Russian River Frost Program

November 10, 2009

Via Email Only
commentletters@waterboards.ca.gov

RECEIVED
NOV 10 2009
SWRCB EXECUTIVE

State Water Resources Control Board
P.O. Box 2000
Sacramento, CA 95812

Re: ***11/18/09 Russian River Frost Protection Workshop***

Dear Chair Hoppin and Members of the Board:

This letter presents for your consideration the Russian River Frost Program, a coordinated effort by water users in the Russian River watershed to manage the diversion and use of water for frost protection. This program responds to the State Water Board's request at the April 7, 2009 workshop for a stakeholder solution to frost control issues.

As the culmination of much work by individual landowners, Mendocino County Farm Bureau, Russian River Flood Control and Water Conservation Improvement District, California Land Stewardship Institute, and Sonoma County Farm Bureau, the Russian River Frost Program ("Frost Program") brings together the existing frost protection efforts in both Mendocino and Sonoma Counties. By joining the Mendocino County effort, known as the Upper Russian Rive Stewardship Alliance ("URSA"), and the Sonoma County effort, the Middle Russian River Stewardship Alliance ("MRSA"), into a single plan, the Frost Program provides a more efficient and comprehensive approach to frost protection in the Russian River watershed while also allowing the necessary flexibility to implement that program in areas with distinct needs.

The Program is a practical and straightforward approach to reduce the impact on stream flows from diversions for frost protection by implementing conservation actions (projects that reduce the volume of water used for frost control and change the ways that frost water is obtained) in order to reduce instantaneous demand and prevent acute reductions is stream flow. This will ensure that the Endangered Species Act ("ESA") is not violated. Quite simply, the purpose is to sustain agriculture by protecting fish.

This grassroots, cooperative approach has already resulted in immediate and real improvements. Under this Frost Program, both episodes of alleged frost diversion-related stranding mortality referred to in the National Marine Fisheries Service ("NMFS") February 2009 letter to the State Water Board have been resolved and actions are being taken to prevent similar problems from recurring in the future, some off stream ponds to reduce water diversion rates have already been constructed, alternative water sources are being developed, and BMPs are being implemented. As the program continues to implement these and other conservation actions, it will ensure the continued sustainability of fish and farms; recognizing that the prosperity of each, and that of our communities, is intertwined.

Frost Program Management and Participation

The Frost Program is managed by the Russian River Frost Program Steering Committee, which is comprised of:

- Mendocino County Farm Bureau – *Devon Jones*
- Fetzer Vineyards – *David Koball*
- Sonoma County Farm Bureau – *Lex McCorvey*
- Rodney Strong Vineyards – *Doug McIlroy*
- Silverado Premier Properties – *Pete Opatz*
- Russian River Flood Control – *Sean White*
- California Land Stewardship Institute – *Laurel Marcus*

Landowner participation in the Frost Program is most appropriately measured in terms of the participation necessary to resolve identified problems. As demonstrated in the included URSA and MRSA implementation plans, participation has been sufficient to resolve frost diversion contributions in all known instances of stranding. Participation in the implementation plans will grow substantially through outreach efforts this winter.

Through outreach efforts, conducted through the wine commissions of the two counties which are not voluntary organizations, 100% of the growers will be informed as to their responsibility to comply with the ESA. Growers will be made aware of the risks they assume by not participating in the Frost Program, and will understand through education, demonstration and organized events that non-participants will assume tremendous risks as individuals if they do not take action to address frost issues.

Background of the Frost Program

To explain the Frost Program, it is necessary to describe in some detail how and why it developed the way it has. Originating as a group of individuals responding to agency concerns, efforts to address frost protection have matured into the coordinated watershed-wide approach described herein.

In the past two years, very dry springs coincided with unusual cold snaps during a time when vineyards and orchards are particularly vulnerable to crop-destroying frost damage. In April of 2008, during this "perfect storm," NMFS discovered two episodes of stranding: one in Mendocino County on the mainstem of the Russian River near Hopland, and another in Sonoma County on Felta Creek.

In response to the events of 2008, and in anticipation of another cold dry spring in 2009, NMFS sent a letter to the State Water Board on February 19, 2009 expressing concern that diversions for frost water could again contribute to salmonid stranding. To address the concerns raised by this letter, the State Water Board held a workshop in April to look into the issue. At the Board's direction, water users set to work to develop a plan, now formalized as the Russian River Frost Program, to resolve the episodes that occurred and to prevent future such occurrences.

While the Frost Program presented here is a single plan for the entire Russian River watershed, it did not begin as such. The original water user response was a Mendocino County plan presented by URSA to NMFS' Frost Protection Task Force in 2008. Sonoma growers were not invited to the Task Force until early 2009 and accordingly development of the Sonoma County plan has trailed the Mendocino efforts. The Mendocino and Sonoma implementation plans were initially developed independently because the climate, geology, infrastructure, and hydrology are sufficiently different between the upper and middle portions of the Russian River watershed and these differences mandate unique solutions.

As grower led efforts progressed, however, it became evident that the best way to deal with frost water diversion issues was with a single program implemented in each reach by the respective local group. The uniform structure and single Science Advisory Group of the Frost Program provide for efficiency and uniformity while implementation plans tailored to local conditions allow for appropriate focus on the mainstem issues that dominate the upper part of the watershed and the tributary issues that are the primary concern in the middle watershed.

The Unexpected Incidents of 2008 Will Not Recur

It is important to recognize that the concerns raised by NMFS' February 19, 2009 letter were acute problems in discrete locations that occurred unexpectedly during an unusually cold and dry spring. While the importance of these episodes is not to be understated, these two occurrences do not support the generalization that stranding is a chronic problem occurring every year throughout the entire Russian River watershed. As is demonstrated in the attached Frost Program documents, the majority of the past 20 years were not as critically cold and dry as 2008 and 2009, thereby showing that the climactic combination that coincided with the strandings rarely exists. Furthermore, because the Russian River watershed is so varied, it cannot be assumed that because strandings occurred near Hopland and on Felta Creek, similar problems occur throughout the watershed. Now that the conditions potentially contributing to stranding have been identified and appropriate conservation actions have been identified, the Frost Program will work to ensure that these problems do not recur.

Effectiveness Monitoring and Independent Science are Foundations of the Frost Program

This program uses a watershed based approach to monitoring directed by an independent Science Advisory Group. Watershed based monitoring will examine a variety of factors affecting stream flows including factors other than diversions for frost protection. Focused monitoring will therefore allow the Frost Program to direct its conservation actions to provide the greatest benefit to stream flow. Alternatively, the 'command and control' regulation of individual frost diversions proposed by NMFS will inevitably miss these critical linkages. The Program's systematic science-based approach is the only method which will actually benefit the fish.

The decisions about what factors to investigate and monitor, and selection of protocols for conducting such inquiries, are critically important for the success and scientific validity of the Frost Program. Accordingly, an independent Science Advisory Group will provide advice to the Frost Program on these critical issues. Hydrologic data sets require qualified professionals to review and interpret their meaning typically with an entire range of other hydrologic and geologic data. Analyses based on one data set will be incomplete and unreliable. Additionally, farmers must be comfortable providing information to the Frost Program. This cannot happen if people feel that this information will put their livelihoods at risk. The Science Advisory Group will both inform the Frost Program as to the reliability of the data collected and give participants comfort that the science is objective.

Proactive Resource Management–not Regulation–is the Solution

While much attention has been paid to whether the Board should regulate direct diversions for frost protection, such a regulation is neither necessary nor appropriate. Any Water Board regulation will redirect resources from the most meaningful real world improvements of the Frost Program to the cost of compliance with the regulation. The ESA already prohibits the take of endangered species and dictates enforcement; the Frost Program will enable growers to comply with the ESA, negating the need for further regulation. A ban on the use of direct diversion for frost protection will cause economic ruin for farm families and the communities that support them, while the adoption of the proposed Frost Program as a solution will enable the continued survival of both fish and farmers.

Conclusion

This Russian River Frost Program recognizes that while a single plan for the entire Russian River watershed is the most appropriate and efficient way to make improvements, both the problems and the solutions vary significantly between the upper and middle parts of the watershed. Consequently, separate implementation plans have been prepared for these two regions.

The three documents included with this letter explain the Russian River Frost Program and how it will be implemented. First is a description of the overarching Russian River Frost Program explaining the principles of the program and describing how it will be implemented through its regional constituents. The second attachment, "Russian River Frost Control Program – Upper Russian River, Mendocino County," describes the URSA implementation plan. The third attachment is the implementation plan for the Middle Russian River operated by the Sonoma County Farm Bureau Frost Subcommittee.

As indicated earlier, the joining of the upper and middle plans is a relatively recent development. Consequently, the attachments describing the upper watershed implementation plan and middle watershed implementation plan are not as completely integrated as they ultimately will be. These implementation plans are being revised and may undergo further development and integration before the 2010 frost season.

Thank you for your consideration.

Sincerely,

Devon Jones
Mendocino County Farm Bureau

David Koball
Fetzer Vineyards

Lex McCorvey
Sonoma County Farm Bureau

Doug McIlroy
Rodney Strong Vineyards

Pete Opatz
Silverado Premier Properties

Sean White
Russian River Flood Control

Laurel Marcus
California Land Stewardship Institute

Russian River Frost Program

Overview

The Russian River Frost Program provides a general framework to address frost protection issues and for the coordination of the frost protection plans being implemented in the upper part of the Russian River watershed by the Upper Russian River Stewardship Alliance ("URSA"), and in the middle part of the watershed by the Sonoma County Farm Bureau Frost Subcommittee ("MRSA"). A more detailed description of how the Frost Program is implemented is in the following URSA and MRSA implementation plans.

General Principles

Problem: Stranding of salmonids on Felta Creek and on the main stem of the Russian River near Hopland.

Objective: Prevent to the extent possible additional occurrences of stranding at the two locations it occurred and generally reduce the acute effects on stream flow from direct diversions for frost protection throughout the Russian River watershed.

Approach: Implement conservation actions to reduce the demand for water for frost protection and reduce instantaneous diversion rates.

How it works

The Russian River Frost Program improves the diversion and use of water for frost protection by working with diverters and agencies to learn about frost water use and watershed conditions, and then implementing conservation actions that improve the management and infrastructure for the purposes of reducing overall frost water use and reducing instantaneous demand. The implementation of this strategy, while described in greater detail in the implementation plans, can generally be explained by the following four components: Outreach, Watershed Assessment, Conservation Actions, and Program Coordination and Analysis.

Outreach: Contact farmers that divert water for frost protection and educate them about the Program. Have stakeholder meetings and annual program updates before and after frost season.

Watershed Assessments: Assess sub-watersheds to determine where conservation actions would be most beneficial.

- Focus on watersheds agencies have identified.
- Collect land use information.
- Work with Scientific Advisory Group to determine priorities for locations and types of monitoring and Conservation Actions.
- Stream Flow Monitoring – Identify existing gages and install additional gages where appropriate.

Conservation Actions: The goal is to reduce the potential for conflict between diversions for frost protection and fishery resources. This will be done by reducing the instantaneous diversion rates through implementing the following actions where appropriate:

- *Frost Protection BMPs* – Reduce the total instantaneous demand for frost water through BMP implementation. BMPs were developed and are being field tested in October/November 2009.
- *Infrastructure Improvements* – Reconfigure or construct infrastructure necessary to reduce instantaneous diversion rates. Typical infrastructure improvements include: constructing off stream ponds, revising pumping and piping systems to remove large pumps from waterways, drilling wells, and use of recycled water.
- *Diversion Coordination* – Work with water users to coordinate diversions and releases in order to minimize the chance of fish stranding due to diversions for frost protection.
- *Frost Forecasting* – An important part of improving frost water diversion and use management is improving the quality of and access to frost forecasts.

Program Coordination and Analysis: On an ongoing basis:

- *Annual Frost Program Reporting* – Annual reports on the effectiveness of the Frost Program will be provided to the SWRCB, NMFS, and CDFG.
- *Agency Coordination* – There will be ongoing communications with the agencies regarding particular tributaries of concern, fish planting scheduling, and other possible areas for improvement. There will be at least one meeting before frost season and one after frost season to exchange information.
- *Adaptive Management*: Changes will be made to the Program based upon information and recommendations from participants, agencies, and the Science Advisory Group.

Science Advisory Group: The Science Advisory Group, further described in the URSA implementation plan, will provide objective guidance for the Frost Program. This will include:

- Articulate conceptual models of stream flow processes, differentiating between geomorphic settings and geographic areas of the Russian River watershed.
- Review the existing evidence and research, identify data gaps, and recommend methodology to resolve data gaps.
- Recommend necessary monitoring to provide a basis for determining changes in water management to assure adequate instream flows.
- Review Watershed Analysis
- Review Annual Report

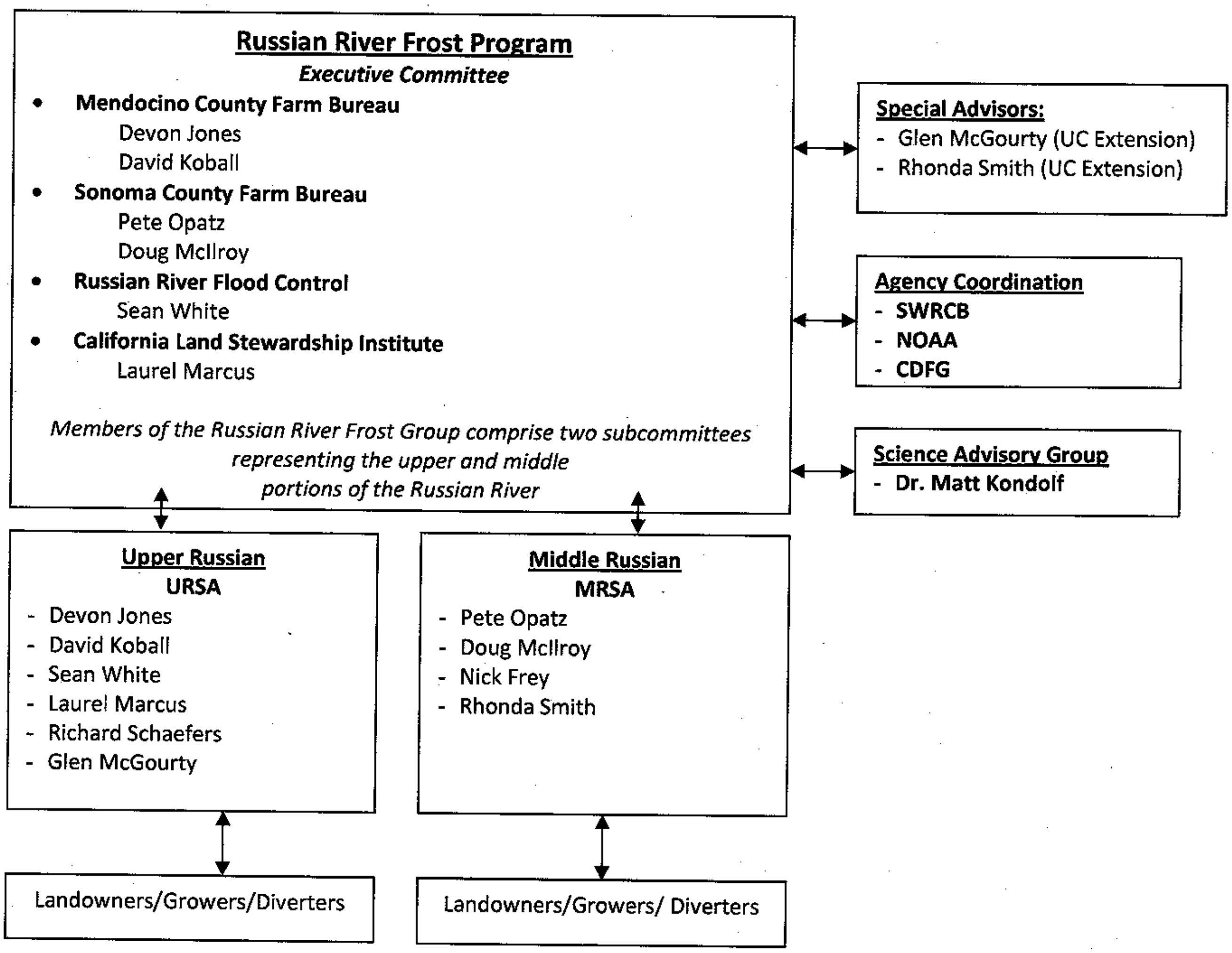
The Russian River Frost Program

Management

The Russian River Frost Program Executive Committee will manage the Frost Program. Comprised of individuals from URSA and MRSA, This group will comprise two sub-committees representing the upper and middle reaches of the Russian River, and will implement the Russian River Frost Program in their respective regions.

- **URSA** (Upper Russian Sustainability Association) – This committee consists of organizations and landowners in Mendocino County, and will implement the Program in the upper Russian River.
- **MRSA** (Sonoma County Farm Bureau Frost Subcommittee) – Consists of Sonoma County Farm Bureau board members and vineyard representatives from the Russian River watershed within Sonoma County.

The following organizational chart graphically represents the Russian River Frost Program management.



RUSSIAN RIVER FROST CONTROL PROGRAM

UPPER RUSSIAN RIVER, MENDOCINO COUNTY

UPPER RUSSIAN RIVER STEWARDSHIP ALLIANCE

NOVEMBER 2009

I. INTRODUCTION

The National Marine Fisheries Service (NMFS) has requested a written action plan to address the stranding of fish which occurred in April 2008 on the Russian River near Hopland. Through the formation of a Frost Task Force, a number of organizations have been meeting with NMFS, Ca. Department of Fish and Game (CDFG), and the State Water Resources Control Board Water Rights Division (WRD) regarding this event. This document describes short- and long-term measures to change water management in Mendocino County or the Upper Russian River (Figure 1). This document addresses the three requirements identified by NMFS: conservation actions, effective monitoring and transparency. A similar document has been submitted for the Middle Russian River in Sonoma County. Taken together, these documents comprise the Russian River Frost Program.

II. PROBLEM STATEMENT

In the spring of 2008, the Russian River was in a second year of drought with minimal releases from Coyote Dam. March 2008 was the driest March on record with no rainfall. Freezing temperatures occurred on 20 nights in late March and early April, requiring frost control measures to protect new growth on grapevines in low-lying valley areas. The 2008 frost season was the worst frost season in over 30 years. Typical frost events are radiation frosts where cold air sinks to low-lying areas and these areas are subject to frost damage. Advective frost events occur when a large air mass with freezing temperatures moves into a valley and frost damage occurs both in low-lying areas and on hillsides. Ukiah and Hopland Valleys are subject to severe frost temperatures of 27°F.

The use of water for frost control is one of the only effective methods for protecting vineyards. Passive measures such as mowing cover crops or applying anti-bacterial sprays are used, but these measures are only effective on reducing the volume of water used by allowing a slightly later turn-on time for sprinkler systems. During a frost event, low temperature conditions occur throughout the Upper Russian region such that water is turned on in numerous locations simultaneously, creating a large instantaneous water demand.

