Integrated Groundwater Hydrologic Model results as saying that the emergency flow targets are too high and would be impossible to meet in most years. Is this a fair

characterization? Why or why not?" Presentation at Meeting of California: Environmental Protection Agency: State Water Resources Control Board. October 6, 2023.

Hatfield, T. and J. Bruce. 2000. "Predicting Salmonid Habitat-Flow Relationship for Streams from Western North America". North American Journal of Fisheries Management. 20. (4):1005-1015.

Hirsh, S. 2022. "What is a megadrought and how is it impacting major regions in the United States". Website. World Economic Forum. Published September 20, 2022. Accessed November 28, 2023. URL: https://www.weforum.org/agenda/2022/09/western-america-megadrought-climate-change-weather-affects/

Holt, J., Yost, M., Allen, N., Creech, E., Winward, D., Sullivan, T., and Kitchen, B. 2021. "Guide to Irrigation Sprinkler Packages for Pivots and Laterals". Website. Utah: Utah State University: Crop Resources Extension. Published February 2021. Accessed October 27, 2023. URL: https://extension.usu.edu/crops/research/irrigation-pivots-laterals

Hockaday, A.T. and Kane, N. "Karuk Tribe Fishery Presentation". Karuk Tribe and Environmental Law Foundation. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Jeffres, C.A., E.M. Buckland, M.L. Deas, B.G. Hammock, J.D. Kiernan, A.M. King, N.Y. Krigbaum, J.F. Mount, P.B. Moyle, D.L. Nichols, and S.E. Null. 2008. "Baseline Assessment of Salmonid Habitat and Aquatic Ecology of the Nelson Ranch, Shasta River, California Water Year 2007". Prepared for United States: Department of the Interior: Bureau of Reclamation: Klamath Area Office.

Jeffres, C.A., R.A. Dahlgren, M.L. Deas, J.D. Kiernan, A.M. King, R.A. Lusardi, J.F. Mount, P.B. Moyle, A.L. Nichols, S.E. Null, S.K. Tanaka, and A.D. Willis. 2009. "Baseline Assessment of Physical and Biological Conditions Within Waterways on Big Springs Ranch, Siskiyou County, California". Prepared for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

Jeffres, C.A., A.L. Nichols, A.D. Willis, M.L. Deas, J.F. Mount, and P.B. Moyle. 2010. "Assessment of Restoration Actions on Big Springs Creek, Shasta River, California 2009-2010". Prepared for National Fish and Wildlife Foundation, San Francisco, CA.

Karuk Tribe of California, Environmental Law Foundation, Pacific Coast Federation of Fishermen's Associations, and Institute for Fisheries Resources. 2023. "Petition for Rulemaking to Set Minimum Flows on the Scott River". Submitted to the California: Environmental Protection Agency: State Water Resources Control

Board. May 23, 2023. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2023/petition-minimum-flows.pdf

Kouba, C. 2021. “Scott Valley Management Scenario Results”. Appendix 4a of the Scott River Valley Groundwater Sustainability Plan (Public Draft). Prepared for California: Siskiyou County: Flood Control and Water Conservation District, Yreka, CA. August 2021.

Mack, S. 1960. “Geology and ground-water features of Shasta Valley, Siskiyou County, California”. U.S. Geological Survey Water Supply Paper, 1484. United States: Department of the Interior: Geological Survey, Washington D.C. Prepared in cooperation with California: Division of Water Resources, Sacramento, CA.

McBain and Trush. 2014. “Shasta River Canyon Instream Flow Needs Assessment – Final Report”. Prepared by McBain and Trush, Inc and California: Humboldt State University, Arcata, CA for Ocean Protection Council and California: Natural Resources Agency: Department of Fish and Game. March 7, 2014.

Medellín-Azuara, J. Howitt, R.E., and J. Lund. 2014a. “Estimating Fiscal Impacts of Implementing Water Diversion Curtailments in the Sacramento-San Joaquin Delta Watershed”. Prepared for the California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

Medellín-Azuara, J. Howitt, R.E., and J. Lund. 2014b. “Estimating Fiscal Impacts of Implementing Water Diversion Curtailments in the Delta Basins”. Spreadsheet prepared for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

Meehan, M. A., Stokka, G., and Mostrom, M. 2021. “Livestock Water Requirements”. North Dakota: North Dakota State University Extension, Fargo, ND.

Montague Irrigation District. 1963. “Geologic investigations for reservoir leakage and groundwater development”. Prepared by Wessley W. Paulsen, Consulting Geologist.

Montague Water Conservation District (MWCD). 2021. “Water Operation Plan”. California: Montague Water Conservation District. March 2021.

Moyle, P.B., J.A. Israel, and S.E. Purdy. 2008. “Salmon, Steelhead, and Trout in California: Status of an Emblematic Fauna”. Prepared by California: University of California, Davis: Center for Watershed Science, Davis, CA for California Trout.

National Drought Mitigation Center. 2023. “U.S. Drought Monitor”. Website. Produced by Nebraska: University of Nebraska-Lincoln: National Drought Mitigation Center and the United States: Department of Agriculture and Department of Commerce: National Oceanic and Atmospheric Administration. Updated: December 5, 2023. Accessed: December 8, 2023. URL: https://droughtmonitor.unl.edu/

National Integrated Drought Information System (NIDIS). 2023. “California-Nevada Drought Status Update: October 19, 2023". Website. Prepared by the Department of Commerce: National Oceanic and Atmospheric Administration, California-Nevada Adaptation Program, and the Desert Research Institute: Western Regional Climate Center. October 19, 2023. URL: https://www.drought.gov/drought-status-updates/california-nevada-drought-status-update-2023-10-19

National Research Council (NRC). 2004. “Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery”. National Academies: National Research Council: Division of Earth and Life Sciences: Board on Environmental Studies and Toxicology: Committee on Endangered and Threatened Fishes in the Klamath River Basin, Washington DC. The National Academic Press

Newsom, G. 2021a. “State of Emergency Proclamation”. California: Executive Department. April 21, 2021. URL: https://www.gov.ca.gov/wp-content/uploads/2021/04/4.21.21-Drought-Proclamation.pdf

Newsom, G. 2021b. “Proclamation of a State of Emergency”. California: Executive Department. May 10, 2021. URL: https://www.gov.ca.gov/wp-content/uploads/2021/05/5.10.2021-Drought-Proclamation.pdf

Newsom, G. 2021c. “Proclamation of a State of Emergency”. California: Executive Department. July 8, 2021. URL: https://www.gov.ca.gov/wp-content/uploads/2021/07/7.8.21-Drought-SOE-Proc.pdf

Newsom, G. 2021d. “Executive Order N-10-21". California: Executive Department. July 8, 2021. URL: https://www.gov.ca.gov/wp-content/uploads/2021/07/7.8.21-Conservation-EO-N-10-21.pdf

Newsom, G. 2021e. “Proclamation of a State of Emergency”. California: Executive Department. October 19, 2021.

Newsom, G. 2022. “Executive Order N-7-22.” California: Executive Department. March 28, 2022. URL: https://www.gov.ca.gov/wp-content/uploads/2022/03/March-2022-Drought-EO.pdf

Newsom, G. 2023. “Executive Order N-5-23”. California: Executive Department. March 24, 2023. URL: https://www.gov.ca.gov/wp-content/uploads/2023/03/3.24.23-Drought-update-executive-order.pdf

Nichols, A.L. 2008. “Geological Mediation of Hydrologic Process, Channel Morphology, and Resultant Planform Response to Closure of Dwinnell Dam, Shasta River, California”. California: University of California, Davis, CA.

Nichols, A.L., Jeffres, C.A., Willis, A.D., Corline, N.J., King, A.M., Lusardi, R.A., Deas, M.L., Mount, J.F., and Moyle, P.B. 2010. “Longitudinal baseline assessment of

salmonid habitat characteristics of the Shasta River, March to September 2008". Prepared for United States: Department of the Interior: Bureau of Reclamation: Klamath Basin Area Office, Klamath Falls, OR.

National Marine Fisheries Service (NMFS). 2014. "Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionary Significant Unit of coho salmon (Oncorhynchus Kisutch)". United States: Department of Commerce: National Oceanic and Atmospheric Administration: National Marine Fisheries Service, Arcata, CA.

NMFS. 2021a. "Lower Sugar Creek BDA Pond 1 Fish Relocation." Field Note by Donald Flickinger. United States: Department of Commerce: National Oceanic and Atmospheric Administration: National Marine Fisheries Service. July 23, 2021.