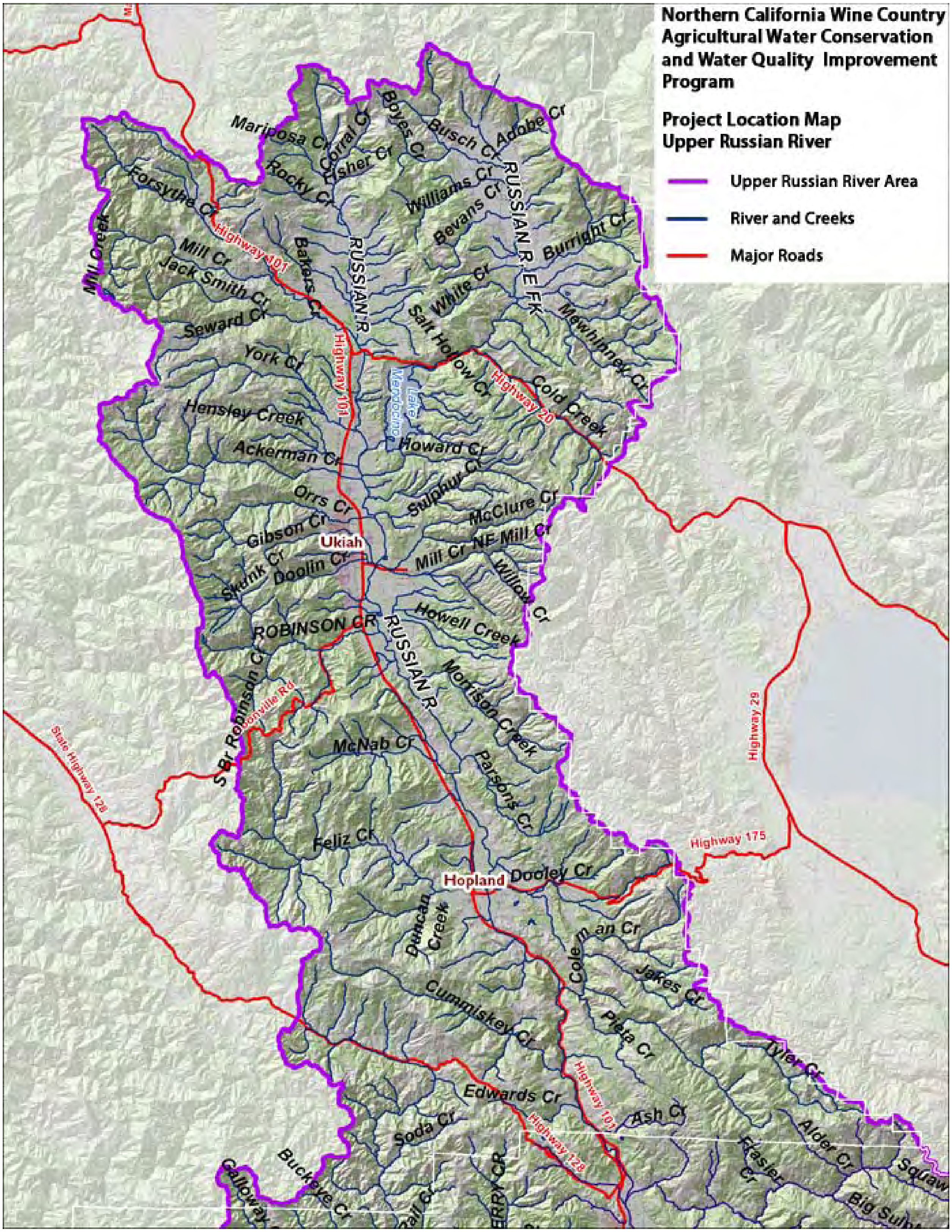


Figure 1 Upper Russian River Watershed

In a year with average rainfall, Upper Russian River flows during the frost protection season (March 15 to May 15) range from 500 to several thousand cubic feet per second (cfs) (Exhibit 3). During spring 2008, instream flows averaged slightly above 200 cfs. On April 20, 2008, an advective frost event occurred and an instantaneous drawdown of 83 cfs was recorded at the Hopland USGS gage, reducing flows below 180 cfs. This drawdown caused a two-inch drop in river stage. NMFS found that this sudden drop stranded juvenile steelhead trout, causing a “take” of this threatened species.

Direct diversion from the Russian River channel is the primary source of water for vineyard frost control in the Upper Russian River. Lake Mendocino, a large reservoir on the Russian River, impounds up to 122,400 ac.-ft. of water and releases water into the river. Since stream flow is typically high in the spring frost period (Exhibit 3), direct diversion is a reasonable system of water diversion in most years. Most diverters have several different types of water rights—appropriative, riparian, and water purchased from the Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC). Typically, these water rights do not require off-stream storage.

The combination of extreme frost, very low rainfall and runoff, and low water releases from the Coyote Dam resulted in the stranding or “take” of threatened steelhead trout on the Upper Russian River in April 2008. This event was the result of cumulative direct water diversions along the mainstem Russian River and will require changes to diversions to avoid future instances of fish stranding during dry years. The Upper Russian River Stewardship Alliance (URSA) has developed a series of Conservation Actions that address the effects of this instantaneous demand thru improved monitoring and coordination as well as demand management and minimization.

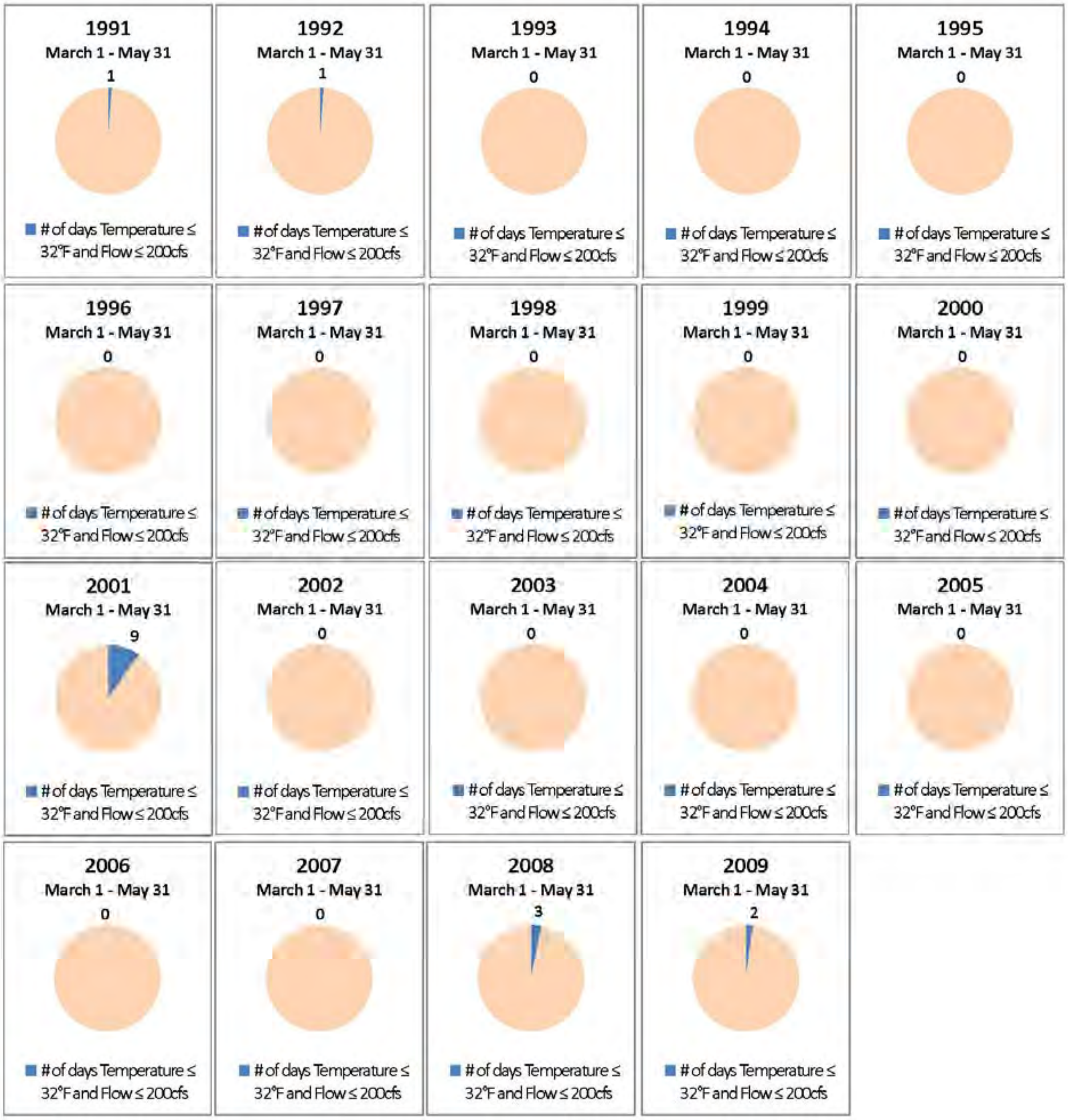
The Frequency of Low River Flow and Freezing Temperatures Occurring Together

The spring 2008 fish stranding incident occurred from two simultaneous conditions – very low flows in the Russian River due to drought conditions and limited water released from Coyote Dam; and extreme frost temperatures. A review of the frequency with which these two conditions occur simultaneously provides an indication of how often fish may be affected by frost operations on the Upper Russian River.

Stream gage data from the USGS Hopland gage (11462500) and the East Fork Russian River near Ukiah (11462000) were plotted against air temperature data from CIMIS Station 106 in Sanel Valley (Hopland).

11/9/2009

Number of Days Flow on Russian River near Hopland ≤ 200 cfs and Air Temperature at Sanel Valley ≤ 32°F



Notes:
Flow data for USGS 11462500 Russian River near Hopland per U.S. Geological Survey.
Air temperature data for Station #106 Sanel Valley FS per California Irrigation Management Information System (CIMIS).
The number of days with freezing temperatures but higher flow levels is not indicated.

SWRCBH014.xls, Sanel Valley (Pie Charts)

Figure 2

An air temperature of 32° F was used as an indicator of a day when frost control would be required. Then, the frequency of days with a 32° F air temperature and stream flow of less than 200 cfs were required. The flow level of 200 cfs was chosen as being low enough to potentially affect fish. The total number of days where these two conditions both occurred was then compared to the total number of days in the spring frost period of March 1 to May 31 in a series of pie charts for the 1991-2009 period (Figure 2). The incidence of these two conditions – freezing temperatures and low stream flow was relatively low over a 19 year period occurring in only 5 years. In most of these 5 years, there were 1-3 days with both conditions. 2001 had the highest number of days where both conditions occurred, with 9 total days. It is important to note that there are no stream flow gaging records that cover the past 20 years to complete the analysis for a tributary in the upper Russian River watershed.

This analysis demonstrates that for the Upper Russian River, the likelihood of occurrence of stranding of juvenile salmonids from frost control is minimal. However, any stranding, or 'take', of listed species is unlawful and unacceptable and a program of improvements to completely eliminate stranding is needed.

Status and Distribution of Salmonids in the Upper Russian River

Two species of salmonids, Chinook salmon and steelhead trout, inhabit the Upper Russian River and its tributaries. Both species are anadromous using both fresh and salt water habitats. Exhibit 4 describes the current understanding of the status of each species in the Upper Russian River.

Steelhead Trout *(Oncorhynchus mykiss)*

In the Upper Russian River, steelhead use both the river channel and tributaries for spawning and rearing. Adults enter the Russian River from the ocean in November or December after the first major rains, with the majority migrating from January to March. Steelhead adults spawn by laying eggs into the gravels of the stream where they will require cold and high quality water flows for the 4-6 week incubation period. After hatching, steelhead spend 1-4 years in the freshwater where they require cool water with adequate food and cover.

Steelhead trout are widely distributed in the Russian River, inhabiting major tributaries as well as the upper river channel from the Ukiah area through the river canyon at Squaw Rock.

There are no population estimates for steelhead trout but most experts agree that the abundance of this species has significantly declined over the past 50 years. The species is listed as threatened under the Federal Endangered Species Act for the Russian River Watershed.

Chinook salmon *(Oncorhynchus tshawytscha)*

Chinook salmon enter the Russian River as early as August if conditions allow, and most spawning occurs in January. The main stem of the river and most downstream reaches of the large tributaries are typically used by spawning adults. Adults die after spawning. Young salmon emerge in the spring and migrate to the mainstem and estuary where they may remain until late spring or summer. In the estuary, the young fish acclimate to salt water and soon head out to the ocean where they will stay for the next 1-5 years before returning to their natal stream to spawn.

Studies by the Sonoma County Water Agency of Chinook salmon distribution found the highest abundance of salmon in the Upper Russian River and Dry Creek, near the dam outlets. In low water years, the distribution shifted more to Squaw Rock Canyon and Alexander Valley. Annual Chinook counts at the Mirabel inflatable dam have recorded 1,400-6,100 adults.

Economic Concerns

The economy of the Upper Russian River area is primarily agricultural with wine grapes making up the biggest crop. A total loss of crop can occur in grapes and pears without frost protection. The Mendocino Agricultural Commissioner lists the value of the grape and pear crop in the Ukiah, Hopland and Redwood Valleys in 2007 as $67 million. Assuming that the value of wine is three times that of the grapes and if roughly 30% of the grape crop is processed in Mendocino County for wine then there would be an estimated economic loss of $45,559,500 experienced in the winery sector. In addition, for every dollar of pears or grapes lost, there will be an additional 1.8 dollars lost to the local economy. So $67 million x 1.8 = $120 million in additional economic loss. All together, the region could suffer an economic loss of approximately $235 million dollars annually if frost protection is not allowed.

In 2008, following the severe frost season, wine grape production was recorded at 45,779 tons for a total value of $62,047,200. When compared to the data from 2007, the 2008 tonnage was reduced by almost 16,000 tons with a total value difference of approximately $13 million. This economic data is available in the 2007 and 2008 Mendocino County Crop Report.

URSA has developed a series of Conservation Actions using improved monitoring and coordination as well as demand management and minimization that have significantly reduced the instantaneous direct diversion of water from the Upper Russian River for frost control. The cooperation of the URSA member organizations and individual diverters has achieved the changes that are necessary to prevent the future stranding of listed species during low water years. The presence of Lake Mendocino and the ability to closely monitor and manage water releases is a key factor in solving the problem on the Upper Russian River.

III GOALS AND APPROACH

The principal goal of this program is to reduce any acute effects on stream flow from direct diversions during frost periods through two means: reducing the demand for water for frost protection (e.g., BMPs) and changing the manner of diversion (e.g., shift from direct diversion from streams to diversion by well or to offstream storage). This program is being developed to satisfy NMFS' three standards for success for the Frost Protection Task Force: conservation actions, effective monitoring, and transparency.

IV. ORGANIZATIONAL STRUCTURE

Following the April 2008 fish stranding, a number of organizations began holding regular meetings in Mendocino County to prepare a strategy to address this event. These organizations included: Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC), California Land Stewardship Institute (CLSI), Mendocino County Farm Bureau (MCFB), Mendocino Wine & Grape Commission, UC Cooperative Extension, Redwood Valley County Water District, and Mendocino County. Meetings were organized by the Mendocino County Farm Bureau. General grower meetings were also held regularly to assure input and communication directly from farmers. The topics of the meetings were: development of an interim frost control water release program, long-term storage and infrastructure needs, frost control water conservation BMPs, water user associations, and recycled water use.

From these meetings, a number of actions were taken:

- Mendocino County Farm Bureau and RRFC developed the *Draft Upper Russian River Frost Protection Pumping Coordination Protocol* to coordinate frost forecasting, growers' input, and requests to SCWA for water releases from Coyote Dam (see Exhibit 1).
- CLSI, with review from RRFC and MCFB, drafted and submitted a number of proposals to state and federal agencies to fund off-stream storage ponds, meters, stream monitoring, and outreach to growers. This program is named the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program (see Exhibit 2).
- The Mendocino Wine and Grape Commission and UC Cooperative Extension held a workshop on frost forecasts and site-specific temperature monitoring methods.
- CLSI held a workshop on water conservation BMPs for frost control.
- The Upper Russian River Stewardship Alliance (URSA) was formed.
- The primary URSA organizations—MCFB, CLSI, and RRFC—prepared a Memorandum of Understanding (MOU) to implement the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program (see Exhibit 2).

The governance structure decided on by the agricultural community is a coalition of organizations implementing a set of actions with consistent and regular communication with individual growers through grower and Farm Bureau meetings. URSA is this coalition of organizations and meets every two weeks with frequent calls and e-mails between meetings. Three of the organizations—RRFC, CLSI, and MCFB—have signed a Memorandum of Understanding (MOU) which defines what each organization's role will be and how the organizations will communicate and make consensus decisions (Exhibit 2). The following describes the role of each organization:

- The Mendocino County Farm Bureau (MCFB) is a membership organization with agricultural producers concerned about the protection of agricultural water rights. MCFB will provide outreach and information to landowners and water rights holders in the Project Area, organize and facilitate landowner meetings, distribute information about and attend meetings with agencies, regularly communicate with the other parties to this MOU, and coordinate meetings of URSA.

- The Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) is a special district which holds water rights of 8.000 ac-ft in Lake Mendocino and provides water to agricultural producers. RRFC will be the lead for studies for the recycled water project, meter district water diversions, and participate in planning and implementing of the monitoring program and meetings of landowners. RRFC will provide input into the locations and types of water management projects involving its customers and, to the extent feasible, support water rights permitting needed for water storage projects.

- The California Land Stewardship Institute (CLSI) is a 501(c)(3) non-profit organization and operates the Fish Friendly Farming (FFF) Certification program. This program addresses environmental improvements on agricultural lands through a collaborative process with the landowner/manager. CLSI has signed a cooperator agreement with the Natural Resource Conservation Service (NRCS) to implement $5.7 million in funding for water management projects over the 2009-2014 time period. CLSI will serve as the grant administrator and oversee implementation of water storage facilities and other projects, oversee BMP application and certification, attend landowner meetings, and with RRFC, coordinate the monitoring program.

In Sonoma County, a Middle Russian River Sustainability Alliance or MRSA has formed to direct the same program of conservation actions as URSA. The two efforts are coordinated through the county farm bureaus and a steering committee which oversees the overall Russian River Frost Program.

V CONSERVATION ACTIONS

Conservation Actions in 2008-2009

Demand Monitoring and Coordination

Agriculture along the Upper Russian River has historically relied on regulated flows from Lake Mendocino. Prior to the events of 2008, the Sonoma County Water Agency (SCWA) managed demand in the Upper Russian River basin simply by monitoring the USGS gage at Hopland and responding with release changes from Lake Mendocino. However, the frost events of 2008 demonstrated that frost protection diversions have the potential to overwhelm this system. In an effort to provide better coordination and management of demand and releases in 2009, URSA implemented the Conservation Actions described below.

Draft Protocol- In the fall of 2008, URSA developed *the Draft Upper Russian River Frost Protection Pumping Coordination Protocol* to improve the coordination of the onset of demand as well as compensatory releases from Lake Mendocino. The protocol uses local proprietary frost forecasting information combined with expert local data to provide the RRFC and SCWA with proactive information about the likelihood and magnitude of frost pumping demand. This proactive information is intended to alleviate the problems caused by relying only on the Hopland gage information. A complete copy of the protocol is attached (Exhibit 1).

URSA and SCWA successfully implemented the Draft Protocol in 2009. During base flows similar to those observed in 2008, the variation in flow was reduced by as much as 50%. During 2008, the maximum variation in flows from frost pumping was over 80 cfs despite steady increase in releases from Lake Mendocino (Figure 3). In 2009, similar levels of frost pumping resulted in flow variation of approximately 20 cfs by carefully timed pulse releases (Figure 4). The effectiveness of the Draft Protocol steadily improved throughout the season as implementation was improved. Monitoring showed that the key to reducing flow variations was tied to the timing, duration, and magnitude of compensatory releases. While the Draft Protocol does not address the core issue of instantaneous demand, it does partially mitigate the impacts on flows.

New USGS Talmage gage- One of the major constraints limiting SCWA's ability to make effective compensatory releases during frost protection diversions is a lack of gaging data. While much of the frost protection demand is in the Redwood and Ukiah Valleys, SCWA is unable to track the onset of demand in those areas until stage changes become apparent on the USGS Hopland gage. Since the transit time between Lake Mendocino and the Hopland gage ranges from 8 to 12 hours, by the time the effects of frost control demand become measurable at Hopland, it is too late to make an effective compensatory release from the reservoir. To reduce this inherent lag time, URSA, Redwood Valley County Water District, and SCWA partnered with the USGS and installed a new gage in the Russian River at Talmage in 2009. This new gage will reduce the transit time to approximately 2 hours and greatly improve SCWA's ability to react effectively to the onset of frost control demand.

Enhanced forecasting- The phone-in frost forecast is the primary point of communication for frost related information in the Upper Russian River. The proprietary forecasting provided by Fox Weather has been recently enhanced to improve forecasting and information coordination. Forecast resolution has been increased to develop more site specific forecast information. Additionally, the phone-in forecast has been modified to include information regarding reservoir releases and frost protection releases specifically. Including reservoir release information closes the communication loop between the agricultural community, the RRFC, and SCWA.

Telemetric meters- To further aid in the management of frost protection demand, the RRFC will upgrade its customer's meters to include telemetric capabilities. Telemetric meters would be able to signal the onset as well as the magnitude of demand for frost control diversions and further refine the ability to make needed reservoir releases. Several of these meters will be installed in the fall of 2009 and more will be installed in 2010.

Demand Flattening and Reduction

The pattern of demand generated by frost protection is markedly different than irrigation. There is enough variation amongst crops and operations that the likelihood of every grower irrigating simultaneously is extremely low. Irrigation is accomplished by irrigating subsets of each ranch in a series of blocks in a rotation that may take several days to complete. In addition, the majority of the crops in the Upper Russian River use low-volume drip irrigation systems. As a result, irrigation is self randomizing and of relatively low intensity.

Frost protection is essentially the opposite. During major frost events, almost everyone is forced to protect all of their crops simultaneously using high-volume overhead sprinkler systems for a relatively short period of time. This acute demand can cause large, short-term fluctuations in flow. In order to reduce or offset demand, URSA has implemented the Conservation Actions described below.

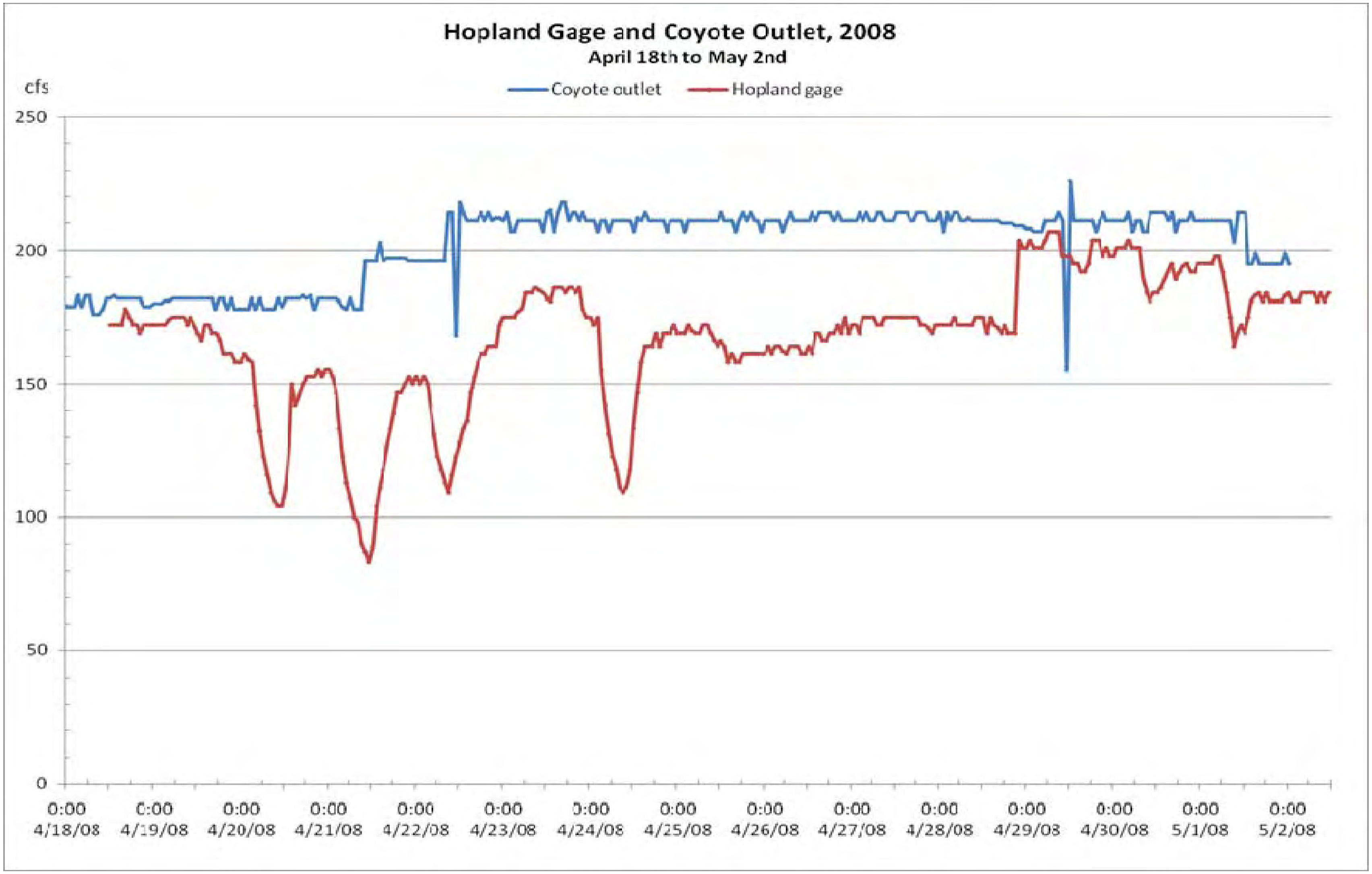


Figure 3. Instream flows at the Hopland gage (red) and releases from Coyote Dam (blue) during a portion of the 2008 frost protection season. Note heavy daily variation in flow despite static increases from Coyote Dam.

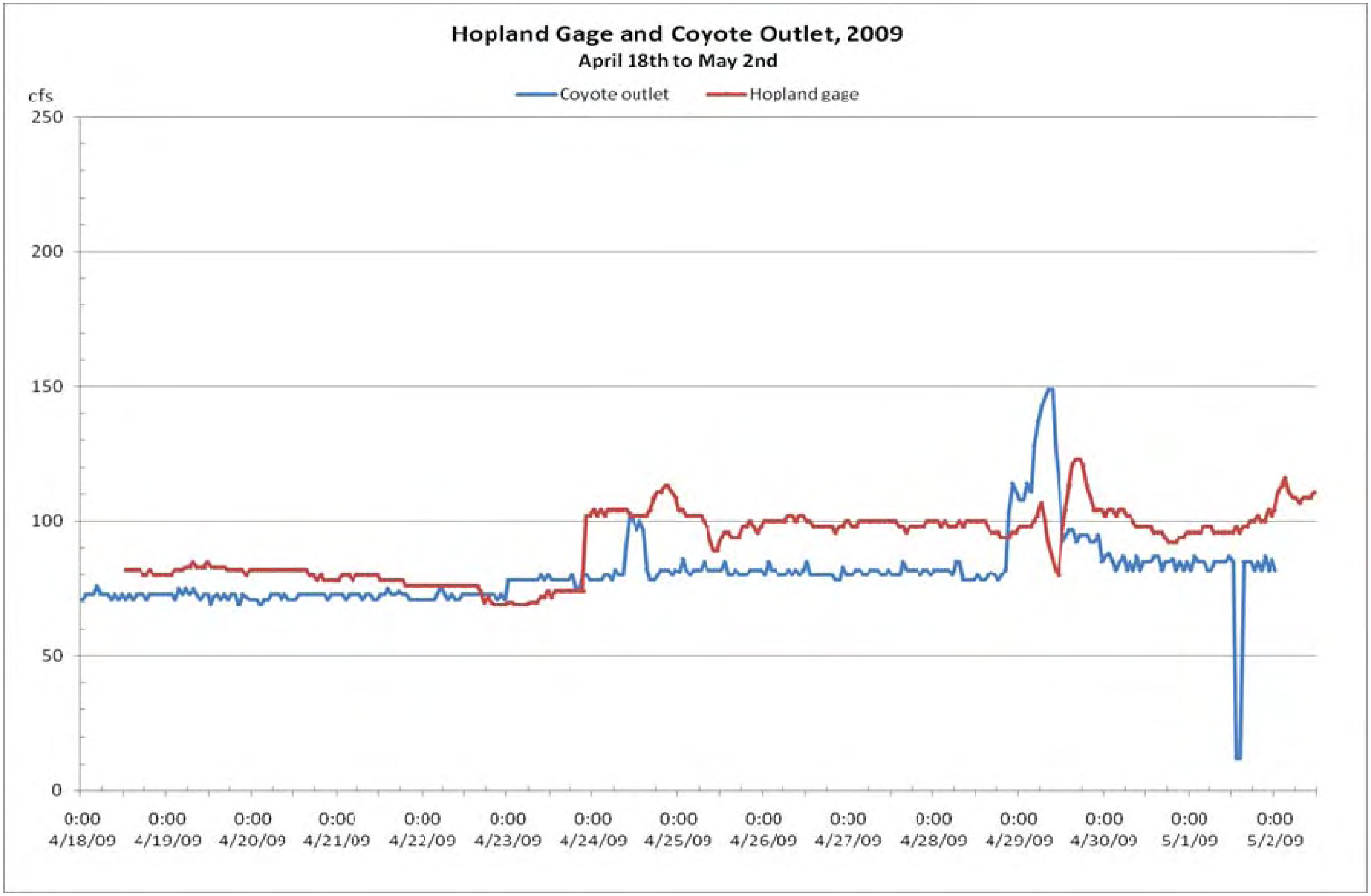


Figure 4. Instream flows at the Hopland gage (red) and releases from Coyote Dam (blue) during a portion of the 2009 frost protection season. Note reduction in flow variation (approximately 20 cfs) from timed pulse from Coyote Dam of 75 cfs on 4/29/09.

Agricultural Water Enhancement Program (AWEP) Funding- The long-term solution to avoiding another incident like the 2008 fish stranding on the Upper Russian River is the construction of water management infrastructure. Off-stream ponds provide water storage and greatly reduce the cumulative instantaneous diversion rate on the mainstem river. The **Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program** (Exhibit 2) focuses on the construction of off-stream ponds and other water conserving infrastructure to allow for a reduction of direct diversions and create a more reliable and flexible agricultural water supply.

In July 2009, the $5.7 million proposal submitted by CLSI to the Natural Resources Conservation Service (NRCS) to fund the construction of off-stream ponds and other water infrastructure was approved. AWEP was a provision in the 2008 Farm Bill and NRCS had a national competitive grant round to determine funding priorities. The funding all goes to the NRCS; CLSI does not receive any of the funding. CLSI is the cooperator with NRCS and is responsible for landowner outreach, setting project priorities, assisting in project identification, implementation of the BMP program for frost water, water conservation and water quality certifications through the FFF program, development and implementation of stream and river monitoring, establishing a Science Advisory Group, attending landowner meetings throughout the program area, and working with NRCS on all aspects of the program. The funding covers the 2009-2014 period and provides a 50% cost-share for construction; the landowner provides the remaining funding. NRCS also provides design and engineering for the project. Not all growers qualify for NRCS funds. Publicly traded corporations, partnerships with numerous members, and individuals with non-farm income in excess of one million dollars per year typically do not qualify for this type of NRCS funding. CLSI will continue to submit proposals to fund all aspects of the program and seek additional funding for sites which do not qualify for the NRCS program.

The program area for the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program includes the Navarro, Russian, and Napa River watersheds and Sonoma Creek watershed. The program focus in the Sonoma/Mendocino area is freshwater storage/reduced direct diversion rates and reduction in frost water demand; in the Napa area, the program focus is storage for recycled water.

Between the end of July and August 21, 2009 landowners in the Upper Russian River applied for AWEP funding for 11 different projects for a total value of $1.8 million (NRCS 50% cost of $900,000). In the Upper Russian River, three projects were funded. All the projects were for water management and conservation improvements. Several of these projects will be eligible for funding in 2010.

In the Middle Russian River landowners applied for 5 different projects for a total value of $368,000 of which 2 were funded including one at Felta Creek which will allow the landowner to stop diverting creek water entirely.

Offstream Storage- Storage ponds function much like a battery and allow diverters to draw from stored water during periods of high demand and then slowly recharge their ponds from instream sources during off peak hours. The size of the diversion pumps is changed with the construction of an offstream pond, permanently reducing the capacity of a particular site to divert water and reducing the diversion rate to a recharge level. This offset of demand is the best solution for eliminating the problems associated with acute demand from frost protection. Full utilization of these new or modified facilities will require the modification of multiple water rights. The RRFC, as well as all of the owners of these facilities are working with the SWRCB to pursue expedited permit modifications. La Ribera Vineyard has already applied for and received their permit modification.

It is important to note that the aggregate of demand offset from these new facilities (87 cfs) exceeds the maximum amount of flow fluctuation observed in 2008 (83 cfs). While these two numbers are not entirely corollary, removing more demand than the observed “problem”, in combination with the other Conservation Actions should greatly reduce, if not eliminate, the impacts of frost protection diversions in the Upper Russian River stream flow.

Recycled water- Another long-term solution for reducing the water demand associated with frost protection is the use of recycled water. The City of Ukiah produces over 4,000 acre feet of recycled water per year. This water would be an ideal source for filling and refilling offstream storage for both frost protection and irrigation.

Table 1: Summary of offstream storage developed in Mendocino County to mitigate the impacts associated with frost protection. "CFS" column indicates the amount of former direct diversion demand that will now be met from offstream storage.						
Ranch	**Type of project**	**Acreage Affected**	**Total Cost**	**AWEP Cost Share**	**Previous CFS Diversion Rate**	**Year Complete**
Fetzer	Modification	34	$47,000	No	3.8	2009
Fetzer/Dolan	Modification	40	$20,000	No	4.4	2009
Sawyer	New Construction	45	$80,000	Yes	5.5	2009
La Ribera	New Construction	110	$400,000	Yes	13.4	2009
Beckstoffer	New Construction	300	$800,000	No	36	2009/10
Fetzer	New Construction	148	$775,000	No	16.6	2009/10
Haiku	New Construction	60	$250,000	Yes	7.3	2010
Total		**737**	**$2,372,000**		**87**	

Unfortunately, there is no distribution system in place to accomplish this goal. To date, URSA has been unsuccessful in obtaining planning funds to begin the process of designing a distribution system. URSA will continue to pursue grant dollars to advance this long term goal. URSA did organize a workshop for growers in July of 2009 and invited speakers from Sonoma County to share experiences and answer questions regarding the use of recycled water for agricultural purposes. Since the workshop, interest in recycled water in Mendocino County has increased.

Fish Friendly Farming BMPs for Frost Water Conservation- CLSI has prepared a comprehensive set of Beneficial Management Practices (BMPs) addressing all aspects of water conservation in frost control operations. These BMPs are part of the Fish Friendly Farming (FFF) program. The BMPs follow the FFF program format with a description of the required site inventory and mapping, background information on frost events, temperature monitoring, types of frost control and passive and active frost control measures, and a farm plan template.

The approach of the BMP program for frost control is to evaluate all aspects of the vineyard and frost control operations to determine all the ways water can be conserved within the limitations of the type of frost zone. The Upper Russian River is a severe frost zone. Working with each grower, CLSI staff will map vineyards by grape variety, map the frost water distribution system, and document the type and extent of the frost control system and any passive measures used. Then, frost water demand is calculated without any BMPs and then with a range of BMPs (conservation measures). Conservation measures include passive actions such as mowing cover crops and spraying bacterial sprays to reduce ice nucleating bacteria as well as active measures such as installing valves in the water system to limit water applications to grape varieties with later bud break, temperature monitoring in the vineyard to precisely time water turn on, and replacing old overhead sprinklers with new ones. In moderate to mild frost zones, use of smaller sprinklers and wind machines are BMPs that may be applied.

The FFF frost control BMPs include the practices listed by the Frost Task Force as well as many others and provide a methodology for application and the FFF certification validation. As part of these BMPs, a requirement was added to the FFF program water conservation section for all direct diversions to be analyzed for potential instantaneous drawdown effects on stream flow and the need for a water storage facility.

Following a well-attended BMP workshop on August 27 in Ukiah (35 growers representing over 3500 vineyard acres), CLSI field tested the BMPs. The field trials of this methodology found significant water conservation on many sites and the potential to manage and reduce demand using this method. CLSI has met with NMFS staff to request review of the BMPs and input. CLSI is now also working with Sonoma growers. Additional workshops will be held with certification offered to validate implementation. Completion of the BMPs and analysis will be a requirement of the AWEP funding.

Frost Task Force-The URSA organizations have participated in every Frost Task Force meeting since the formation of this group. In addition, CLSI and MCFB representatives have served on the BMP and permit sub-committees. No one from Mendocino was involved in the monitoring sub-committee.