NMFS. 2021b. "Permanent Alternative Stockwater System Cost. Transmitted by personal communication. United States: Department of Commerce: National Oceanic and Atmospheric Administration: National Marine Fisheries Service

National Water and Climate Center (NWCC). 2023. "iMap | NWCC Interactive Map". Website. United States: Department of Agriculture: Natural Resources Conservation Service: National Water and Climate Center. Accessed December 8, 2023.

National Weather Service (NWS). 2023. "Three-Month Outlooks: Official Forecasts: Nov-Dec-Jan 2023-24". United States: Department of Commerce: National Oceanic and Atmospheric Administration: National Weather Service: Climate Prediction Center. Date accessed: October 24, 2023. URL: https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1

North Coast Regional Water Quality Control Board (NCRWQCB). 2005. "Staff Report for the Acton Plan for the Scott River Watershed Sediment and Temperature Total Maximum Daily Loads". California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA.

NCRWQCB. 2006. "Staff Report for the Action Plan for the Shasta River Watershed Temperature and Dissolved Oxygen Total Maximum Daily Loads". California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA.

NCRWQCB. 2018. "Water Quality Control Plan for the North Coast Region". California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA.

NCRWQCB. 2021a. "Water Temperature Data". Transmitted by personal communication. California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA. August 10, 2021.

NCRWQCB. 2021b. “Subject: Analysis of the Shasta Valley Resource Conservation District’s Proposed Temperature and Flow Targets for Emergency Regulations”. Correspondence with the California: Environmental Protection Agency: State Water Resources Control Board. California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, CA. July 27, 2021.

Orloff, S., D. Putnam, B. Hanson, and H. Carlson. 2003. “Controlled Irrigation of Alfalfa: Opportunities and Pitfalls”. In *California Alfalfa Symposium* (p. 39). California: University of California: Agronomy and Range Science Extension.

Orloff, S., D. Putnam, B. Hanson, and H. Carlson. 2005. “Implications of deficit irrigation management of alfalfa”. In *Proceeding of California Alfalfa and Forage Symposium* (pp. 12-14). California: University of California: Agronomy and Range Science Extension.

Orloff, S., K. Bali, and D. Putnam. 2014. “Deficit irrigation of alfalfa and grasses: What are the impacts/options”. In *Proceedings of the California Alfalfa and Grains Symposium Proceedings, Fresno, CA, USA* (pp. 10-12). California: University of California: Agronomy and Range Science Extension.

PRISM Climate Group. 2023. Website. Oregon: Oregon State University. Accessed: October 2023. URL: http://prism.oregonstate.edu

R2 Resource Consultants (R2) and Stetson Engineers (Stetson). 2008. “North Coast Instream Flow Policy: Scientific Basis and Development of Alternatives Protecting Anadromous Salmonids”. Prepared for California: Environmental Protection Agency: State Water Resources Control Board. Updated: March 14, 2008.

Richter, B.D., M.M. Davis, C. Apse, and C. Konrad. 2011. “Short Communication: A Presumptive Standard for Environmental Flow Protection”. In *River Research and Applications*. February 7, 2011. DOI: 10.1002/rra.1511

Riverbend Sciences. 2023. “Evaluating the hydrologic effects of the 2021-2022 Scott and Shasta irrigation curtailments using remote sensing and streamflow gages”. Prepared for Klamath Tribal Water Quality Consortium. September 11, 2023. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2023/riverbend-2023-scott-shasta-curtailment.pdf

Schaefer, S. 2023. “Quartz Vally Indian Reservation Fishery Presentation”. Quartz Valley Indian Reservation: Environmental Department. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Scott, E. 2022a. Decl. of Elias Scott in Support of SWRCB's Court-Approved Sur-Reply in Oppo. to Mot. for Temp. Restr. Order (CV CV 22-317). April 14, 2022.

Scott, E. 2022b. Decl. Of Elias Scott in Support of SWRCB's Court-Approved Sur-Reply in Oppo. To Mot. For Temp Restr. Order (CV CV 22-317). May 3, 2022.

Scott, E. 2023. "Flow and Water Quality in the Scott and Shasta Watersheds". California: Environmental Protection Agency: North Coast Regional Water Quality Control Board. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Scott Valley Agriculture Water Alliance. 2023. "RE: Scott-Shasta Preliminary Draft Emergency Regulation Comments". Correspondence to California: Environmental Protection Agency: State Water Resources Control Board. Scott Valley Agriculture Water Alliance, November 16, 2023.

Scott Valley and Shasta Valley Watermaster District (Watermaster). 2014. "Summary of Watermaster Services for the 2014 Season". Prepared by California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA and GEI Consultants. December 2014.

Watermaster. 2016. "Summary of Watermaster Services for the 2015 Season". Prepared by California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA and GEI Consultants. January 2016.

Watermaster. 2017a. "Summary of Watermaster Services for the 2016 Season". Prepared by California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA and GEI Consultants. February 2017.

Watermaster. 2017b. "Summary of Watermaster Services for the 2017 Season". Prepared by California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA and GEI Consultants. December 2017.

Watermaster. 2021a. "Comment Letter on Draft Regulations". California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA. Submitted to California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA. July 23, 2021.

Watermaster. 2021b. Preliminary Annual Statement of Diversion and Water use For 2019. California: Scott Valley and Shasta Valley Watermaster District, Yreka, CA July 27, 2021.

Siskiyou County Flood Control and Resource Conservation District (Siskiyou County). 2022a. "Scott Valley Groundwater Sustainability Plan". Prepared by Larry Walker and Associates, Davis, CA for California: Siskiyou County: Flood Control and Resource Conservation District, Yreka, CA. January 2022.

Siskiyou County. 2022b. “Shasta Valley Groundwater Sustainability Plan”. Prepared by Larry Walker and Associates, Davis, CA for California: Siskiyou County: Flood Control and Resource Conservation District, Yreka, CA. January 2022.

Siskiyou County. 2022c.“Siskiyou County 2020 Annual Crop and Livestock Report”. California: Siskiyou County: Department of Agriculture, Yreka, CA.

Siskiyou County Board of Supervisors. 2023. “Subject: Comment Letter – Preliminary Draft Emergency Regulations for Scott and Shasta Rivers”. Correspondence to California: Environmental Protection Agency: State Water Resources Control Board. California: Siskiyou County: Board of Supervisors, Yreka, CA. November 16, 2023.

Siskiyou County Farm Bureau. 2023a. “Re: Comment Letter – Proposed Emergency Drought Regulations for the Scott and Shasta Watersheds”. Correspondence to California: Environmental Protection Agency: State Water Resources Control Board. Siskiyou County: Farm Bureau, Yreka, CA. October 27, 2023.

Siskiyou County Farm Bureau. 2023b. “Re: Comment Letter – Draft Emergency Drought Regulations for the Scott and Shasta Watersheds”. Correspondence to California: Environmental Protection Agency: State Water Resources Control Board. Siskiyou County: Farm Bureau, Yreka, CA. November 16, 2023.

Siskiyou County Superior Court. 1932. “In the Matter of the Determination of the Relative Rights Based on Prior Appropriation, of the Various Claimants to the Use of the Water of the Shasta River and its Tributaries in Siskiyou County, California, No. 7035”. Judgement and Decree No. 7035. The Superior Court of the State of California in and for the County of Siskiyou.

Siskiyou County Superior Court. 1950. “In the Matter of the Determination of the Rights of the Various Claimants to the Waters of Shackleford Creek and its Tributaries in Siskiyou County, CA, No. 13775.” Decree No. 13775. The Superior Court of the State of California in and for the County of Siskiyou.

Siskiyou County Superior Court. 1958. “John H. Mason, et al., Plaintiffs vs. Harry N. Bemrod, et al., Defendants, No. 14478”. Judgement No. 14478. The Superior Court of the State of California in and for the County of Siskiyou.

Siskiyou County Superior Court. 1980. “Scott River Adjudication: Decree No. 30662, Scott River Stream System within California in County of Siskiyou”. Decree No. 30662. Superior Court for Siskiyou County. The Superior Court of the State of California in and for the County of Siskiyou.

State Water Resources Control Board (SWRCB). 1974. “Report on Water Supply and Use of Water Scott River Stream System”. California: Environmental Protection Agency: State Water Resource Control Board, Sacramento, CA.