In addition to the above, the following tasks are scheduled for completion in the remainder of 2009:

- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Establish Science Advisory Group (described later in this document)
- Seek funding for Integrated Monitoring and Watershed Analysis for tributaries (described later in this document)
- Prepare detailed scope for Ukiah recycled water use feasibility study; seek funding
- Establish quarterly meetings with the Resource Agencies (described later in this document)

Conservation Actions in 2010

The URSA actions planned for 2010 include:

- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Review of mainstem gaging data and Coyote Dam releases for effectiveness of off-stream storage in reducing instantaneous drawdown.
- Begin engineering for Phase 2 of ponds for off-stream storage, wells, or other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs and validation
- Seek funding for measurement of efficiency of selected water conservation practices
- Establish monitoring stations
- Install instruments and complete surveys
- URSA meets regularly and holds landowner meetings regularly

- Science Advisory Group meets to review monitoring and adjust/revise program
- Begin construction of Phase 2 of projects
- Coordinate changes to water rights permits to allow for storage of frost water
- Begin study of recycled water engineering feasibility
- Resource Agency quarterly meetings

Conservation Actions in 2011-2012

The actions planned for 2011-2012 include:

- Complete construction of Phase 2 ponds
- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Continue monitoring program and meet with Science Advisory Group to review results and adjust/revise program
- URSA meets regularly and holds landowner meetings regularly
- Begin engineering for Phase 3 projects
- Complete recycled water engineering study; seek funds for detailed design, environmental review, and permitting
- Complete construction of Phase 3 ponds
- Review monitoring findings with resource agencies
- Resource Agency quarterly meetings

Conservation Actions in 2013-2014

The actions planned for 2013-2014 include:

- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects

- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Continue monitoring program and meet with Science Advisory Group to review results and adjust/revise program
- URSA meets regularly and holds landowner meetings regularly
- Begin engineering for Phase 4 of ponds for off-stream storage, wells, or other projects
- Review monitoring findings with resource agencies
- Complete construction of Phase 4 ponds
- Complete design, permitting and environmental review of recycled water project, seek construction funds
- Resource Agency quarterly meetings

VI. EFFECTIVE MONITORING—TAKING A WATERSHED APPROACH

Monitoring and assessment of physical conditions in tributary streams and the Upper Russian River can provide a clearer picture of how the system functions and help identify the limiting factors to anadromous fish populations. The Upper Russian River is both a complex and highly altered physical system. Numerous tributary streams drain from steep mountains through rocky canyons and across the alluvial valley to the main river. In many locations, alluvial fans occur at the canyon outlet of the creek. Anadromous fish spawning and rearing habitats are typically upstream from the alluvial reaches. Flow in the lower alluvial reaches can be intermittent in dry years, possibly limiting fish passage.

In the Upper Russian River, groundwater/surface water interactions are key processes defining the timing and magnitude of surface stream flows and therefore stream values for salmonids. There are a number of potential factors limiting stream flow in tributary creeks in the Upper Russian River:

- Surface flow diversions/shallow groundwater wells in the tributary drainage
- Natural infiltration of stream flow in alluvial fans
- Significant entrenchment (18 ft.) in the main channel, which lowers groundwater levels in the alluvial basin and effects the timing and magnitude of infiltration of tributary stream flow

There have been a few assessments of groundwater conditions (Farrar 1986), groundwater monitoring wells (Ca. Dept. of Water Resources), and a study of shallow groundwater levels and riparian tree survival (Jackson & Marcus 2002). Additional focused monitoring and modeling is necessary to determine the effects of each of these factors on tributary stream flow.

Characterizing Existing Tributary Conditions

With the construction of the Coyote Dam on the East Fork of the Russian River in 1959, the Upper Russian River was significantly and permanently changed. Over the past 50 years, the dam has altered the water/sediment balance in the river and resulted in an 18 ft. drop in the channel bottom. Once a wide, shallow alluvial channel, the river is now a deep, narrow channel with bank erosion and flow managed through reservoir releases. It is reasonable to assume that in tributaries in the Upper Russian River, stream flow is highly altered due to these significant changes in the river channel. Therefore, monitoring and modeling of conditions in a tributary without numerous surface diversions and groundwater wells is needed to establish existing conditions such that the effects of small agricultural diversions can be evaluated in other tributaries. A comprehensive methodology is needed to construct a water budget for a tributary in this system and determine whether and how revised management of small water diversions might benefit fish habitat.

Selecting Tributaries

Two unimpaired tributaries will be monitored: Morrison Creek, which has only one diversion; and one other tributary—Feliz Creek, Coleman Creek, Robinson Creek, Orrs Creek, Sulphur Creek, or Howell Creek (Figure 1). These tributaries have limited diversions. To aid in selecting a second tributary, a GIS system will be used to analyze geology, topography, soils, vegetation, land use, and other features. Existing rainfall gages and other data sources will also be collected. Land ownership will also be evaluated and owners will be contacted to determine willingness to participate. From this information a second tributary will be selected with a focus on choosing a candidate that differs from Morrison Creek yet is relatively unimpaired by reservoirs, diversions, or agricultural and urban development. It may be desirable to have a tributary on the western side of the valley, or one substantially downstream or upstream of Morrison Creek, or one with geologic differences to characterize the broader set of existing conditions occurring in the Upper Russian River system. Additionally URSA will coordinate with MRSA and the Science Advisory Group on tributary monitoring approaches and methods and selection.

Conceptual Model of Stream Flow

A conceptual model of stream flow duration and timing in the Upper Russian River tributaries has to include variations in rainfall, river stage, and reservoir flood release operations over a normal, dry and wet year. The effects on the timing and magnitude of river flow of different impounded water volumes in Lake Mendocino in the fall should also be part of the evaluation. The model should address timing, duration and volume of surface runoff infiltrating into groundwater prior to establishing connected surface flow under a variety of reservoir operations, river stages, and climatic conditions and the resulting duration of the period of connected surface flow. The conceptual model is used to formulate hypotheses about stream flow processes and design field studies.

Synoptic sampling of stream flows at numerous locations in a watershed provides the best real-time data for actual flow conditions. A number of stations would be identified for the installation of stream flow gages in the two tributaries. These stations would be set up during the dry season and field measurements completed. A number of automated rainfall gages would also be installed in the drainage if needed. These types of gages will record information and store it, but require oversight. The stream flow gages also require field measurements to properly interpret the gaging data.

These gaging stations would be distributed in the two tributaries to record the timing of initiation of stream flow and duration, volume, depth and velocity of flow in the upper reaches, lower reaches and confluence with the river channel. These data will characterize the existing timing and magnitude of stream flow in each tributary, under various rainfall events and in relationship to river flow levels and reservoir releases. Shallow groundwater in alluvium next to stream channels, particularly in areas near the river channel should be monitored using piezometers or shallow monitoring wells. Groundwater levels will need to be measured to 15-20 ft. below ground level in the Upper Russian River. Monitoring shallow groundwater levels near alluvial channels will determine when the stream changes from a gaining to a losing reach. The flow in the river will also need to be measured near to the confluence with the tributary creek. Gaging data for upstream reservoir releases and stream flow gaging data at the two river stations will be collected.

A detailed topographic survey will be needed of each tributary, particularly the alluvial reach. Commissioning a LIDAR flight of the watershed may be the cheapest and most accurate way to create a detailed digital topo layer. In addition some channel surveying may be completed on the tributaries and the main river.

In summary for each of the two tributaries, the following will be installed.

- A grid of piezometers or shallow monitoring wells in the alluvial reach of the tributary from canyon outlet to river confluence to measure fluctuations in the shallow groundwater elevation.
- Stream flow gages in the upstream creek canyon, at the canyon exit of the creek, in the creek near the river confluence, and in the river channel near the confluence.
- Complete a topographic survey of the stream channel and river channel near confluence – capture main channel thalweg, creek thalweg, overall floodplain elevation, piezometers/monitoring well and gage network locations and relative elevation.
- Rainfall gages in each tributary watershed if needed.

Evaluate Field Data

The stream flow gaging, GIS, field reconnaissance, river data gaging records, and site specific measurements including the hydraulic conductivity and storability of alluvial material, will allow for a hydrodynamic stream flow model to be set up and be calibrated for each tributary. There are a variety of open access available models which can be used. The model will need to be able to evaluate transmission loss through the bed of the creek into groundwater and how this changes with different sets of river flow/stage and tributary runoff conditions. Reservoir operations must also be included.

Analysis and Recommendations

Characterization of two tributaries with few agricultural diversions and little development would provide a basis for understanding stream flow in tributaries in the Upper Russian River under current conditions with an entrenched river channel and various reservoir operations. The hydrodynamic model created can then be used to evaluate developed watersheds with agricultural diversions. This characterization would be implemented starting in 2010.

This characterization forms a basis for recommending changes to agricultural diversions in other tributaries and for interpreting stream flow gaging in the tributaries with small reservoirs and diversions. Starting in 2012, surface and subsurface stream flow monitoring would be carried out in several tributary watersheds to evaluate the effects of agricultural diversions on stream flows using the collected data along with the characterization and model of the streams with few agricultural diversions. Potential creek watersheds include Dooley and Feliz creeks and the west fork of the Russian River. From this analysis, water management actions can be evaluated. It may not be possible to alter the timing and magnitude of small diversions to overcome large system-wide changes in dry or low flow years. However, in certain rainfall years, coordinating smaller diversions may make a difference to stream flow levels and produce a benefit for fish. The monitoring and modeling of this complex system is essential to deciding how to determine water for fishery benefits.

VII TRANSPARENCY—SCIENCE ADVISORY GROUP

The Science Advisory Group is essential to gaining the understanding of stream flow processes needed to improve conditions for fish. The Russian River watershed covers one million acres and includes a great deal of variation in physical features. Stream flow in the tributaries of the Russian River is generated as a function of physical features such as rock and soil types, slopes, shape of the drainage, vegetative cover and rainfall patterns as well as human land and water uses. This complexity requires analysis and study of tributary basins prior to determining if agricultural water diversions are having a significant effect on stream flow.

There are very few steam flow gaging records for the tributaries of the Russian River and limited scientific studies documenting factors affecting stream flow. Due to variations between tributaries a study of one tributary cannot be applied to all the tributaries in the drainage. There are several examples of this. Deitch et al 2007 studied stream flow in the Franz Maacama Creek drainage in Sonoma County and related changes stream flow gaging records to the use of water for frost control. While this study indicates a need for construction of water storage infrastructure to reduce the instantaneous diversion rate and a reduction in frost water demand through BMP applications in these two tributaries, it cannot be assumed that the same conditions exist throughout the watershed.

In another example, Jackson and Marcus (2002) studied surface stream flow and shallow groundwater levels in two tributaries, Parsons and Morrison Creeks in Mendocino County. This study found the water level in the main Russian River had the greatest effect on surface stream flow in low water years causing infiltration of surface flow into groundwater in the alluvial Ukiah Valley.

The conclusions of both of these studies are valid for the tributaries involved; however, neither one can be applied to all tributaries across the entire Russian River drainage. Unfortunately, during the meetings of the Frost Protection Task Force, representatives of California Department of Fish and Game (CDFG) and the National Marine Fisheries Service (NMFS) stated that they assume frost water diversions and use pose a problem in all tributaries in the Russian River basin regardless of whether specific data and studies were available to demonstrate this. This situation emphasizes the need for an independent Science Advisory Group to objectively review monitoring proposed by growers or agencies. Monitoring data for stream flow always needs to be interpreted by professionals within the watershed context of where the measurements are completed. Strict Quality Assurance/Quality Control (QA/QC) on the monitoring instruments and their placement needs to be used to assure reliable and accurate data. Depending on the location subsurface water levels may also need to be monitored to provide a complete picture of the hydrology of a tributary basin.

The Science Advisory Group will be made up of 5-10 members drawn from academia and agencies such as the U.S. Geologic Survey and UC Cooperative Extension. Scientists involved in URSA, MRSA, the Russian River Property Owners or the primary agencies- California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), State Water Resources Control Board (SWRCB) and

North Coast Regional Water Quality Control Board would not be eligible for inclusion in the Science Advisory Group. This prohibition will maintain the objectivity of the findings of the Science Advisory Group.

The Science Advisory Group will carry out two primary tasks:
1. A review of the physical processes in the Russian River watershed.
2. Specific review of the efforts of URSA and MRSA.

The first task will consist of the following steps:
Articulate conceptual models of flow processes for streams as defined by geomorphic features. These stream types include: small tributaries, canyon streams, alluvial fans, alluvial channels and incised channels.

The conceptual models will consider natural processes and then consider the range of changes due to all developments in the watershed including all of the causes listed for the reduction in populations of steelhead trout and Coho and Chinook salmon (65 Fed Reg 42421-42481; 64 Fed Reg 73479-73506). This second analysis will consider the Upper Russian and Middle Russian watershed areas separately to provide the most applicable information. Within the Upper and Middle Russian areas regions will be identified where tributaries are expected to have similar processes and conceptual models. The relationship of tributaries to the main Russian River will be considered in the models.

Existing research and all available data will be reviewed and any data gaps will be identified.

The Science Advisory Group will then recommend a methodology for answering the following questions for each group of tributaries with a similar conceptual model:

- What effects do direct diversions of stream flow for frost control have on tributary flow and in-stream fish habitat in a high, average and low rainfall year?
- What effects do groundwater extractions for frost control have on tributary flow and in-stream fish habitat in a high, average and low rainfall year?
- What other land uses, water uses, geomorphic and hydrologic features have major effects on stream flow during the frost control period in high, average, and low rainfall years?

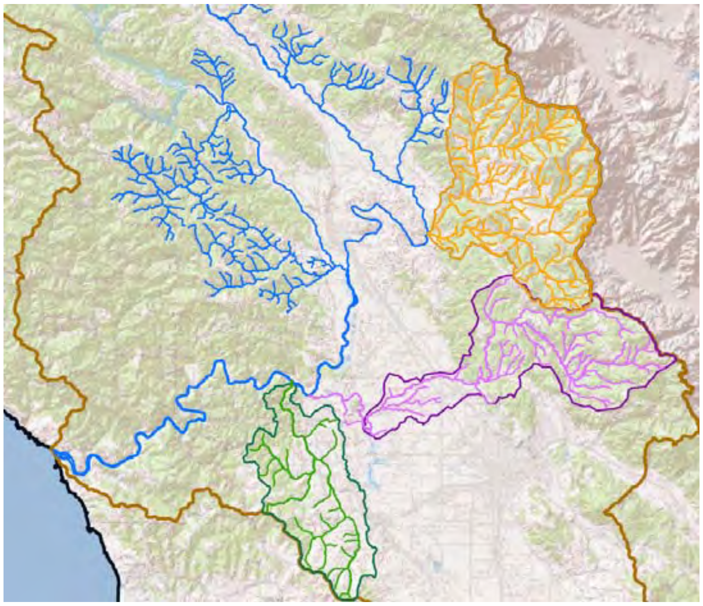
In addition to this first major task, the Science Advisory Group will work with URSA and MRSA to review proposed monitoring programs, monitoring data and proposed conservation actions. A summary report of these findings and actions will be produced no less frequently than yearly. URSA and MRSA will proceed with BMP application and frost water demand reductions, construction of off stream ponds to reduce direct diversions and other conservation actions while the conceptual model analysis is developed.

VII. CONTINUING THE DIALOGUE WITH THE RESOURCE AGENCIES

URSA and MRSA will meet quarterly with representatives from the Resource Agencies (CDFG, NMFS, SWRCB) from the Frost Protection Task Force to discuss implementation actions and the findings of the Science Advisory Group. It is the intention of both URSA and MRSA to form a collaborative working relationship with the agencies to implement needed changes to water infrastructure and improve stream flows to sustain both the fishery and agriculture.

RUSSIAN RIVER FROST CONTROL PROGRAM

MIDDLE RUSSIAN RIVER, SONOMA COUNTY



MIDDLE RUSSIAN RIVER STEWARDSHIP ALLIANCE

NOVEMBER 2009

I. INTRODUCTION

The Russian River Frost Program is a cooperative program of winegrape growers, the Mendocino County Farm Bureau, Russian River Flood Control and Water Conservation District, California Land Stewardship Institute, Sonoma County Farm Bureau, and other organizations to address frost protection efforts in the Russian River watershed in Mendocino and Sonoma counties. The Russian River Frost Program includes separate frost protection implementation plans for the Upper Russian River region in Mendocino County by the Upper Russian River Stewardship Alliance (URSA Plan) and for the Middle Russian River region in Sonoma County. This Middle Russian River Frost Protection Plan (MRSA Plan or Plan) is being prepared by the Middle Russian River Stewardship Alliance (MRSA), a group of vineyards from Alexander Valley, Knights Valley, Russian River Valley, and Dry Creek Valley participating through the Sonoma County Farm Bureau Frost Subcommittee. . The Plan describes the cooperative process by which MRSA will manage water diversions for frost protection in the Middle Russian River watershed within Sonoma County starting in 2010.

II. PROBLEM STATEMENT

Water application is the most common and effective method of protecting new growth on grapevines from frost (generally March 15 to May 15) in the low lying regions in the Russian River watershed (Figure 1). During a frost event low temperature conditions occur throughout the Russian River region such that water is turned on in numerous locations simultaneously, creating a large instantaneous water demand. Where frost protection water is provided through direct diversions from streams, the high instantaneous demand for frost protection along with municipal, small domestic and other non-frost uses may cause rapid change in stream flow, especially when stream flows are low. Low minimum stream flow requirements for the mainstem Russian River may exacerbate these effects, particularly in the Upper Russian River near Hopland where direct diversions provide a large source of water for frost protection. In the Middle Russian River region in Sonoma County (Figure 2), wells provide nearly all water for frost protection for vineyards along the mainstem Russian River and mainstem Dry Creek. Frost diversion-related effects are more likely to be manifest in the handful of tributaries that have direct diversions for frost protection (see watersheds highlighted in Figure 2).

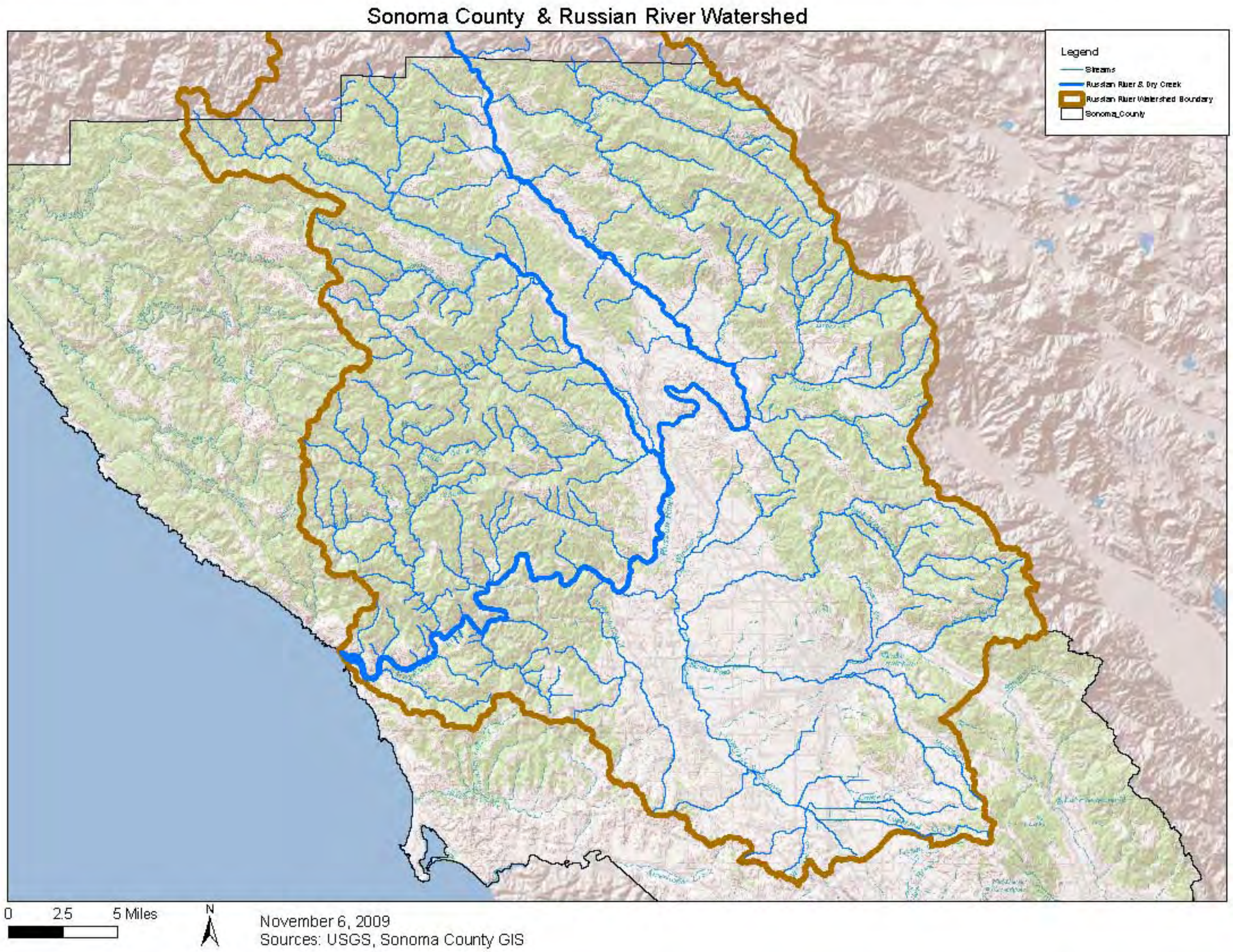


Figure 1 Russian River Watershed within Sonoma County

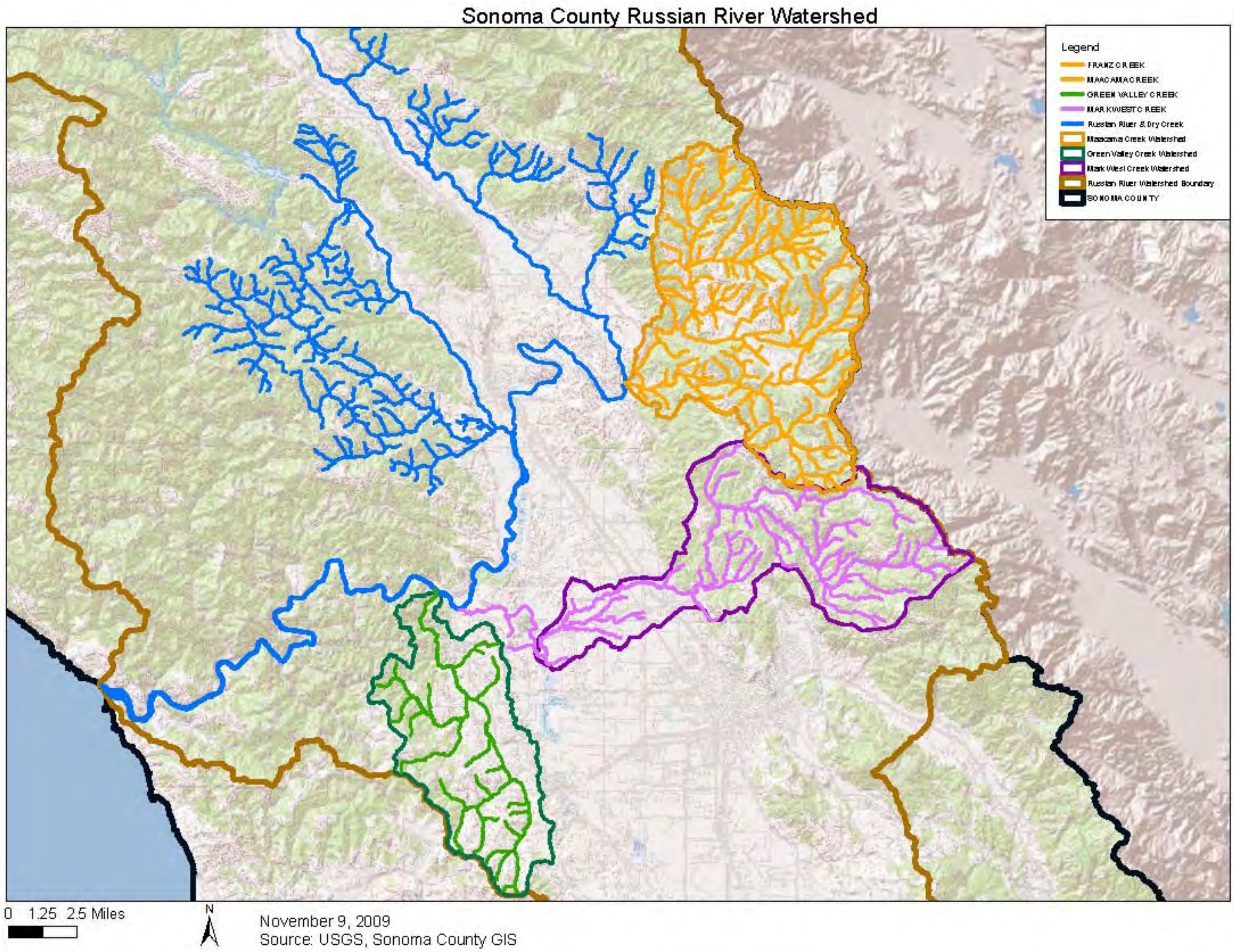


Figure 2 Middle Russian River Region Showing Russian River, Dry Creek, and Major Frost Diversion Tributaries

The 2008 frost season had major frost events on over 20 nights and was the worst frost season in over 30 years. This extreme frost season coincided with drought conditions and low stream flows. As discussed in the URSA Plan, these two conditions coincided in only 5 of the last 19 years.

The NOAA National Marine Fisheries Service (NMFS) alleged that direct diversions for frost protection in April 2008 resulted in fish stranding mortality on the mainstem of the Russian River, near Hopland in Mendocino County and in 2008 and 2009 on Felta Creek in Sonoma County. As a result NMFS has requested that the State Water Resources Control Board (SWRCB) take immediate action to regulate diversions for frost protection on all waterways. This Plan is being prepared to identify water resource conflicts associated with frost protection in the Middle Russian River region and their causes and to implement conservation actions to address them.

III. GOALS AND APPROACH OF THE PLAN

The principal goal of the Plan is to reduce any acute effects on stream flow from direct diversions during frost periods through two means: reducing the demand for water for frost protection (e.g., BMPs) and changing the manner of diversion (e.g., shift from direct diversion from streams to diversion by well or to offstream storage).

This Plan is being developed to satisfy NMFS' three standards for success for the Frost Protection Task Force: conservation actions, effective monitoring, and transparency.

IV. ORGANIZATIONAL STRUCTURE

The Sonoma County Farm Bureau Frost Subcommittee will serve as the Governing Board for MRSA. The Governing Board is comprised of vineyard representatives from Alexander Valley, Dry Creek Valley, Green Valley Creek, Knights Valley, Mark West Creek, and the Russian River Valley regions of the Russian River watershed within Sonoma County, which encompass the vast majority of frost protected vineyards in the Sonoma County portion of the Russian River.

The Governing Board acting through the Sonoma County Farm Bureau (SCFB) will partner with the Sonoma County Winegrape Commission (SCWC), the California Land Stewardship Institute (CLSI), Russian River Property Owners Association (RRPOA), and other groups to accomplish the following:

- Recruit participants (Governing Board, SCFB, SCWC, CLSI, RRPOA).
- Provide general outreach and information dissemination (SCWC, SCFB).
- Provide technical guidance (SCWC, SCFB, CLSI, NRCS, Science Advisory Group).
- Participate in monitoring program formulated by the Science Advisory Group (Governing Board).
- Provide regulatory guidance (SCFB, CLSI).
- Communicate with the State Water Board, DFG and NMFS on the effectiveness of frost protection measures (Governing Board).
- Produce the annual Frost Protection Report (described below) (Governing Board with Science Advisory Group).

To date, the following vineyards have expressed support for and intend to participate in the Plan: Foster's Wine Estates, E&J Gallo Winery, Constellation Wines U.S., Rodney Strong Wine Estates, Silverado Sonoma Vineyards, and Vino Farms, Inc. These vineyards collectively own approximately 9,600 acres of vineyard in the region. Aggressive efforts have begun to recruit additional vineyards to participate in the Plan. The goal is to obtain 100% participation of frost protecting vineyards by the start of the 2010 frost season.

Representatives of the MRSA Governing Board will sit on a Steering Committee of the Russian River Frost Program to provide consistency between the URSA and MRSA plans.

V. CONSERVATION ACTIONS

Conservation Actions in 2009

In 2009, conservation efforts were directed to resolve the one incident of fish stranding in Sonoma County that occurred on Felta Creek. The upstream vineyard owner received cost share funding through the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement

Program (AWEP) program and technical assistance from CLSI to install a well and stop use of the instream diversion for frost protection.

Conservation Actions in 2010

Prior to the 2010 frost season the following actions will be implemented:

Implement BMPs (Commencing in 2010 and Ongoing as New Participants Join)

The Governing Board will provide guidance to landowners on the utility of BMPs under various scenarios. The Board will also provide information on permitting, construction and other guidance for conservation projects including offstream storage, well construction or well deepening, and wind machines.

Each participant shall prepare a plan for adoption of BMPs applicable to its property and hydrologic conditions by January 30, 2010 and shall implement applicable BMPs before directly diverting surface water for frost protection purposes.

BMP Verification by Third Party Organizations (Commencing in 2010 and Ongoing as New Participants Join)

Providing multiple verification options for growers is important for grower cooperation. The Governing Board will continue to review verification options and make the final determination as to acceptable options.

Tributary Frost Protection Assessments

Frost Protection Assessments will be prepared by the Governing Board in cooperation with cooperating organizations and vineyards for each major tributary by December 31, 2009. The primary purposes of the Assessments are to estimate the peak surface water direct diversion demand for frost protection on the tributary, if any, and to identify strategies for reducing the instantaneous demand. The Assessments shall identify the following for each major tributary:

- All vineyards employing frost protection.
- Vineyards using water for frost protection and the sources of water used.
- For the vineyards directly diverting surface water for frost protection: identify the total number of acres and the specific sources of surface water; evaluate the maximum potential instantaneous demand in the tributary watershed; evaluate reduction in demand from near-term implementation of BMPs; identify longer-term potential strategies for reducing the instantaneous direct diversion demand, including wind machines, offstream storage, new wells, or deeper wells.

The watersheds with the highest concentration of frost protection include Green Valley Creek, Mark West Creek, and Maacama Creek. The Governing Board expects that many of its resources will be focused on those three watersheds.

Frost Event Notification

SCWC contracts with Fox Weather for frost forecasts and all growers within the County have access to this information.

Commence Monitoring Program (discussed in section VI)

<u>Conservation Actions After 2010</u>

Identify Conservation Actions

The Plan will identify conservation actions that will reduce any acute effects on stream flow from direct diversions during frost periods. Conservation actions may include use of wind machines and construction of offstream reservoirs and new or deepened groundwater wells.

Identify Grant and Other Funds for Implementation of Conservation Actions

The URSA Plan discusses the availability of Agricultural Water Enhancement Program (AWEP) funding for conservation actions in the Middle Russian River region.

Implement and Monitor the Effectiveness of Conservation Actions

Develop Tributary Frost Diversion Schedules if Warranted

VI. EFFECTIVENESS MONITORING

Objectives and Approach of the Monitoring Program

The monitoring program will be directed to inform the Governing Board about the following: (1) the effects of direct water diversions for frost protection on stream flow; (2) how factors other than frost protection diversions affect stream flow during the frost season (e.g., surface water-groundwater interaction, geomorphic factors, precipitation and runoff, and non-frost diversions of water); and (3) whether conservation actions are addressing these effects.

The program will focus on tributaries with significant frost diversions, which have preliminarily been identified as Maacama Creek, Mark West Creek, and Green Valley Creek. These three tributaries exhibit a diverse range of hydrologic and geologic attributes, which may inform the understanding of similar streams in the region. For these tributaries, the program will include stream flow gaging, reporting cumulative water use by tributary for frost seasons starting in 2010. The need for subsurface water level monitoring will be evaluated in each tributary. The program will also gage and report stream flow conditions for two tributaries with no significant frost diversions to serve as a control to isolate frost diversions from other effects. The information collected in the monitoring program will be described in an annual report (described below).

The monitoring program will share the same conceptual framework and be developed in coordination with the monitoring program for URSA. Both the Upper and Middle Russian River efforts will utilize the same Science Advisory Group to guide the development and implementation of the monitoring program. The Science Advisory Group will provide advice on quality assurance and quality control of monitoring and collection protocols and will review the annual monitoring report. The monitoring program is described in more detail in the URSA Plan.

Availability of Data

The Governing Board proposes to use an existing public gage and/or install a new gage on each of the tributaries with significant frost direct diversions and make that data available to the SWRCB and fisheries agencies; provided, however, data for these gages will not be disseminated until the Governing Board and the Science Advisory Group are satisfied as to the soundness of the monitoring protocols and the accuracy and reliability of the data collected.

Stream Flow Monitoring

The stream flow monitoring component of the monitoring program will use the tributary frost assessments to identify the streams with significant direct diversions for frost protection and non-frost diversion "control" streams to monitor. The tributary assessments will also be used to identify any relevant existing gauging efforts, stream flow and habitat studies and major physical elements of the streams including critical pools, riffles, hard points (culverts, bridge abutments), and gaining and losing reaches. With this information the monitoring program will identify at least two locations on each frost diversion stream for gauging stream stage: one near the confluence with the Russian River and one at or just below the transition from higher gradient boulder-pool reach to lower gradient alluvial reach. Groundwater elevation at one or two shallow well locations will also be collected. Stream flow monitoring will be coordinated with URSA and the Science Advisory Group.

VII. TRANSPARENCY

Reporting

The following reporting protocols will ensure the Plan is transparent:

- Each participant in the Plan will be identified.
- Each participant who uses surface water for frost protection shall report to the Governing Board the following: the total number of acres frost protected; the source of the water used for frost protection; the total quantity of water used; and the date and time(s) of diversion(s).

- The Governing Board will communicate with the SWRCB during the frost season to discuss any frost diversion issues.
- The Governing Board will produce an Annual Frost Protection Report summarizing the frost diversion reporting, streamflow monitoring results, and effectiveness of BMPs.

Science Advisory Group

The Science Advisory Group described in the URSA Plan will also consult to the Governing Board for this Middle Russian River Plan.

Attachments:
Exhibit 1 Draft Upper Russian River Frost Protection Pumping Coordination Protocol
Exhibit 2 Memorandum of Understanding with Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program Description
Exhibit 3 Analysis of Low Water Levels and Freezing Temperatures at Hopland and Healdsburg
Exhibit 4 Salmonids in the Russian River Watershed

RUSSIAN RIVER FROST CONTROL PROGRAM

EXHIBITS

Exhibit 1
Draft Upper Russian River Frost Protection Pumping Coordination Protocol

Draft
Upper Russian River Frost Protection Pumping
Coordination Protocol

This Draft Frost Protection Pumping Coordination Protocol was developed to help mitigate the effects of acute frost events on instream flow when there is a possibility for the over-drafting of available water resources. By coordinating short-term increases in demand with the release of stored water in Lake Mendocino, it is hoped the type of fisheries related impacts observed in the spring of 2008 can be avoided in the future.

Step 1: The Mendocino County Farm Bureau (MCFB) will receive and analyze daily frost reports. A committee of agricultural stakeholders appointed by the MCFB will review the report and determine the likelihood of significant frost protection pumping. If the committee believes that pumping is likely the MCFB will notify the Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC).

Step 2: Once notified by the MCFB, the RRFC will examine the current instream flow at the Hopland USGS gage, as well as consider the current release from Lake Mendocino and determine if widespread frost protection pumping could have deleterious impacts to instream flows and fisheries resources in the upper Russian River. If the RRFC determines that significant impacts are likely the RRFC will notify the operations desk at the Sonoma County Water Agency (SCWA) and request an additional release of approximately 80 cfs.

Step 3. Once notified by the RRFC, the SCWA will take the necessary steps to have additional water released from storage as soon as possible. Flows and weather will be closely monitored. When frost protection pumping subsides, additional releases will be curtailed as soon as possible in order to conserve water for fall fisheries releases.

Exhibit 2
Memorandum of Understanding with
Northern California Wine County Agricultural Water Conservation and Water Quality Improvement Program Description

MEMORANDUM OF UNDERSTANDING BETWEEN MENDOCINO COUNTY FARM BUREAU, CALIFORNIA LAND STEWARDSHIP INSTITUTE, AND THE MENDOCINO COUNTY RUSSIAN RIVER FLOOD CONTROL AND WATER CONSERVATION IMPROVEMENT DISTRICT

Whereas the Mendocino County Farm Bureau (MCFB) is a membership organization with agricultural producers concerned about the protection of agricultural water rights.

Whereas California Land Stewardship Institute (CLSI) is a 501(c)(3) non-profit organization which operates the Fish Friendly Farming (FFF) Certification program. This program addresses environmental improvements on agricultural lands through a collaborative process with the landowners/managers. A FFF certification provides regulatory compliance for TMDLs in a number of watersheds and full certification requires permitted water rights;

Whereas Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) is a special district which holds water rights of 8.000 ac-ft in Lake Mendocino and provides water to agricultural producers;

Whereas these three organizations (the” Parties”) share a concern regarding diversions and impoundments for agricultural use, the need for in-stream flows for anadromous fish, and the balancing of these uses of water in the Upper Russian River watershed (“Project Area”);

Whereas regulatory oversight and requirements for water diversions and impoundments are increasing;

Whereas the majority of irrigated agricultural producers in the Project Area have individual water rights, diversions and storage systems;

Whereas currently available hydrologic data is very limited, making the analysis and determination of the causes of impairments for listed anadromous species difficult. This lack of information limits the development of a fair and reasonable water policy and regulatory decisions under the current system;

Whereas a new approach is needed to secure agricultural water supplies while retaining adequate flows for anadromous fish;

Whereas The City of Ukiah produces 4,000 ac-ft of recycled water annually and this recycled water offers an opportunity for additional agricultural water supply;

Whereas RRFC is negotiating a joint powers agreement to allow for utilization of the City of Ukiah’s recycled water;

THEREFORE the parties agree to cooperate and work together for the planning and implementation of the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program – Upper Russian River (”The Program”). The Program includes landowner outreach, watershed and stream monitoring and hydrologic analysis, fresh and recycled water storage facility development and coordinated permitting. The Program is attached as Exhibit A. This agreement generally describes how the parties will communicate as well as the separation of tasks between the parties to make best use of their varied purposes and skills.