SWRCB. 1976. “Scott River Adjudication Proposed Principles for Allocating Water to the Various Claimants”. California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

SWRCB. 2010. “Instream Flow Studies for the Protection of Public Trust Resources: A Prioritized Schedule and Estimate of Costs”. California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

SWRCB. 2018. “Draft Shasta River Watershed Characterization and Model Study Plan”. Prepared by Paradigm Environmental, San Diego, CA for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

SWRCB. 2020. “Lower Klamath Project License Surrender Final Environmental Impact Report, Volume III”. Prepared by Stillwater Sciences, Berkeley, CA for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

SWRCB. 2021. “Establishment of Minimum Instream Flow Requirements, Curtailment Authority, and Information Order Authority in the Klamath Watershed”. Approved by California: Government Operations Agency: Office of Administrative Law for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/klamath_reg_oal_approval.pdf

SWRCB. 2022a. “Daily Forecasted Flows, Drought Emergency Minimum Flows, and Expected Shortfall to Meet Drought Emergency Minimum Flows for Period of July 2022 to July 2022 at Scott River Fort Jones Gage and Shasta River Yreka Gage”. California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA.

SWRCB. 2022b. “Establishment of Minimum Instream Flow Requirements, Curtailment Authority, and Information Order Authority in the Klamath Watershed”. Approved by California: Government Operations Agency: Office of Administrative Law for California: Environmental Protection Agency: State Water Resources Control Board, Sacramento, CA. URL: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/scott_shasta_rivers/docs/2022/klamath-reg-2022.pdf

SWRCB. 2023a. “Electronic Annual Reports”. Website. California: Environmental Protection Agency: State Water Resources Control Board: Division of Drinking Water, Sacramento, CA. Accessed October 26, 2023. URL: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html

SWRCB. 2023b. “electronic Water Rights Information Management System”. Website. California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights, Sacramento, CA. Accessed October 26, 2023.

SWRCB. 2023c. “Temporary Conditional Suspension of California Code of Regulations, Title 23, Section 875.5 During High Flows in the Shasta River Watershed”. California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights, Sacramento, CA. January 12, 2023.

Stanford, B. 2023. “Emergency Flow Targets in the Scott and Shasta Rivers”. The Nature Conservancy. Presented at Public Workshop Regarding Emergency Regulation Efforts in the Scott River and Shasta River Watersheds hosted by California: Environmental Protection Agency: State Water Resources Control Board: Division of Water Rights. Sacramento, CA. October 6, 2023

Stenhouse, S., C. Bean, W. Chesney, and M. Pisano. 2012. “Water Temperature Thresholds for coho salmon in a spring fed River, Siskiyou County, California”. Prepared for California: Natural Resources Agency: Department of Fish and Game, Redding, CA.

Stull, C., Peterson, N., Nader, G., Maas, J., Lehenbauer, T., and Collar, C. 2012. “Cattle Care Standards: Recommendations for Meeting California Legal Requirements”. California: University of California, Davis: School of Veterinary Medicine: Center for Food Animal Health, Davis, CA.

Tessmann, S. 1980. Environmental Use Sector Reconnaissance Elements of the Western Dakotas Region of South Dakota Study: Environmental assessment: Technical Appendix E. South Dakota: South Dakota State University: Water Resources Institute. 1980. Brookings, SD.

Tolley, D., Floglia, L., and T. Harter. 2019. “Sensitivity Analysis and Calibration of an Integrated Hydrologic Model in an Irrigated Agricultural Basin With a Groundwater-Dependent Ecosystem.” In *Water Resources Research, 55*, p. 7876-7901.

Tractor Supply Company. 2021. “Livestock Waters and Tanks”. Accessed August 10, 2021 at: https://www.tractorsupply.com/tsc/catalog/livestock-waterers-tanks

Trihey & Associates, Inc. 1996. “Instream Flow Requirements for Tribal Trust Species in the Klamath River”. Prepared by Trihey & Associates, Inc., Concord, CA for the Yurok Tribe, Eureka, CA.

UC Davis. 2023. “Groundwater in Working Landscapes – Nora S. Gustavsson Endowed Professorship & Cooperative Extension: Scott Valley”. California: University of California, Davis: Agriculture and Natural Resources. Website. Accessed: October 24, 2023. URL: https://groundwater.ucanr.edu/Research/ScottValley/

United States Department of Fish and Wildlife (USFWS). 2013. “Study Plan to Assess Shasta River Salmon and Steelhead Recovery Needs”. Prepared by Shasta Valley Resource Conservation District and McBain & Trush, Inc. United States: Department of the Interior: Department of Fish and Wildlife.

United States Geological Survey (USGS). 2023a. “Scott River near Fort Jones, CA – 11519500”. Website. United States: Department of the Interior: Geological Survey. Accessed December 2023. URL: https://waterdata.usgs.gov/monitoring-location/11519500/#parameterCode=00065&period=P7D&showMedian=true

USGS. 2023b. “Shasta River near Montague, CA – 1151700”. Website. United States: Department of the Interior: Geological Survey. Accessed December 2023. URL: https://waterdata.usgs.gov/monitoring-location/11517000/#parameterCode=00065&period=P7D&showMedian=true

USGS. 2023c. “Shasta River near Yreka, CA – 1151750”. Website. United States: Department of the Interior: Geological Survey. Accessed December 2023. URL: https://waterdata.usgs.gov/monitoring-location/11517500/#parameterCode=00065&period=P7D&showMedian=true

Watercourse Engineering. 2007. “Technical Memorandum: Year 2000 Unimpaired Shasta River Model Simulation for Flow and Water Temperature - Draft”. Prepared for California: Environmental Protection Agency: North Coast Regional Water Quality Control Board, Santa Rosa, California.

Western Resource Strategies LLC. Transmitted by personal communication by Jack Rice. July 12, 2021.

Williams, A.P., B.I. Cook, and J.E. Smerdon. 2022. “Rapid intensification of the emerging southwestern North American megadrought in 2020–2021”. Nature: Climate Change. 12. 232–234. URL: https://doi.org/10.1038/s41558-022-01290-z

Willis, A.D., Nichols, A.L., Jeffres, C.A., and Deas, M.L. 2013. “Water Resources Management Planning: Conceptual Framework and Case Study of the Shasta Basin”. Prepared for United States: Department of Commerce: National Ocean and Atmospheric Administration: National Fish and Wildlife Foundation, San Francisco, CA.

Wilson, R., Galdi, G., and Stevens, N. 2015. “Influence of Irrigation Cut-off Dates on Forage Production in Shasta Valley Pastures. Prepared by University of California Cooperative Extension, Yreka, CA for The Nature Conservancy, San Francisco, CA. Prepared by California: University of California Cooperative Extension, Yreka, CA.

Wilson, R., Galdi, G., and Stevens, N. 2020. “Influence of Irrigation Cut-off Dates on Forage Production in Shasta Valley Pastures”. Prepared for Nature Conservancy, San Francisco, CA.

Worth, D. 2022a. Decl. of Daniel Worth ISO State Water Resources Control Board Response to April 1, 2022 Chambers Order and Supplemental Opposition to Application of BSID for a TRO (CV CV 22-317). April 14, 2022.

Worth, D. 2022b. Decl. of Daniel Worth ISO State Water Board's Further Supplemental Response to Application of BSID for TRO (CV CV 22-317). May 2, 2022.

Worth, D. 2022c. Decl. of Daniel Worth ISO of Respondent State Water Resources Control Board's Response to BSID Supplemental Memorandum (CV CV 22-317). June 12, 2022.

Yokel, D. 2014. "Scott River Adult Coho Spawning Ground Surveys 2013-2014 Season" Prepared by Siskiyou Resource Conservation District for United States: Department of the Agriculture: Forest Service: Klamath National Forest. Siskiyou Resource Conservation District, Etna, CA.

ATTACHMENT 1. FISCAL IMPACT STATEMENT

Fiscal Effect on Local and State Government

The fiscal effects resulting from the proposed Emergency Regulation are the costs that would be incurred by state and local government agencies to respond to any requirements therein, pursuant to Government Code section 11346 et seq. This Fiscal Impact Statement has been prepared in accordance with State Administrative Manual 6600-6616.

The fiscal effects incurred by state and local government agencies as a result of the proposed Emergency Regulation include the following: (1) revenue losses for municipal water supply agencies, (2) revenue losses for non-municipal water supply agencies (water for agriculture), (3) state and county tax revenue losses, (4) reporting costs to complete and submit initial compliance certification forms and ongoing diversion reporting in response to a curtailment order, and (5) reporting costs to complete and submit the information required by an information order, including supporting documentation.

Fiscal effects were estimated for three different flow forecast scenarios for 2024: the expected-range scenario, extreme-drought scenario, and above-average scenario. These flows forecast scenarios are discussed in the next section, "Water Demand and Supply Data for Fiscal Impact Analysis".