1. PROGRAM GOALS

The parties mutually agree that the following goals will guide the Program:

- Protect agricultural water sources by increasing flexibility in the timing of diversions and thereby reducing effects on stream flow.
- Cooperative actions between the parties can provide the greatest level of improvement in water management;
- Support long term solutions to fishery issues which address all causes of stream flow changes.
- Support local solutions that directly involve growers and recognize individual water rights.
- Assure landowner involvement in solutions and regular communication with landowners.

2. DESCRIPTION OF ROLE OF EACH ORGANIZATION

Each party will focus their efforts on a different part of the Program. Working together the three organizations have formed a partnership named the Upper Russian River Stewardship Alliance or URSA.

- MCFB will provide outreach and information to landowners and water rights holders in the Project Area, organize and facilitate landowner meetings, distribute information and attend meetings with agencies, regularly communicate with the other parties to this MOU and coordinate meetings of URSA.

- RRFC will be the lead for studies for the recycled water project, metering of district water diversions, and participate in planning and implementing the monitoring program and meetings of the Science Advisory Group and landowners. RRFC will provide input into the locations and types of water management projects involving its customers and to the extent feasible support water rights permitting needed for water storage projects.

- CLSI will serve as the grant administrator and oversee implementation of water storage facilities and other BMP implementation in the Program, oversee the monitoring program and Science Advisory Group and attend landowner meetings. CLSI and MCFB will develop a database for the Program. CLSI has signed a cooperator agreement with the Natural Resource Conservation Service (NRCS) to implement $5.7 million in funding for water management projects over the 2009-2014 time period. This funding includes the Upper Russian River watershed as well as other areas.

3. COMMUNICATIONS

- The Parties will meet in person or by phone every two weeks and come to consensus on decisions on major issues in the Program. If a consensus cannot be reached by the three parties through the staff involved in the Program then the Board of Directors of each organization will be brought into the discussion to develop a consensus agreement.

- The Parties will determine what information to make pubic and what information to retain as private.

• The Parties will prepare joint press releases for events or issues associated with the Program. Each individual party will not issue press releases without the input of the other parties.

- The parties will work to keep each other appraised of recent events and meetings and openly share information.
- The three organizations will regularly discuss the details of the Program and determine direction and strategy for implementation

This MOU will extend from July 2009 to July 2014 and can be extended by mutual agreement of the signatories below.

Devon Jones, Executive Director	9/15/09 Date
Mendocino County Farm Bureau	
Sean White, Executive Director	9/16/09 Date
Mendocino County Russian River Flood Control and Water Conservation Improvement District	
Laurel Marcus, Executive Director	9/15/09 Date
California Land Stewardship Institute	

EXHIBIT A

To

Memorandum of Understanding between the Mendocino County Farm Bureau, California Land Stewardship Institute and the Mendocino County Russian River Flood Control and Water Conservation Improvement District

Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program – Upper Russian River

California Land Stewardship Institute

Mendocino County Russian River Flood Control and Water Conservation Improvement District

Mendocino County Farm Bureau

August 2009

Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program – Upper Russian River

INTRODUCTION

The Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program is an integrated regional program for private agricultural lands in the Navarro, Russian, and Napa Rivers and the Sonoma Creek watersheds. The majority (up to 95%) of these watersheds are private land. The goal of the program is to reduce conflicts between the needs of agricultural producers and the need for water quality, instream flows, and habitat improvements for listed anadromous fish species. The Program encompasses actions to address fine sediment and water temperature TMDL listings, instream flow and water management concerns, and aquatic and riparian habitat restoration—all major problems affecting beneficial uses of waterways in this region. All three of these problems—water quality, stream flow and water supply management, and aquatic and riparian habitat restoration—are inter-related and require analysis of river and watershed processes to produce sustainable results.

This report describes the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program in the Upper Russian River area. The Upper Russian River area extends from the headwaters of the west fork of the Russian River and the outlet of the Coyote Dam on the north to the Mendocino County line on the south (Figure 1). This area recently experienced a controversy between federal/state regulators and agricultural landowners, and as such this area has been identified as the highest priority within the four watershed program area. Landowners in this area have volunteered to construct significant improvements to protect beneficial uses in the Upper Russian River.

A partnership of the California Land Stewardship Institute (CLSI), Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) the Mendocino County Farm Bureau and the Natural Resources Conservation Service (NRCS) will carry out this program.

BACKGROUND

<u>Geology and Rainfall</u>

The Upper Russian River drains a watershed of 561 square miles. Rainfall in the Upper Russian River averages 37 inches per year. The climate is Mediterranean with a six-month dry season from April to September and a six-month wet season from October to March.

The watershed includes 72 tributary creeks and the Redwood, Ukiah, and Hopland valleys. These valleys were formed by faulting and uplift of mountains combined with subsidence of the valley (Figures 2 and 3). These geologic processes created wide basins filled with alluvium eroded from the bordering mountains through landslides and

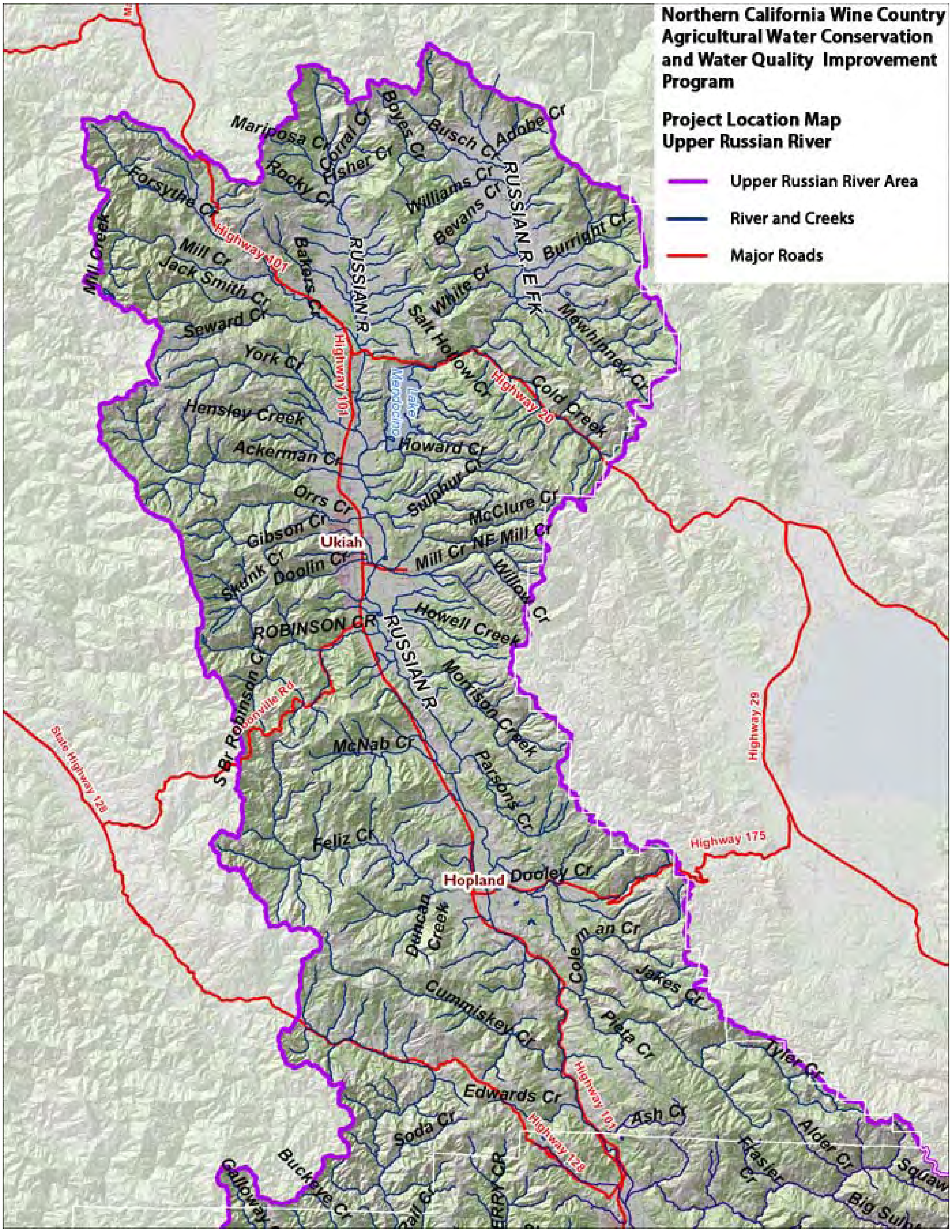

Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program
Project Location Map
Upper Russian River
Upper Russian River Area
River and Creeks
Major Roads
Mariposa Cr
Corral Cr
Boyes Cr
Busch Cr
Adobe Cr
Fisher Cr
Rocky Cr
Forsythe Cr
Williams Cr
Bevans Cr
RUSSIAN R E FK
Burright Cr
Highway 101
Mill Creek
Mill Cr
Jack Smith Cr
Bakers Cr
RUSSIAN R
White Cr
Salt Hollow Cr
Mewhinney Cr
Seward Cr
York Cr
Lake Mendocino
Highway 20
Cold Creek
Hensley Creek
Howard Cr
Ackerman Cr
Sulphur Cr
Orrs Cr
McClure Cr
Gibson Cr
Ukiah
NF Mill Cr
Mill Cr
Skunk Cr
Doolin Cr
Willow Cr
Howell Creek
ROBINSON CR
RUSSIAN R
Morrison Creek
S Br Robinson Cr
Boonville Rd
State Highway 128
McNab Cr
Parsons Cr
Highway 29
Highway 175
Feliz Cr
Hopland
Dooley Cr
Duncan Creek
Coleman Cr
Jakes Cr
Cummiskey Cr
Pieta Cr
Tyler Cr
Highway 101
Edwards Cr
Ash Cr
Soda Cr
Highway 128
Alder Cr
Flasier Cr
Squaw
Big Sulph
Calloway
Buckeye Cr

Figure 1

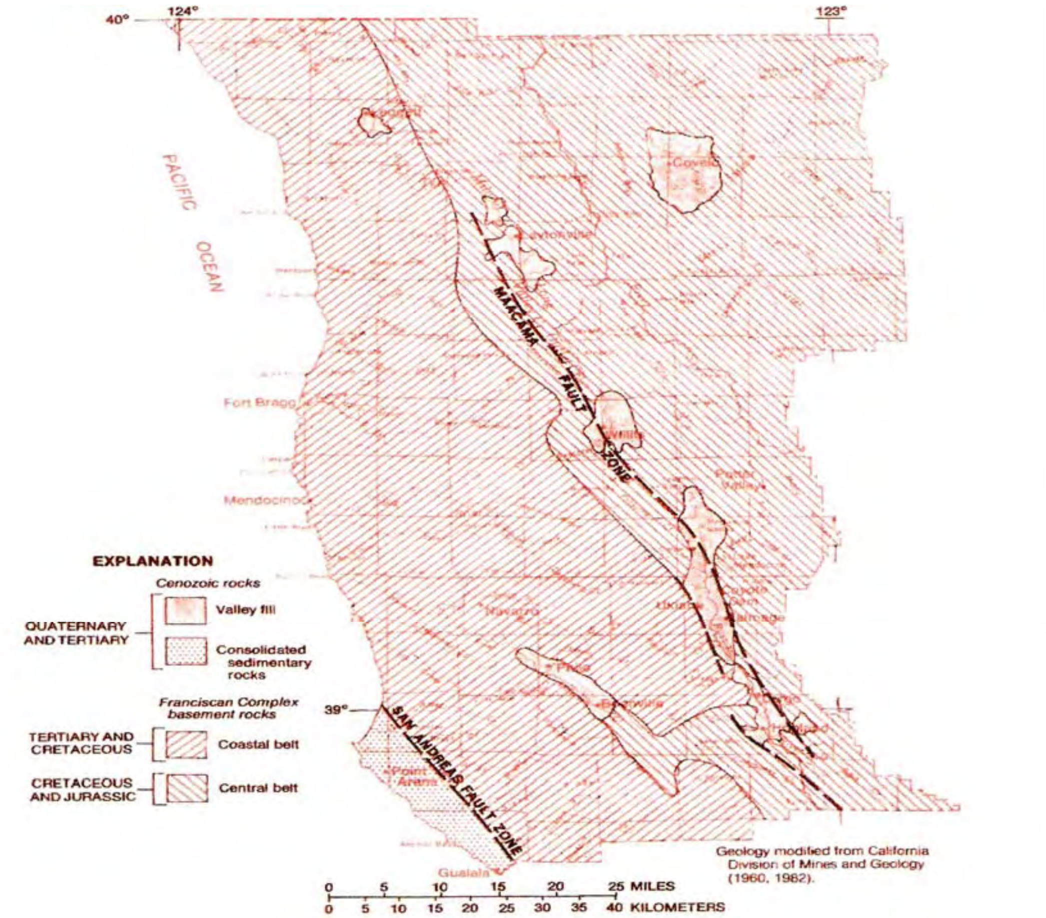


Figure 2: Generalized Geology of Upper Russian River area

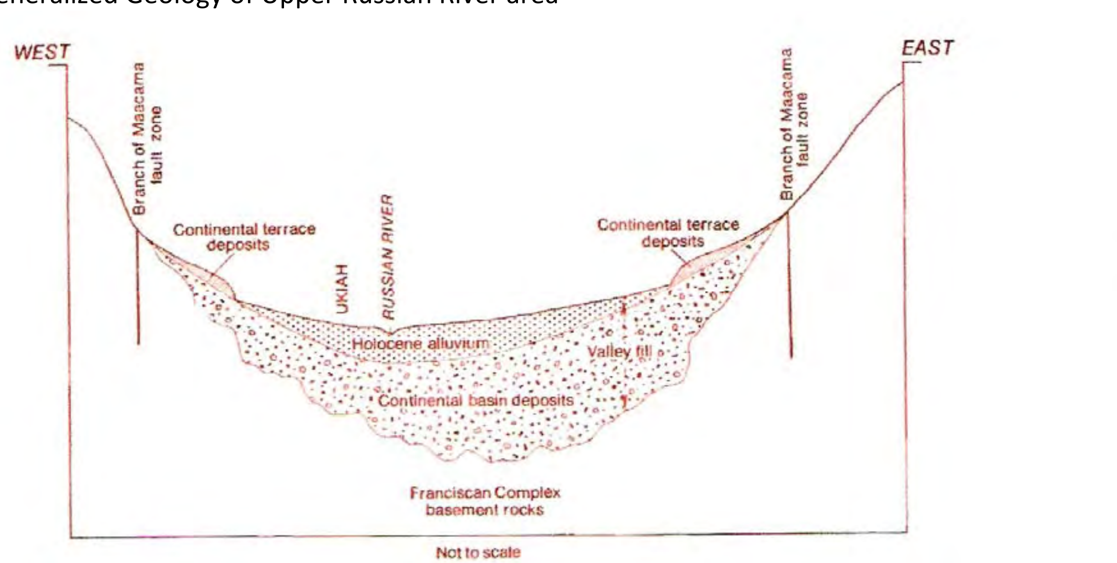


Figure 3: Generalized cross section of the Ukiah Valley

Both figures from Farrar, C.D. 1986. Groundwater Resources in Mendocino County, Ca. U.S. Geological Survey Water Resources Investigations Report 85-4258.

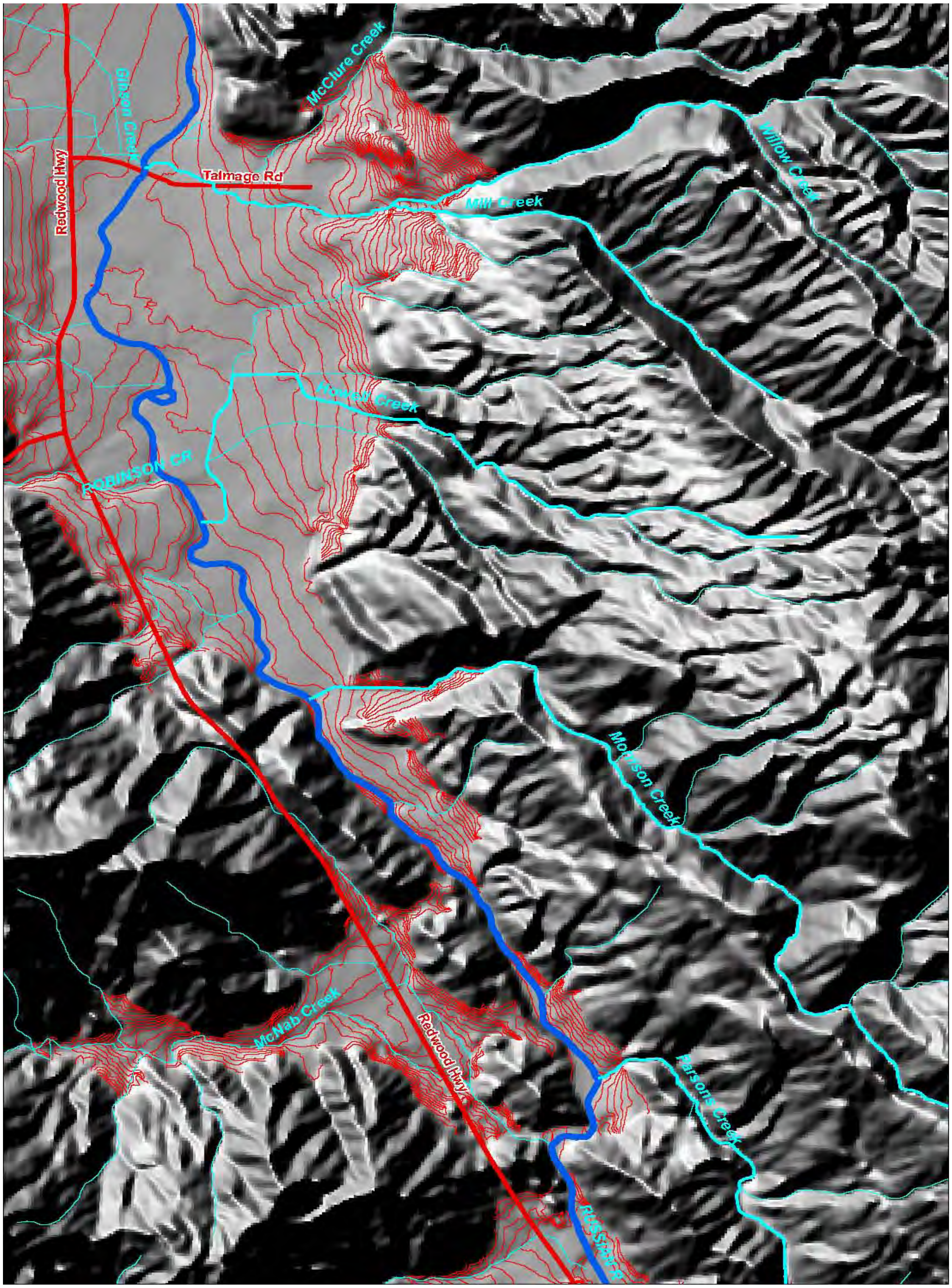


Figure 4: Contour map of Ukiah Valley shows the presence of alluvial fans where creeks exit their canyons and flow out onto the valley floor.

debris flows (USGS 1986). The Russian River has sorted and redistributed the surface alluvium through flood events. Tributary creeks in the Upper Russian River watershed drain the mountains that flank the east and west boundaries of the drainage. Most of these creeks are confined in hard rock canyons in the mountains and cross through alluvial fans as they flow to the river (Figure 4).