The State Water Board estimates the total cost to all state and local agencies (including city, county, schools, and publicly owned water suppliers) due to the proposed Emergency Regulation as $1,377,940 for the expected-range scenario, $2,042,755 for the extreme-drought scenario, and $322,628 for the above-average scenario.

The total revenue loss for municipal water supply agencies is estimated to be $666,202 for the expected-range scenario, $846,218 for the extreme-drought scenario, and $249,471 for the above-average scenario. Total revenue losses for non-municipal water supply agencies are estimated to be $263,445 for the expected-range scenario, $485,550 for the extreme-drought scenario, and $6,630 for the above-average scenario. Total county and state agricultural tax revenue losses are estimated to be $391,713 for the expected-range scenario, $654,407 for the extreme-drought scenario, and $9,947 for the above-average scenario[1]. The total reporting costs for all state and local agencies to complete and submit initial compliance certification forms, ongoing diversion reporting for the curtailment order, and complete and submit the information

[1] Total revenue loss for agricultural crop sales is not a component of the fiscal analysis, but it was calculated in order to develop state and local tax revenue losses and was conservatively estimated to be $5,054,355 for the expected-range scenario, $8,443,953 for the extreme-drought scenario, and $128,341 for the above-average scenario. Please refer to the section below titled Siskiyou County and State Estimated Tax Revenue Loss for more information on how the revenue loss for agricultural crop sales was calculated.

required by an informational order is conservatively estimated to be $56,580, the same amount for each of the three scenarios.

Water Demand and Supply Data for Fiscal Impact Analysis

The State Water Board used the best available water supply and demand data to inform the fiscal impact statement as described below for the Scott River and Shasta River watersheds.

Scott River Watershed

The Scott River gage near Fort Jones (USGS gage no. 11519500) is about 21 miles upstream of the outlet of the Scott River watershed and represents the observed (impaired) flow of the watershed. Figure A shows forecasted impaired streamflow (i.e., with diversions) for 2024 for expected-range, extreme-drought, and above-average scenarios, the average of streamflow data from all the period of record, 1941-present, and the proposed emergency minimum flow requirements. Curtailment of diversions and LCSs are forecast as needed to achieve the proposed emergency minimum flow requirements during many months of 2024.

The National Weather Service (NWS, 2023) forecasts that there are equal chances of above or below average precipitation for most of the WY 2023-2024. Given this forecast, the best alternative for the expected flows of WY 2023-2024 could be the average of historical flows, as used in this document. However, two filters have been applied to select the historical years for the averaging process: 1) Only historical years after Water Year 1999-2000 are considered. It is assumed that the data of water years prior to WY 1999-2000, do not represent the current average flows, due to land use changes and climate change; and 2) to consider the effect of Fall baseflows on the annual hydrograph, only years with flows similar to the current November flow (latest available monthly data for this document calculation) are considered for averaging. This means that years with November flows much higher or much lower than the current November flows are excluded from averaging.

Therefore, in the expected-range scenario, daily streamflow data for every month of November from WY 1999-2000 to the present was evaluated. In eight selected WYs, monthly average streamflow was close to 77 cfs (this equals the average flow of November 2023) during the month of November. Daily average streamflow from all months in the eight selected WYs are plotted for the expected-range scenario case. All the WY lines are represented with the same color in Figure A. In the expected-range scenario, daily average streamflow is forecast to fall below the minimum flow requirements during August 2024 to November 2024 for most of those eight selected WYs.

In the extreme-drought scenario, daily average streamflow from WY 2020-2021 is assumed to occur again in WY 2023-2024. WY 2020-2021 was an extremely dry WY. In the extreme-drought scenario, daily average streamflow is forecast to fall below the

minimum flow requirements during January 2024, June 2024 to October 2024, and in December 2024.

Above-average scenario in this document means a year with above-average precipitation (which does not necessarily provide an above-average runoff). Therefore, the recent water year 2022-2023 with above average precipitation is considered as an alternative for the above-average scenario. In the above-average scenario, daily average streamflow from WY 2022-2023, a recent near-average WY, is assumed to occur again in WY 2023-2024. In the above-average scenario, daily average streamflow is forecast to exceed the minimum flow requirements, except during August 2024.

Table A shows the Scott River forecasted average daily impaired flows, the proposed drought emergency minimum flows, and the expected shortfall needed to meet the proposed drought emergency minimum flows for the period of January 2024 to December 2024, as calculated under the assumptions above. Shortfall is calculated as the difference between daily forecasted flows and the proposed drought emergency minimum flows and is reported as monthly averages of the daily calculations.

Table B compares the Scott River forecasted shortfall with reported water demand. Estimated surface water demand was calculated by combining information from the electronic Water Rights Information Management System (eWRIMS) database (SWRCB, 2023b) with information from the Scott River Adjudication (Siskiyou County Superior Court, 1980). After removing ineligible water right records (cancelled, inactive, pending, rejected, revoked, and state filing) from the eWRIMS data, the data were checked for duplicates, unit errors, and unrealistically high diversion values. The surface water demand is an average of WY 2017-2018 and WY 2019-2020 reported water use, which represents the two most recent dry water years with reported water use data.

The demand estimate for the dry years may result in over-estimating demands for the above-average and the expected-range scenarios, however, due to the lack of enough data about the annual demand variability in the watersheds, demand data is assumed to be a constant value for all scenarios.

Groundwater demand is based on land use estimations from the SVIHM developed by UC Davis (Foglia et al., 2018; Harter, 2021ab)

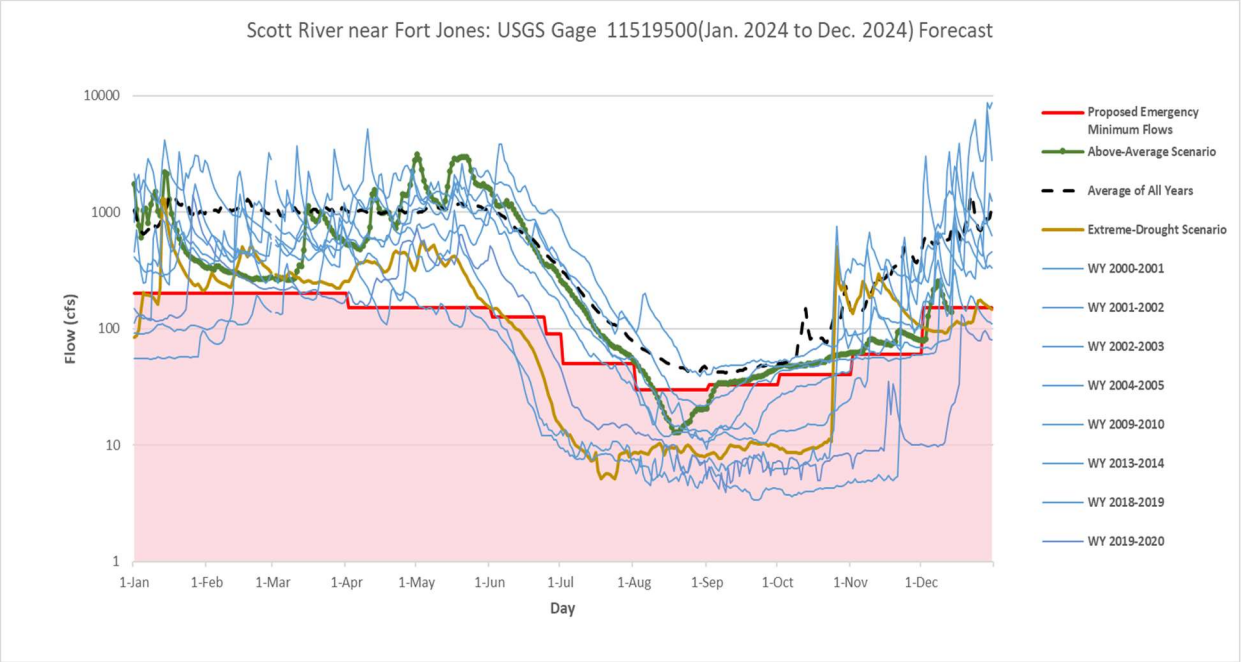


Figure A. Forecasted monthly average flow for Scott River gage near Fort Jones (USGS gage no. 11519500). Streamflow data source: USGS (2023a).