The alluvial valley portions of the creeks and river once supported an extensive riparian corridor, floodplain wetlands, and slough areas. Creek and river channels were wide and shallow with groundwater levels close to the floodplain surface (Figure 5). This system supported populations of steelhead trout (Oncorhynchus mykiss) and Chinook salmon (Oncorhynchus tshawytscha).

<u>Development</u>

Agriculture began in these valleys in the 1860s with livestock, dairy, and cultivated crops. Recent estimates of irrigated acreage are 15,539 acres of grapes and 1,889 acres of pears. (Mendocino Dept. of Agriculture 2007, Lewis et al 2008)

Coyote Dam

A series of floods in the 1930s and 1940s brought interest from the federal government to control floods and create a larger water supply in the Upper Russian River. Coyote Dam was built by the Army Corps of Engineers in 1959, impounding 122,400 acre-feet on the East Fork of the Russian River and creating Lake Mendocino (Figure 6). During the wet season, the Army Corps of Engineers operates Coyote Dam to hold back flood peaks and, once the storms have passed, releases flow sometimes for a week or more (Figures 6, 7 and 8). During the dry season, the Sonoma County Water Agency manages Lake Mendocino for its water supply; releasing flows that are then diverted for urban uses over 50 miles downstream at the Mirabel Pump Station. The Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) also has rights to 8,000 acre-feet of water in Lake Mendocino.

The long-term effects of the Coyote Dam are typical of a large dam on an alluvial river: the impoundment of sediment in the reservoir causes the river to replace its needed sediment supply by eroding its bed and banks (Figure 9). The result is the current Russian River channel which is 20 ft. deep with very steep banks. Following Lake Mendocino flood control releases, saturated banks fail, greatly increasing sediment loading in the Russian River. This process on the Upper Russian River is well-documented (Florsheim and Goodwin 1993; NMFS 2008). The entrenchment of the main river channel moves up tributary creeks as well, affecting bridges and other infrastructure. In addition, the summer groundwater level is defined by the lowest point in the river channel and entrenchment of the main river channel can significantly change stream flow conditions in tributaries (Figure 10).

Large reservoirs not only cause changes such as channel entrenchment, but also significantly alter the timing of river flows rising in response to rainfall. For example, large water supply reservoirs may require numerous rainfall events to fill the reservoir before releases to the downstream river channel are increased above minimum levels. This may further delay the timing of connected flow in tributaries.

Reservoirs with flood control functions may further complicate the timing and duration of connected flow necessary for salmonid in-migration and spawning and out-migration. Most flood control reservoirs fill with water during rainfall events and hold back releases until after storms are over. Then, releases are made, filling the river channel for a few days to over a week, and then are abruptly stopped when the release volume is completed. Flood control operations artificially move the river's water level up and down. This rapid change in the water level of the river due to reservoir releases can directly change flow in tributary creeks from surface to subsurface.

Over the 50-year period since the Coyote Dam was constructed, the Upper Russian River has transformed from a wide, shallow river channel with riffles, deep pools, and gravel bars and frequent connection with its floodplain (Figure 5) to a narrow, deep channel with high-velocity flows and limited aquatic and riparian habitat.

In addition to the large reservoir, numerous small agricultural reservoirs have been built on tributary creeks, primarily in the canyon areas of creeks. These on-stream reservoirs can cause similar localized effects on tributary creeks as Coyote Dam has on the main river. In many locations, however, the tributary creeks are incising as the river's entrenchment moves upstream along the creek until it reaches a natural rock hard point or human-made structural hard point. Thus, the effect of small reservoirs on a tributary creek may be insignificant compared to the effects of migration of incision up the creek from the main river channel.

The effects of Coyote Dam on the Upper Russian River watershed need to be noted and understood in evaluating the impacts of agricultural water management and instream flows for anadromous fish. The potential for changing these effects, however, is very limited.

Figure 5: Historic photograph of the Vichy Springs Road Bridge showing the Upper Russian River prior to the Coyote Dam. Note the river channel is wide and shallow.

Figure 6: Coyote Dam created Lake Mendocino in 1959 on the East Fork of the Russian River.

Figure 7: Erosion of the Upper Russian River channel due to incision largely caused by the Coyote Dam. Channel erosion results in direct delivery of fine sediment into the Russian River which is listed as impaired by this pollutant.

Figure 8: A flood control release from Coyote Dam on the Upper Russian River

Figure 9: Bank erosion on Upper Russian River following flood control release. Changes from the reservoir have created a river channel which is narrow and deep.

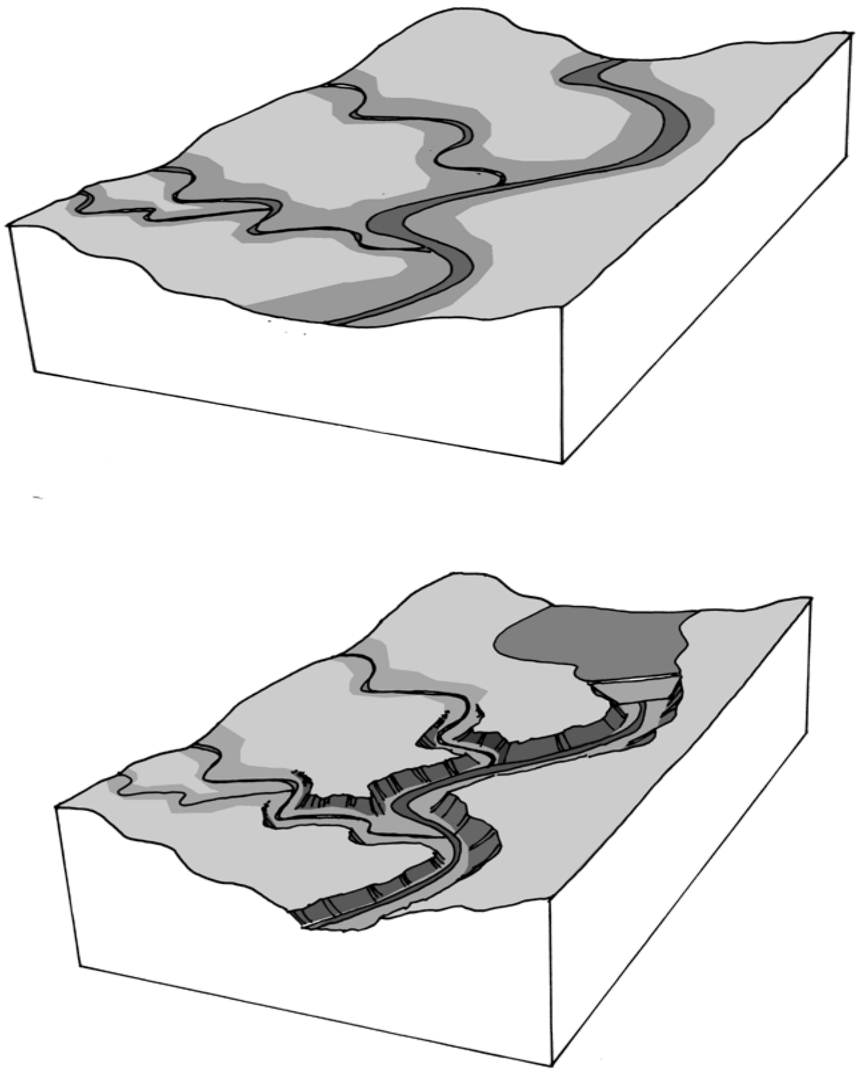
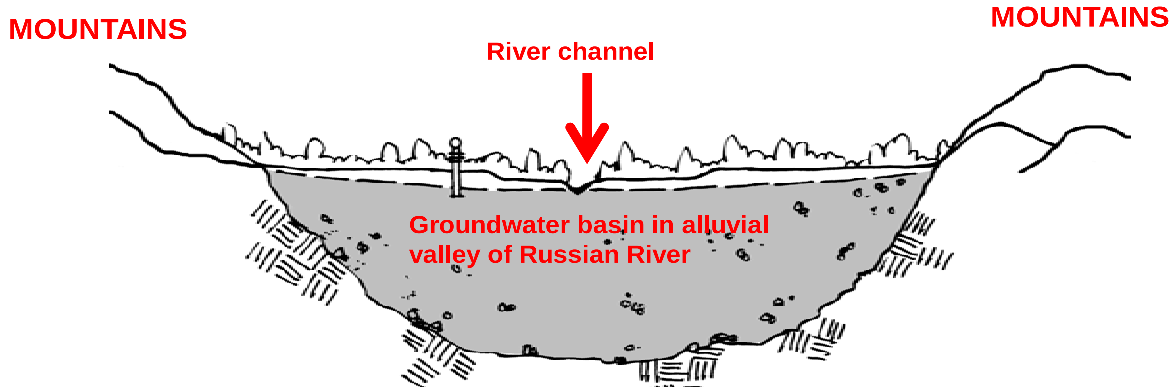


Figure 10: Illustrations depict alluvial valley and river prior to dam and after dam showing the entrenchment of the main river channel and the movement of that drop in base level up alluvial reaches of tributary creeks.

RIVER CHANNEL AND GROUNDWATER BASIN PRIOR TO ENTRENCHMENT



RIVER CHANNEL AND GROUNDWATER BASIN AFTER ENTRENCHMENT – SIGNIFICANT SYSTEM-WIDE CHANGE

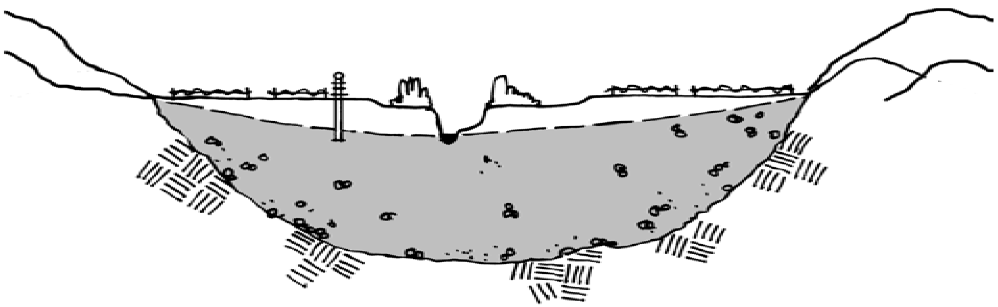


Figure 11: Illustrations depict changes to groundwater levels from channel entrenchment of main river channel.

Beneficial Uses and Non-Point Source Pollution

The Upper Russian River (Coyote Valley, Forsythe Creek, and Ukiah HSA) is listed as impaired by fine sediment and high water temperatures (State Water Resources Control Board 2006). Beneficial uses include:

- Municipal and agricultural water supply
- Industrial service water supply
- Cold freshwater habitat
- Groundwater recharge
- Navigation
- Hydropower generation
- Water and non-water contact recreation
- Rare, threatened, and endangered species habitat
- Migration of aquatic organisms
- Spawning habitat
- Warm water habitat
- Commercial and sport fishing

The TMDL for the Russian River is scheduled for 2010 and will require significant field monitoring and analysis. The TMDLs for the Napa River and Sonoma Creek, both of which are also highly incised channel systems, found that the main river channel incision is the primary source of fine sediment polluting the water and impairing beneficial uses.

Altered Stream flows

The channel of the Russian River, where it is incised by the effects of the Coyote Dam, is cut off from its floodplain and has a very limited area for riparian forest. In addition, the high flow velocities resulting from the incision produce scour which affects aquatic habitats.

The timing and magnitude of stream flow in the Upper Russian River and its tributaries are also affected by the entrenchment of the main channel. The Upper Russian River courses through an alluvial valley. Runoff from the watershed percolates into the alluvium and fills up the shallow groundwater basin before water levels rise in the river and creeks (Figure 11). When the main river channel entrenches, the low point in the groundwater table is lowered and tributary streams go subsurface through their alluvial reach, particularly if the water level in the river is kept low by dam operators (Figures 12, 13 and 14). In several tributary creeks in the Ukiah Valley, groundwater level monitoring (Figure 15) has found the creeks dry up starting from the river confluence and progressing upstream. This indicates the strong effect river flow levels have on the tributary flow levels (Jackson and Marcus 2002). In years with a dry spring or fall, this situation can restrict the movements of both anadromous salmonid adults and juveniles attempting to migrate between creek and river areas. In addition, juveniles moving from rearing areas to the main river in spring may get stranded on the alluvium as stream flow goes subsurface in response to low river flows.

Agricultural Diversions

Agricultural diversions, reservoirs, and wells may exacerbate stream flow problems by reducing the volume of stream flow in tributaries and potentially lowering the shallow groundwater level. Another effect of agricultural diversions is rapid drawdown of stream flow for frost control. Wine grapes in the Ukiah Valley area use water applications during night time freezes in the spring (March 15-May 15). There are few alternative technologies (i.e. wind machines) that will consistently protect grapes from frost damage in this severe frost zone. For grape growing operations, limiting frost damage is essential as frost will ruin the year's crop. In 2008 the worst frost season in over 40 years occurred, and water was used for over 20 nights in many areas. This frost event occurred during the driest March on record, creating the unusual occurrence of high instantaneous water demand and very low stream flow. On April 20, an 83 cfs rapid drop in flow was recorded at the Hopland U.S. Geologic Survey stream flow gage. Several dead juvenile steelhead trout were found in the Russian River and in one creek in Sonoma County. With another dry year in 2009 in Mendocino, the need for frost diversions was coordinated with releases from Coyote Dam to avoid affecting fish. The Mendocino Farm Bureau worked with local growers, Fox Weather Service, and the Russian River Flood Control District (RRFC) to determine when a frost event was forecast. RRFC then requested a gate change and water release by the Sonoma County Water Agency. These efforts avoided the instantaneous drawdown and fish stranding which occurred the prior year; however, a long-term solution is needed.

Aquatic and Riparian Habitat Restoration

The entrenchment of the Upper Russian River channel creates fish passage barriers at culverts and bridges on tributary creeks. Many of these barriers have been retrofitted by placement of rock weirs or other structures in the channel. The entrenchment process can undermine these retrofit structures over time. The change to stream flow processes due to incision also can cause tributary stream flow to go subterranean, creating another type of barrier to fish passage.

Revegetation projects on the main channel of the Upper Russian River have been completed in only a few locations and formal monitoring data on these is largely unavailable. There are anecdotal accounts of successful dormant willow restoration combined with rock placement installed for the purposes of bank stabilization. There are also accounts and photographs of bank failures following flood control releases in locations which have been stabilized as well as in locations without stabilization (Figure 16). The flood release saturates the banks; then when the release ends the stage of the river drops 10 feet or more in a few hours and the super-saturated banks slump as they lose the hydrostatic pressure created by the water. The eroded sediment will cover over streambed habitats until subsequent flow moves it downstream.

There are no habitat restoration techniques which can stabilize the steep vertical river banks against these failures without coordination and revision of release methods from Coyote Dam. It is not possible to install native plants on vertical banks, making bank setbacks a necessity. However, the success of any restoration/revegetation project rests on limiting flood control releases which saturate banks and cause them to fail until the vegetation gets established.

Non-point source pollution, instream flow and water management, and habitat restoration are all affected by river and creek flow processes, and the alteration of these processes are caused by multiple changes in the Upper Russian River watershed.

PLANNING AND POLICY ACTIVITIES

There are several ongoing planning and policy activities led by various agencies in the Upper Russian River.

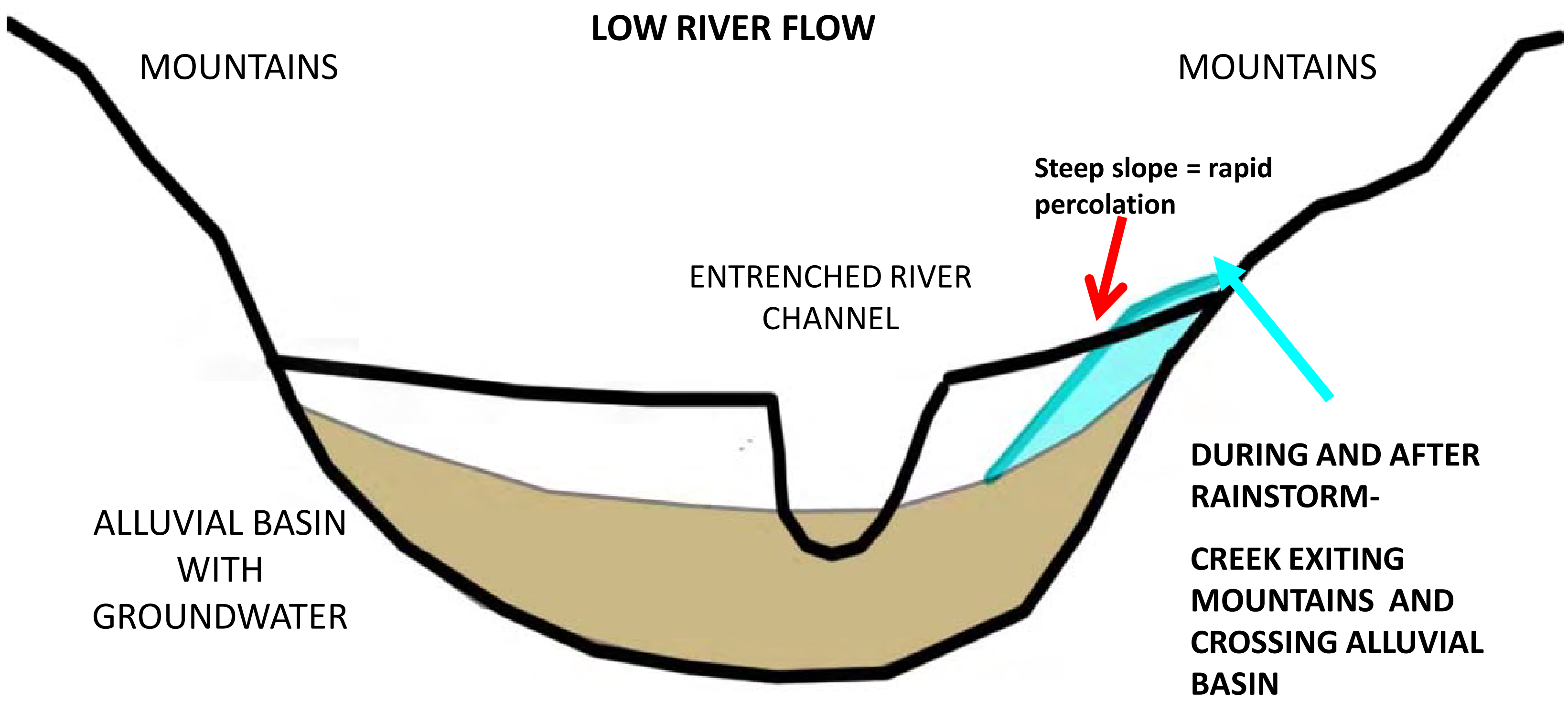
Non-Point Source Pollution-Fine Sediment and Temperature Total Maximum Daily Loads (TMDLs)

The North Coast Regional Water Quality Control Board (RWQCB) prepares the technical studies, policy documents such as Basin Plan Amendments, and implementation plans for each individual pollutant. For each TMDL the RWQCB prepares a written plan that describes how an impaired water body will meet water quality standards. A water body may be listed as impaired by excess nutrients, fine sediment, high water temperatures, pathogens, or chemical pollutants such as mercury, PCBs, or selenium. The Upper Russian River is listed as impaired by excessive fine sediment and excessive high water temperatures.