Table A. Average daily forecasted flow, proposed emergency minimum flows, and expected shortfall as Compared to proposed emergency minimum flows for period of January 2024 to December 2024 at USGS Scott River gage near Fort Jones (USGS gage no. 11519500). Forecasted shortfalls are calculated each day and then averaged for the month, and the forecasted flow is shown as a daily average for the month. Therefore, the difference between the monthly forecasted average daily flow and the drought emergency minimum flow does not always equal the average daily forecasted shortfall. In January for example, there is an average daily forecasted shortfall even though it looks like the average daily forecasted flows are greater than the drought emergency minimum flow. cfs = cubic feet per second.

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Emergency Minimum Flow (cfs)		200	200	200	150	150	125, 90[1]	50	30	33	40	60	150
Average Daily Forecasted Flow (cfs)	Expected-Range Value	627.8	533.4	614.6	775.2	821.3	525.9	89.7	23.8	18.3	44.4	135.7	801.6
	Extreme-Drought Scenario	349.3	336.6	258.0	367.0	343.7	78.7	8.3	9.0	9.5	64.6	180.8	118.6
	Above-Average Scenario	907.3	296.9	585.9	1104.6	1989.7	733.9	117.4	24.1	36.4	52.64	77.7	168.12-
Number of Shortfall Days	Expected-Range Value	31	28	12	5	22	30	31	31	30	31	30	31

	Extreme-Drought Scenario	10	0	0	0	0	24	31	31	30	31	30	31
	Above-Average Scenario	0	0	0	0	0	0	0	23	3	0	0	0
Average Daily Forecasted Shortfall (cfs)	Expected-Range Value	39.4	0.0	0.0	0.0	0.0	18.8	14.9	13.5	16.5	15.4	11.9	19.7
	Extreme-Drought Scenario	15.7	0.0	0.0	0.0	0.0	41.2	41.7	21.0	23.5	22.7	0.0	34.2
	Above-Average Scenario	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.5	0.0	0.0	0.0

[1] The drought minimum emergency flow is 125 cfs for the period of June 1-23, and it is 90 cfs for the period of June 24-31.

Table B. Scott River watershed demand compared to forecasted shortfall for January 2024 to December 2024 flows at USGS Scott River gage near Fort Jones (USGS gage no. 11519500). cfs = cubic feet per second.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Daily Forecasted Shortfall (cfs): Expected-Range Value	39.4	0.0	0.0	0.0	0.0	18.8	14.9	13.5	16.5	15.4	11.9	19.7
Average Daily Forecasted Shortfall (cfs): Extreme-Drought Scenario	15.7	0.0	0.0	0.0	0.0	41.2	41.7	21.0	23.5	22.7	0.0	34.2
Average Daily Forecasted Shortfall (cfs): Above-average Scenario	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.5	0.0	0.0	0.0
Average Daily Surface Demand[1] (cfs)	24	28	37	139	160	140	80	55	44	24	12	20
Average Daily Irrigation Groundwater Demand[2] (cfs)	0	0	5	51	114	185	197	170	32	8	0	0

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Daily Total Demand[3] (cfs)	24	28	42	190	274	325	277	225	76	32	12	20

[1] Total surface demand = average 2017-2018 and 2019-2020 reported water use from eWRIMS (SWRCB, 2023b) and Watermaster (2017b, 2021b) (this does not account for unreported surface water use);

[2] Land use-based irrigation groundwater demand from SVIHM;

[3] Total of surface and groundwater demands.

Curtailments may need to be higher than what can be estimated from available supply and demand information because of uncertainty related to reported and unreported surface water demand, streamflow depletion losses, and potential dry stream segments in some parts of the watershed and wet stream segments in other parts of the watershed. During approximately July through October in the Scott River watershed, curtailments have the potential to extend for adjudicated and overlying groundwater users. Groundwater demand is high throughout this time and water supply is limited because of low groundwater levels and the Scott River can be disconnected. Once the surface flows become disconnected, precipitation events are needed to reconnect with the river, meet the proposed minimum instream flow requirements; eventually provide flows needed to support salmon. Because surface water flows can go subsurface during the dry season when groundwater levels are low, there may be a need to curtail all priorities of surface water diversions and some or all water pumped by groundwater users to achieve the proposed emergency minimum flows. Based on experience with the emergency regulations in Wys 2021-2022 and 2022-2023, a full curtailment of surface water and groundwater diverters is needed most of the time when there is a shortfall in meeting emergency minimum flows in the Scott River watershed.

Shasta River Watershed

The USGS Shasta River gage near Yreka (USGS gage no. 11517500) is at the outlet of the Shasta River watershed and represents the impaired flow of the entire watershed. Figure B shows forecasted impaired streamflow (i.e., with diversions) for 2024 for expected-range, extreme-drought, and above-average scenarios, the average of streamflow data for the period of record, 1933-present, and the proposed emergency minimum flow requirements. Curtailment of diversions are forecasted as needed to achieve the proposed minimum flows during many months of the 2024.

In the expected-range scenario, due to the strong correlation between hydrologic conditions of Scott River and Shasta River watersheds, the same eight years selected for the Scott River watershed are used and analyzed for the Shasta River watershed. Daily average streamflow from all months in the eight WYs are plotted for the expected-range scenario case; all the WY lines are represented with the same color in Figure B. In the expected-range scenario, daily average streamflow is forecast to fall below the minimum flow requirements during mid-June 2024 to end of September 2024 for most of the selected WYs.

In the extreme-drought scenario (i.e., WY 2020-2021), daily average streamflow is forecast to fall below the minimum flow requirements during April 2024 to end of September 2024.

The above-average scenario in this document means a year with above-average precipitation (which does not necessarily provide above-average runoff). Therefore, the recent water year 2022-2023, which had above average precipitation, is considered the above-average scenario. In the above-average scenario, daily average streamflow from

WY 2022-2023 is assumed to occur again for WY 2023-2024. In the above-average scenario, daily average streamflow is forecast to fall below the minimum flow requirements during July 2024 to September 2024.

Table C shows the average daily forecasted flows, proposed emergency minimum flows, and the expected shortfall as compared to the proposed drought emergency minimum flows for the period of January 2024 through December 2024. Shortfall is calculated as the difference between the daily forecasted flows and the proposed emergency minimum flows and is reported as monthly averages of the daily calculations.

Table D compares the forecasted shortfall with reported water demand. Surface water demand was calculated by combining information from the eWRIMS database (SWRCB, 2023b), the Shasta River Adjudication (Siskiyou County Superior Court, 1932), and Watermaster (2017b, 2021b). Similar to the Scott River, surface water demand was calculated by removing ineligible water right records. This included removing rights that are labeled as cancelled, inactive, pending, rejected, revoked, and state filings from the eWRIMS data (SWRCB, 2023b). The data was then checked for duplicates, unit errors, and unrealistically high diversion values. The surface water demand is an average of WY 2017-2018 and WY 2019-2020 reported water use, which represents the two most recent dry water years with reported water use data. The adjudication data are from the annual Watermaster statements for the following eight streams under Watermaster service: Beaughan, Boles, Carrick, Parks, Jackson creeks, Little Shasta, Lower Shasta, and the Upper Shasta rivers (Watermaster, 2017b, 2021b). The water demand under the adjudication for Willow, Yreka, and Julian creeks and other miscellaneous springs, which do not have Watermaster service, was estimated based on the Shasta River Adjudication (Siskiyou County Superior Court, 1932). Estimated water demand for these streams was adjusted to reflect actual adjudicated water use instead of the full face-value of the decreed water rights, which are not representative of actual water use. As part of the Shasta Valley GSP development (Siskiyou County, 2022b), Larry Walker Associates and Davids Engineering modified the CDWR 2010 Land Use Maps (CDWR, 2023a) to reflect existing conditions and developed remote sensing-based estimates of crop evapotranspiration and applied water for fields in the Shasta River basin for 1989 to 2018 (Davids Engineering, 2020). Davids Engineering (2020) data were used to estimate groundwater demands.

Curtailments may need to be higher than what can be estimated from available supply and demand information because of uncertainty related to reported and unreported surface water demand, streamflow depletion losses, and potential dry stream segments in some parts of the watershed and wet stream segments in other parts of the watershed.

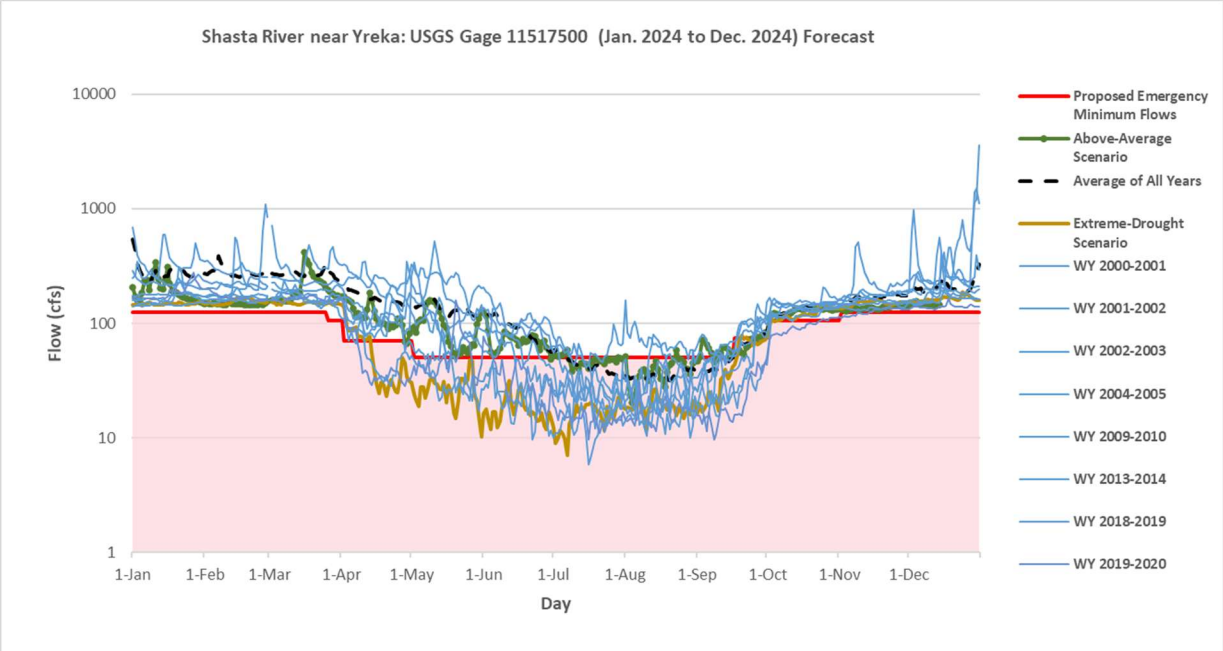


Figure B. Shasta River average daily impaired streamflow at Yreka gage (USGS gage no. 11517500) for forecast for January 2024 to December 2024. Streamflow data source: USGS (2023c).

Table C. Average daily forecasted flow, proposed emergency minimum flows, and expected shortfall as compared to proposed emergency minimum flows for period of January 2024 to December 2024 at USGS Shasta River gage near Yreka (USGS gage no. 11517500). Forecasted shortfalls are calculated each day and then averaged for the month and the forecasted flow is shown as a daily average for the month. Therefore, the difference between the monthly forecasted average daily flow and the drought emergency minimum flow does not always equal the average daily forecasted shortfall. For example, in November there is an average daily forecasted shortfall even though it looks like the average daily forecasted flows are greater than the proposed drought emergency minimum flows. cfs = cubic feet per second.

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drought Emergency Minimum Flow (cfs)		125	125	125, 105[1]	70	50	50	50	50	50, 75[2]	105	125	125
Average Daily Forecasted Flow (cfs)	Expected -Range Value	204.7	205.0	195.1	121.9	100.2	56.1	27.9	29.5	52.7	131.0	164.8	276.4
	Extreme-Drought Scenario	148.1	154.7	149.7	54.3	26.3	17.7	15.9	18.9	47.4	121.7	149.9	163.0
	Above-Average Scenario	200.6	148.0	208.3	115.2	96.5	69.6	47.6	38.6	62.8	128.39	137.13	147.15
Number of Shortfall Days	Expected -Range Value	0	0	0	24	31	30	31	31	30	22	13	0

	Extreme-Drought Scenario	0	0	0	18	31	30	31	31	27	2	0	0
	Above-Average Scenario	0	0	0	2	0	0	23	30	12	0	0	0
Average Daily Forecasted Shortfall (cfs)	Expected-Range Value	0.0	0.0	0.0	5.8	4.5	10.2	22.7	21.9	16.3	1.6	0.4	0.0
	Extreme-Drought Scenario	0.0	0.0	0.0	22.2	23.7	32.3	34.1	31.1	15.2	0.3	0.0	0.0
	Above-Average Scenario	0.0	0.0	0.0	0.1	0.0	0.0	3.0	11.6	4.7	0.0	0.0	0.0

[1] The drought minimum emergency flow is 125 cfs for the period of Mar 1-24, and it is 105 cfs for the period of Mar 25-31.

[2] The drought minimum emergency flow is 50 cfs for the period of Sept 1-15, and it is 75 cfs for the period of Sept 16-30.

Table D. Shasta River watershed demand compared to forecast shortfall for January 2024 to December 2024 at USGS Shasta River gage near Yreka (USGS gage no. 11517500). cfs = cubic feet per second.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Daily Forecasted Shortfall[1] (cfs): Expected-Range Value	0.0	0.0	0.0	5.8	4.5	10.2	22.7	21.9	16.3	1.6	0.4	0.0
Average Daily Forecasted Shortfall[1] (cfs): Extreme-Drought Scenario	0.0	0.0	0.0	22.2	23.7	32.3	34.1	31.1	15.2	0.3	0.0	0.0
Average Daily Forecasted Shortfall[1] (cfs): Above-Average Scenario	0.0	0.0	0.0	0.1	0.0	0.0	3.0	11.6	4.7	0.0	0.0	0.0

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Daily Surface Demand (cfs)[1]	100	98	248	364	354	307	232	200	207	114	88	112
Average Daily Ground-water Demand (cfs)[2]	4	11	9	21	62	98	109	102	98	65	36	4
Average Daily Total Demand (cfs)[3]	104	109	257	385	416	405	341	302	305	179	124	116

[1] Total surface demand = averaged 2017-2018 and 2019-2020 reported water use from eWRIMS (SWRCB, 2023b) and Watermaster (Watermaster 2017b, 2021b).

[2] Land use-based groundwater demand from Shasta Valley GSP development (Siskiyou County, 2022b).

[3] Total surface and groundwater demands.

Methodology for Estimating Projected Curtailments to Water Supply Agencies

Forecasted shortfall data were used as described above to estimate total potential curtailments volumes. To apportion the total forecasted curtailment volumes to specific water supply agencies, additional information was needed about the water rights priority system, including how the water suppliers fit into the priority system relative to other water rights and their water demands.

To estimate projected curtailments to specific water suppliers resulting from the proposed Emergency Regulation in the Scott and Shasta watersheds, the State Water Board also used CDWR groundwater well completion reports, Watermaster yearly narrative reports (2014-2017; e.g. Watermaster, 2014, 2016, 2017a) and the State Water Board's electronic Annual Report database (eAR) (SWRCB, 2023a).

Potential curtailments were estimated based on the forecasted water supply shortfall to meet the emergency minimum flows, and water rights priorities and related demand. For water right priority dates, the State Water Board used water right priority dates in the eWRIMS database (SWRCB, 2023b) and priority dates in the Watermaster Field Schedules notes for the Shasta Adjudication water rights (Siskiyou County Superior Court, 1932). For water rights in eWRIMS, the average of WY 2017-2018 and WY 2019-2020 reported water use was used to represent the forecasted demand, instead of face-values (SWRCB, 2023b). For Shasta Adjudication water rights without detailed reported water use, potential curtailments were estimated based on past curtailments as indicated in the Watermaster annual narrative reports (Watermaster, 2017b, 2021b).

Groundwater appropriations have a priority date from when the well was constructed or when water was first appropriated. For agencies that use groundwater and have more than one well, the latest well construction date was used as a priority date for the agency's groundwater appropriative water right. For example, if a public water supply agency has two wells with priority dates of May 15, 1985, and January 31, 1967, the later date of May 15, 1985 would be used as the priority date for the water supply agency's groundwater appropriative right to conservatively estimate potential curtailments for the fiscal analysis. For public municipal water suppliers, the monthly estimated water supply reductions are limited to maintaining the minimum human health and safety allowance of 55 gallons per capita per day (gpcd).

Revenue Losses for Agencies that provide Municipal Water Supplies

In addition to the water demand and supply data described above, the State Water Board also used data from the State Water Board's eAR database for information on the number of individuals served, amount of water supplied, and the water rate charged to customers (SWRCB, 2023a). Fifteen agencies supply drinking water in the Scott and Shasta watersheds. This section only analyzes suppliers whose primary function is as a municipal drinking water supplier that charge fees to customers for water use. The municipal water supply agencies that were analyzed are listed in Table E, below. A

fiscal analysis was not performed on the agencies listed in Table F because they do not sell municipal drinking water to customers. Based on individuals served and the indoor residential use standard of 55 gpcd, the State Water Board estimates municipal suppliers' minimum water demand for human health and safety in the Scott and Shasta watersheds to be 1,188 acre-feet. Based on the proposed Emergency Regulation, and accounting for minimum human health and safety needs, it is estimated that potential curtailments in the Scott and Shasta watersheds could reduce available water supply to municipal water suppliers by a total of 470 acre-feet in the expected-range scenario, 597 acre-feet in the extreme-drought scenario, and 176 acre-feet in the above-average scenario. See Table G below for shortages for individual municipal water suppliers.

The State Water Board used a conservative water rate estimate of $4.35 per 1000 gallons of water. According to the State Water Board's eAR database, this was the water rate for the City of Montague in 2022 and was the highest rate that a public water supply agency charged to residential customers in the Scott and Shasta watersheds (SWRCB, 2023a). The water rate was converted to $1417.45 per acre-feet of water to develop a cost estimate.

Municipal water systems included in this fiscal impact analysis serve a population of 19,109 individuals in the two watersheds. The public water systems not included in this analysis serve a population of 2,178 individuals. The estimated loss in revenue (income before expenses are subtracted) to municipal water suppliers from the proposed Emergency Regulation is estimated to be $666,202 ($1,417.45 per acre-feet of water multiplied by 470 acre-feet) for the expected-range scenario, $846,218 ($1,417.45 per acre-feet of water multiplied by 597 acre-feet) for the extreme-drought scenario, and $249,471 ($1,417.45 per acre-feet of water multiplied by 176 acre-feet) for the above-average scenario.

Table E. Public drinking water systems in Scott and Shasta watersheds included in fiscal impact analysis. Information provided from State Water Board's Division of Drinking Water electronic Annual Report database (SWRCB, 2023).

Watershed	Public Water System ID	Public Water System Name	2022 Number of Service Connections	2022 Population	Water Source
Shasta	CA4710011	City of Yreka	3,015	7,746	Surface water
Shasta	CA4710007	City of Montague	536	1,495	Surface water
Shasta	CA4710009	City of Weed	1,111	5,324	Surface water and groundwater
Shasta	CA4710013	Lake Shastina CSD	1,293	2,790	Groundwater
Shasta	CA4700523	Grenada Sanitary District	103	289	Groundwater
Scott	CA4710004	City of Etna	413	720	Surface water
Scott	CA4700503	Callahan Water District	31	70	Recycled water and surface water
Scott	CA4710003	Town of Fort Jones	347	675	Surface water and groundwater

Table F. Public drinking water systems not included in fiscal impact analysis in Scott and Shasta watersheds. Information provided from State Water Board's Division of Drinking Water electronic Annual Report database (SWRCB, 2023). AF = acre-feet; gpcd = gallons per capita per day.

Watershed	Public Water System ID	Public Water System Name	2022 Number of Service Connections	2022 Population	Water Source
Shasta	CA4700591	Delphic Elementary School	1	50	No record
Shasta	CA4700577	Big Springs Union Elementary School	1	95	No record
Shasta	CA4700521	Siskiyou County Service Area #5/Carrick	58	143	No record
Shasta	CA4700582	Gazelle School	1	60	No record
Shasta	CA4700559	Butteville Union School	1	165	No record
Shasta	CA4700557	California Department of Transportation: Weed Rest Stop	2	1,000	Groundwater
Shasta	CA4700558	California Department of Transportation: Grass Rest Stop	1	600	Groundwater
Scott	CA4710800	California Department of Forestry and Fire Protection: Deadwood Conservation Camp	13	65	Groundwater

Table G. Public drinking water systems in Scott and Shasta watersheds included in the fiscal impact analysis. Information provided from State Water Board's Division of Drinking Water electronic Annual Report database (SWRCB, 2023). AF = acre-feet; gpcd = gallons per capita per day.

Public Water System Name	Population	Water Source	Annual Total Demand[1] (AF)	Annual Health and Safety Demand[2](AF)	Estimated Water Supply Reduction (AF) - Expected-Range Value	Estimated Water Supply Reduction (AF) – Extreme-Drought Scenario	Estimated Water Supply Reduction (AF) – Above-Average Scenario
City of Etna	720	SW	213	44	72	116	0
Callahan Water District	70	SW	77	4	16	16	2
Town of Fort Jones	675	SW	184	42	82	82	37
City of Yreka	7,746	SW	2,182	482	0	48	0
City of Montague	1,495	SW	274	93	0	0	0
City of Weed	5,324	GW	232	331	19	19	10
Lake Shastina Community Services District	2,790	GW	717	174	267	278	122
Grenada Sanitary District	289	GW	66	18	14	38	5

[1] Annual (2020) total demand is used.

[2] Minimum human health and safety demand of 55 gpcd is used.

Minimum Revenue Losses for Agencies that provide Non-Municipal Water Supplies (primarily for agriculture)

Eight agencies provide water for agriculture or irrigation in the Scott and Shasta watersheds. Of these eight agencies, two agencies were not included in this fiscal impact analysis because they are not an irrigation supplier that charges fees to customers for water use. The agencies included in this fiscal impact analysis are listed in Table H. Agencies that were not included are listed in Table I.

The proposed Emergency Regulation would result in an unmet demand to non-municipal water suppliers from January 1, 2024, to December 31, 2024. The estimated unmet demand is as follows: 4,053 acre-feet for the expected-range scenario, 7,470 acre-feet for the extreme-drought scenario, and 102 acre-feet for the above-average scenario. A water sales price of $65 per acre-feet was used to calculate losses in water sales in the Scott and Shasta watersheds. State Water Board staff obtained this water sales price from Montague Water Conservation District (MWCD) staff. MWCD is an irrigation district located in the Shasta River watershed. MWCD staff provided two water sales prices, $65/per acre-feet for April to June 2023 and $59/per acre-feet for July to September 2023. The higher rate was used to calculate a conservative cost estimate. The estimated loss in water sales revenue for non-municipal water suppliers from the proposed Emergency Regulation is estimated to be $263,445 ($65 per acre-feet multiplied by 4,053 acre-feet) for the expected-range scenario, $485,550 ($65 per acre-feet multiplied by 7,470 acre-feet) for the extreme-drought scenario, and $6,630 ($65 per acre-foot multiplied by 102 acre-feet) for the above-average scenario. See Table J (Public Irrigation Systems in Scott and Shasta Watersheds Included in the Fiscal Impact Analysis) below for shortages for individual non-municipal water suppliers.

Table H. Public irrigation districts in Scott and Shasta watersheds evaluated in the fiscal impact analysis. For Diverters with multiple water rights of the same type and beneficial use group, the Face Values and Most Recent Reported Annual Diversions are summed. AF = acre-feet; cfs = cubic feet per second.

Basin	Public Water System Name	Beneficial Use (Permit Status)	Face Value or Adjudication	2020 Reported Annual Diversion (AF)	Water Source
Scott	Callahan Water District	Irrigation (License)	12.90 (AF)	0.42 (AF)	Surface Water
Scott	Scott Valley Irrigation District	Irrigation (License)	31,131 (AF)	7,844 (AF)	Surface Water
Shasta	Big Springs Irrigation District	Irrigation	30 cfs (summer)	N/A	Ground-water
Shasta	Greenhorn Water District	Irrigation (License)	15.00 (AF)	3.93 (AF)	Surface Water
Shasta	Greenhorn Water District	Irrigation (Claim)	N/A	0.00 (AF)	Surface Water
Shasta	Grenada Irrigation District	Irrigation (Adjudication/ License)	14,599 (AF)	3,252	Surface Water

Basin	Public Water System Name	Beneficial Use (Permit Status)	Face Value or Adjudication	2020 Reported Annual Diversion (AF)	Water Source
Shasta	Montague Water Conservation District	Irrigation (Adjudication/ Permit)	49,000 (AF)	22,683 (AF)	Surface Water
Shasta	Montague Water Conservation District	Domestic (Permit)	1,665 (AF)	247 (AF)	Surface Water
Shasta	Montague Water Conservation District	Irrigation (Claim)	N/A	246 (AF)	Surface Water

Table I. Public irrigation systems in Scott and Shasta watersheds were not evaluated in the fiscal impact analysis. AF = acre-feet.

Watershed	Public Water System Name	Beneficial Use (Permit Status)	Face Value or Adjudication (AF)	2020 Reported Annual Diversion (AF)	Water Source
Scott	California Department of Forestry and Fire Protection	Irrigation (License)	14.00	13.32	Surface Water
Scott	California Department of Forestry and Fire Protection: Deadwood Camp	Irrigation (License)	26.10	1.16	Surface Water
Shasta	California Department of Fish and Wildlife	Irrigation (License)	14,887	2,538	Surface Water
Shasta	California Department of Fish and Wildlife	Irrigation (Adjudication)	8,104	0	Surface Water

Table J. Public irrigation systems in Scott and Shasta watersheds included in the fiscal impact analysis.
AF = acre-feet

Watershed	Public Water System Name	Estimated Water Supply Reduction (AF)-Expected-Range Value	Estimated Water Supply Reduction (AF)-Extreme-Drought Scenario	Estimated Water Supply Reduction (AF)-Above-Average Scenario
Scott	Callahan Water District	18	48	0
Scott	Scott Valley Irrigation District	2,952	2,952	0
Shasta	Montague Water Conservation District	92	92	92
Shasta	Grenada Irrigation District	10	10	10
Shasta	Greenhorn Water District	1	3	0
Shasta	Big Springs Irrigation District	980	4,365	0

Siskiyou County and State Estimated Tax Revenue Loss

Potential Siskiyou County and state tax losses are based on the loss in sales taxes associated with a reduction in crop sales due to the proposed Emergency Regulation. The State Water Board used information from the following sources to calculate tax loss estimates: water rights data from the State Water Board's eWRIMS database (SWRCB, 2023b), Annual Statements of Diversion and Water Use for 2019 and 2020 from Watermaster (2021b), CDWR groundwater well completion reports, the State Water Board's eAR database (SWRCB, 2023a), CDWR 2021b), CDWR 2010 Land Use Maps (CDWR, 2023a), a land use and water use analysis conducted by Davids Engineering (2020), SVIHM (Foglia et al., 2018; Harter, 2021ab), Siskiyou County's 2020 Annual Crop and Livestock Report (Siskiyou County, 2022c), and the tax rate for the cities of Yreka and Dunsmuir, which have the highest tax rates in Siskiyou County) (CDTFA, 2023).

Potential sales tax losses were based on State Water Board calculations of the estimated annual reduction in water supply for agriculture, the estimated amount of crop acreage and yield affected by the reduction in water supply due to the proposed Emergency Regulation, the estimated crop value per acre, the resulting revenue loss from the affected crop acreage, and a 7.75% tax (0.5% local tax and 7.25% state tax) on the revenue loss from the affected crop acreage and yield. Table K (Siskiyou County and State Estimated Tax Revenue Loss) provides an overview of the calculations discussed below. The estimated reduction in agricultural irrigation supply due to proposed Emergency Regulation is 42,325 acre-feet of water for the expected-range scenario, 70,709 acre-feet for the extreme-drought scenario, and 1,076 acre-feet for the above-average scenario. These reductions represent a percent reduction in the agricultural water supply as follows: a 17.26 percent reduction in the expected-range scenario, a 28.84 percent reduction in the extreme-drought scenario, and a 0.44 percent reduction in the above-average scenario. The percentage reduction in water supply was multiplied by the total amount of acres of irrigated agriculture (71,638 acres) in the two watersheds to estimate the affected acreage and reduction in crop yield. The estimated reductions in crop yield acreage in 2024 due to the proposed Emergency Regulation is therefore estimated to be 12,366 acres for the expected-range scenario, 20,659 acres for the extreme-drought scenario, and 314 acres for the above-average scenario. The crop categories of Field Crops, Seed Crops, Vegetable Crops, Nursery Crops, and Organic Crops were used to calculate the total crop revenue in Siskiyou County ($303,093,761) and total crop acreage in Siskiyou County (741,542 acres) (Siskiyou County, 2023). Based on this information the average crop value per acre used in this analysis was calculated as $408.73. The loss in crop sales revenue in 2024 in the Scott and Shasta River watersheds is estimated to be $ 5,054,355 for the expected-range scenario, $ 8,443,953 for the extreme-drought scenario, and $ 128,341 for the above-average scenario. This results in the following estimated losses in tax revenue for Siskiyou County: $ 25,272 for the expected-range scenario, $ 42,220 for the extreme-drought scenario, and $642 for the above-average scenario. The estimated losses in

state tax revenue would be: $ 366,441 for the expected-range scenario, $ 612,187 for the extreme-drought scenario, and $ 9,305 for the above-average scenario.

Table K. Siskiyou County and state estimated tax revenue loss due to the proposed Emergency Regulation. AF = acre-feet

Estimates	January through December 2024 Expected-Range scenario	January through December 2024 Extreme-Drought Scenario	January through December 2024 Above-Average Scenario
Estimated Agricultural Irrigation Demand	245,192 AF	245,192 AF	245,192 AF
Estimated Reduction in Agricultural Irrigation Supply due to proposed Emergency Regulation	42,325 AF	70,709 AF	1,076 AF
Estimated amount of crop acreage affected by reduction in water supply due to proposed Emergency Regulation	12,366 acres	20,659 acres	314 acres
Estimated crop value per acre	$408.73	$408.73	$408.73
Estimated revenue loss from the affected crop acreage	$5,054,355	$8,443,953	$128,341

Tax Losses to Siskiyou County and the State 7.75% tax rate.	$391,713	$654,407	$9,947

Fiscal Costs of Reporting Requirements for State and Local Agencies

The State Water Board expects there will be fiscal impacts on public agencies due to the costs of reporting and self-certification requirements, under the proposed Emergency Regulation. There are three potential reporting costs to local agencies: (1) the costs associated with submittal of the initial compliance certification, which all public agency right holders in the Scott and Shasta watersheds must complete upon being issued a curtailment order per proposed section 875.6, (2) the costs for public right holders to complete required reporting when continuing to divert for non-consumptive uses (proposed section 875.1), minimum health and safety needs (proposed section 875.2), and livestock needs (proposed section 875.3), and (3) the costs associated with completion and submittal of the information required by an information order issued pursuant to proposed section 875.8, including supporting documentation.

For the proposed Emergency Regulation, the State Water Board identified three (3) state agencies, fifteen (15) local agencies, and five (5) schools in the Scott and Shasta watersheds that may be required to submit reports. In this analysis, the fiscal impacts are estimated on reporting for these agencies and schools.

To conservatively estimate the cost of the proposed Emergency Regulation, the State Water Board multiplied the total number of local and state government agencies and schools in the two watersheds by the total average time to complete all three reporting tasks, and then multiplied by an estimated staff cost per hour. The estimated amount of time required to complete the forms will depend on whether each entity already has documentation regarding its diversion and use, or if the entity will need to obtain such information. The State Water Board estimates that completion of its initial compliance curtailment certification would take one hour. It is estimated that the total time for each state agency, local agency, or school to complete the regular reporting would be 1.5 hours per report and the reporting frequency is monthly for 12 months for a total of 18 hours per agency. The State Water Board estimates that the total time to complete and submit information required by an information order will be 6 to 25 hours (between 5 to 24 hours to collect the requested documentation plus one hour to fill out the form and submit the data). Inasmuch as agencies are required to exercise due diligence prior to using public funds to purchase property, it is estimated that at least half of the agencies will have partial or complete records. The remaining agencies will likely have incomplete records. Thus, the average time is expected to be 15.5 hours to gather and submit the information for the information order. The State Water Board has used a conservative estimate of $67 per hour (hourly rate includes wages plus retirement and health care benefits) for local agency and school staff time, representing a Deputy Director position in Siskiyou County. A conservative estimate of $100 per hour (hourly rate includes wages plus retirement and health care benefits) was used for state government staff time, representing an Environmental Program Manager I position. The hourly rate information for these estimates was based on 2019 records from the California State Controller's Government Compensation in California database for local and state agencies.

Using the values above, the estimated cost to state agencies is $10,350, local agencies is $34,673, and schools is $11,558. The estimated costs are calculated as follows: the total number of state agencies (3), local agencies (15), or schools (5) affected by the emergency drought regulation multiplied by the amount of time to complete the reporting tasks of 34.5 hours (1 hour for initial compliance certification, 18 hours for monthly reporting for any exceptions claimed for human health and safety, livestock, or non-consumptive uses, and 15.5 hours to gather and submit the information for the information order) multiplied by the staff pay rate. This results in a total cost to local and state agencies of $56,580 due to the proposed Emergency Regulation. The cost is the same for all three scenarios.

References contained in the Fiscal Impact Statement are listed within the Information Relied Upon section of the Finding of Emergency and Informative Digest.