Extensive monitoring and analysis are required to prepare the technical studies needed for the TMDLs for fine sediment and water temperatures. In particular, the relationship between the channel and tributary creek incision, dam operations, and fine sediment loading levels needs to be measured and quantified in order to determine needed changes. Other sources of fine sediment resulting from sheet and rill erosion (agricultural fields, urban development, and dirt roads in all areas) must also be quantified.

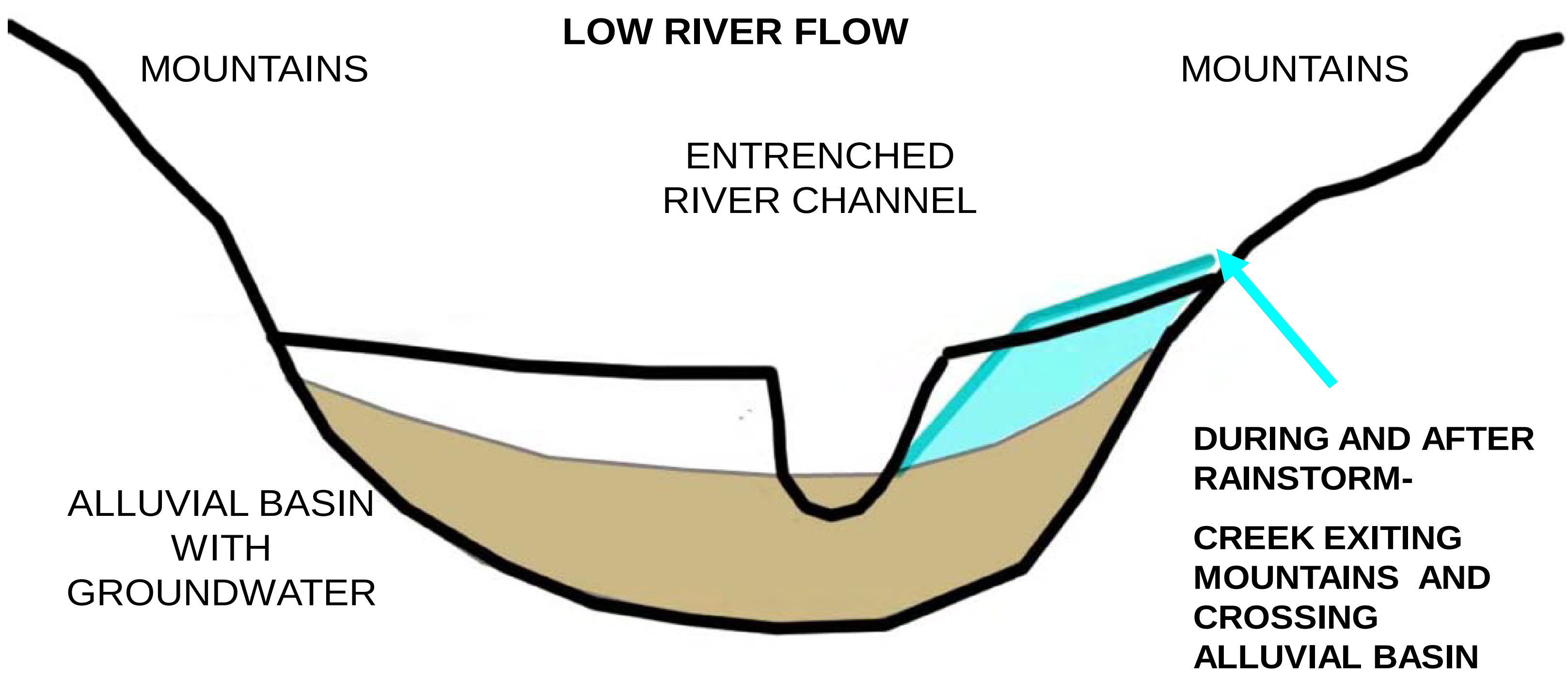
Channel incision directly affects water temperatures by eroding out riparian forest and altering the ability of the system to regenerate riparian canopy. Entrenched alluvial channels typically have high flow velocities and little to no floodplain. Both of these conditions severely limit riparian regeneration and growth. Riparian canopy is a requirement for reducing solar inputs on creeks and the river. The volume of stream flow and therefore the timing and duration of diversions have an effect on water temperatures. Also, Coyote Dam operations and release schedules have a major effect on river water temperatures.

Both the fine sediment and water temperature TMDLs for the Upper Russian River are scheduled for completion in 2011-2012.



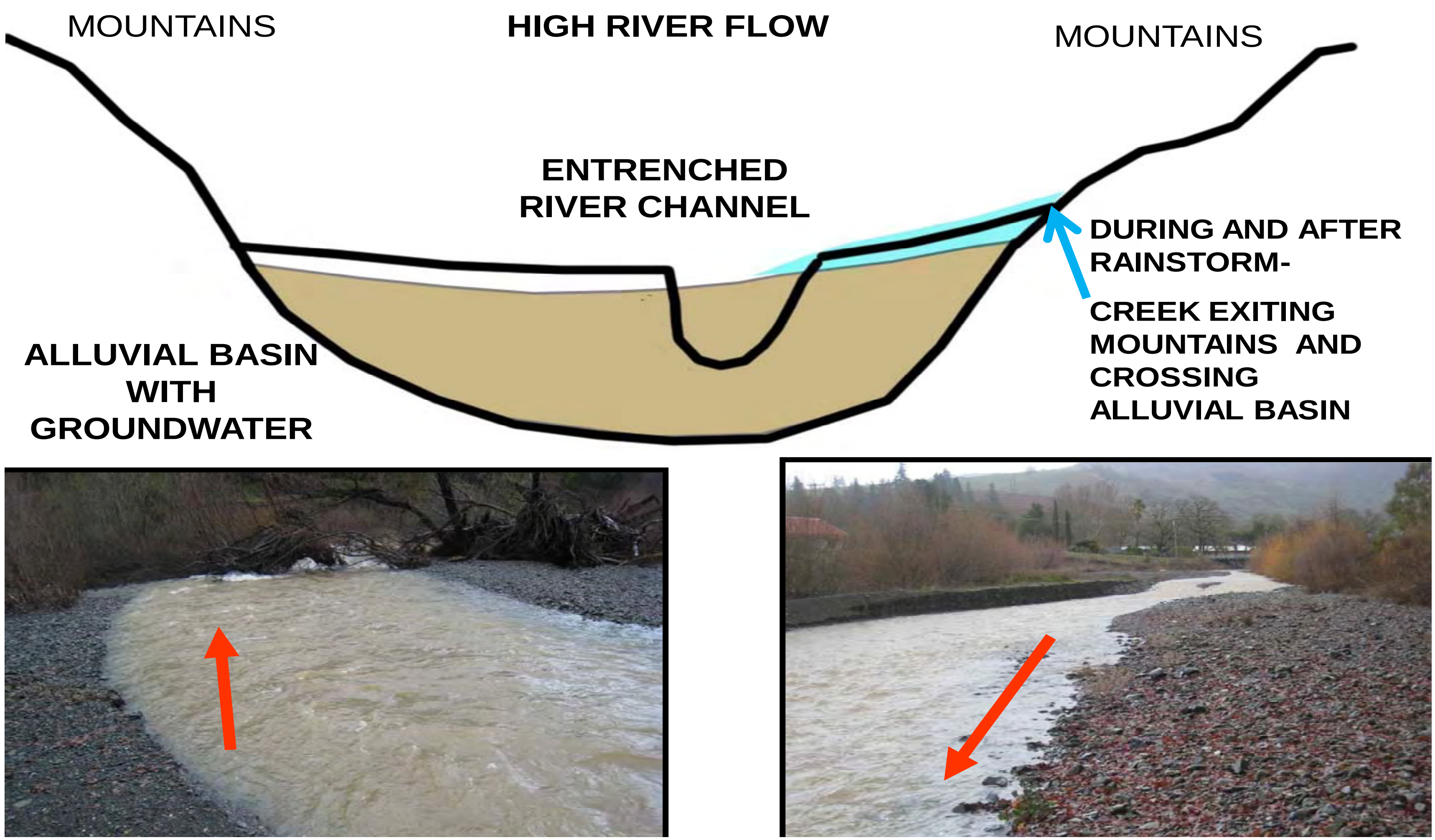
At low flow in the river channel, water exiting the creek canyon onto the alluvial valley will percolate into the alluvium until the alluvium is filled with water and the river rises. The slope of the ground water basin between the creek outlet and the river level determines how quickly the water percolates.

Figure 12: Illustration of stream flow processes on the Upper Russian River with low river flow and a small rainstorm.



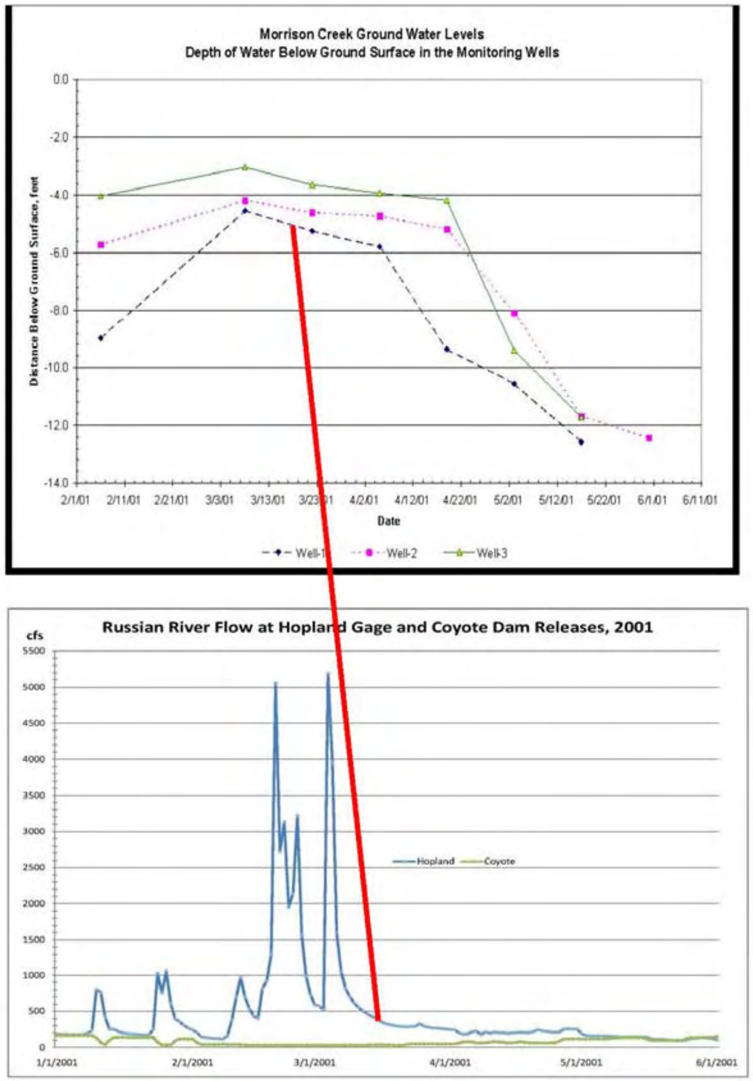
During large or intense rainfall events when the river is still low creek flow may be great enough to make it nearly to the river channel before percolating into the alluvium

Figure 13: Illustration of stream flow processes on the Upper Russian River with low river flow and a large rainstorm.



MORRISON CREEK AT HIGH FLOW IN FEBRUARY 2009.
ONLY ONE PERIOD OF CONNECTED FLOW OCCURRED IN 2009.

Figure 14: Illustration of stream flow processes on the Upper Russian River with high river flow and a large rainstorm.



A 2002 groundwater monitoring project found a drop in ground water levels coincides with the drop in flow levels in the main river channel. The drop was greatest in the well located closest to the Russian River indicating that the river's water surface elevation is a major factor in the dewatering of the tributaries.

Flow in both Morrison and Parsons Creeks went subterranean as soon as the water level in the river dropped. No juvenile steelhead could have migrated out of these creeks which have year round flow in their canyons.

Figure 15: Graphs depict the results of groundwater monitoring in the Upper Russian River

Figure 16: Two views of bank erosion and delivery of fine sediment into the impaired Upper Russian River during flood control releases from Coyote Dam

Instream Flows and Water Management

Pending Applications for Water Diversions

The State Water Resources Control Board recently considered two very different actions to address stream flow issues.

Assembly Bill 2121 (AB 2121) required the development of principles and guidelines for water rights permits in a 2.2 million-acre area including the Russian, Napa, Navarro, Gualala, Garcia, Albion, Big, Noyo, and Mattole Rivers, Sonoma Creek and Tomales Bay watersheds. In response to this bill, the State Water Resources Control Board (Water Board) released the Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams (Draft Policy) in December 2007 to provide guidance for the evaluation and approval of pending water rights applications in a 2.2 million acre area, including the Upper Russian River. Pending applications often cover existing water diversions or impoundments and have been in the review process for up to 20 years.

The Draft Policy sets forth a single methodology and equation to evaluate the potential effects of water diversions on instream flows needed for salmonid in-migration and spawning. The large area encompassed by the Draft Policy, however, is highly variable in terms of geologic formations and annual rainfall amounts as well as existing water storage and diversion facilities. This enormous diversity in the landscape and climatic conditions makes formulation of one set of principles and guidelines to accurately analyze instream flows and the potential effects of agricultural diversions on listed salmonids very problematic. Maintaining flows for the in-migration and spawning portions of the salmonid lifecycle are the primary focus of the Draft Policy.

The Draft Policy, as outlined in the 2007 document, may also have limited applicability to many creeks in large valley alluvial watersheds like the Upper Russian River because its proposed methodology does not address the early season percolation of runoff and the effects of river channel incision on the timing of connected stream flow in tributaries. The requirements proposed in the Draft Policy to install bypass channels around small on-stream reservoirs to produce flow for salmon in-migration is unlikely to change stream flows in alluvial reaches of tributary creeks in the Upper Russian River without corresponding changes to river flow levels through reservoir releases.

The recently released alternative for the Draft Policy (Joint Recommendations for the North Coast Instream Flow Policy) uses the riffle crest thalweg, a geomorphologic feature of creeks in an equilibrium condition, to define needed instream flow levels. This geomorphologic feature is not found on the alluvial fans which mark nearly all of the creeks in the Russian River as well as the Napa River. Additionally, the riffle crest thalweg is highly altered in form in entrenched channels. It is not clear how this geomorphic based criteria will be applied to these other types of creek channels. The State Board has not yet acted on the Draft Policy.

Frost Control Water Diversion Restrictions

In February 2009 the National Marine Fisheries Service requested that the State Water Resources Control Board approve a complete moratorium on the use of water for frost control in the Russian River basin in Mendocino and Sonoma counties (NMFS 2009). This request was based on the effects of the extreme frost event in 2008 on listed fish in two locations in the Russian River drainage. The State Water Board held a workshop on this subject in April 2009.

A frost task force was formed in summer 2008, consisting of the National Marine Fisheries Service, California Department of Fish and Game, State Division of Water Rights, the North Coast Regional Water Quality Control Board, Mendocino Farm Bureau, several Mendocino County growers, the Fish Friendly Farming program, Russian River Flood Control and Water Conservation Improvement District, Sonoma County Water Agency, and Trout Unlimited. In May 2009 a number of Sonoma County groups joined the frost task force.

For 2009 the Mendocino County agricultural organizations and growers devised a protocol for release of additional water from Coyote Dam on nights when frost occurs in order to avoid any fish kills (see p. 13). The task force has discussed the need for a portion of those growers along the Upper Russian River that directly divert water for frost control to have off-stream water storage ponds to reduce the instantaneous drawdown of stream flow.

At the August 13, 2009 meeting of the frost task force, the National Marine Fisheries Service (NMFS) described their expectations for farmers to address the potential effects of diversions for frost control. NMFS outlined three primary elements: conservation actions, effective monitoring, and transparency. These water budgets would be used to determine conservation strategies including limitations to new water diversions. NMFS stated a need for transparency in providing information on water use and gaging data collected by farmers to them. Finally, NMFS stated that all diverters should be subject to oversight. These requirements would apply to licensed and permitted water rights as well as pending water rights.

Coyote and Warm Springs Dams Biological Opinion

In 2008, NMFS released a Biological Opinion (BO) under the Endangered Species Act on the operations of the two large federal dams in the Russian River drainage. The BO requires a number of changes to dam operations. One of the largest changes is a decrease in spring-summer-fall water releases to reduce stream flow levels in the Russian River and Dry Creek. These recommendations are based on an analysis of instream habitats, summer flow velocities, and water temperatures. The BO will be implemented by the Sonoma County Water Agency and the U.S. Army Corps of Engineers.

California Department of Fish and Game 1600 Permits

The California Department of Fish and Game has provided information on the permit requirements of Section 1600 of the California Fish and Game Code:

> *Fish and Game Code (Section 1600 et. seq.) requires an entity to notify the Department of any proposed activity that may substantially modify a river, stream, or lake. This*

would likely include activities such as placing a pump intake into the surface flow of a stream, excavating material from channels to install and submerge a pump intake, and diverting water (including subterranean flow from off-channel wells) which may influence the amount of surface water available for fish and other aquatic species. Water diverters that do not have a valid Lake and Streambed Alteration Agreement ("LSAA") should notify DFG of their projects prior to beginning annual water diversion activities (Ca. Department of Fish and Game 2009).

SUMMARY

- The Upper Russian River is a large valley alluvial system which has been significantly altered by the Coyote Dam and, to a lesser extent, by small reservoirs, gravel mining, and other uses. Large-scale channel incision of the main Russian River channel has occurred, primarily caused by the Coyote Dam.

- The incision of the main Russian River channel has increased fine sediment loading through bank erosion and the migration of the entrenchment up tributary streams.

- Fine sediment loading to the Upper Russian River is exacerbated by extended flood control releases from Coyote Dam which induce bank failures and further loss of riparian canopy.

- Channel incision, bank erosion, and channel scour in the Upper Russian River cause loss of riparian forest canopy with resulting higher water temperatures and loss of instream aquatic habitats.

- The generation of connected stream flow in creeks in alluvial valleys such as the Ukiah Valley is dependent upon recharge of shallow groundwater levels prior to the initiation and maintenance of surface water flows. Channel incision of the main Russian River channel alters the timing and duration of connected stream flow by lowering the system base level and inducing greater percolation of creek runoff prior to the generation of surface flows.

- Dry year operations of Lake Mendocino create low level water releases and, when combined with agricultural frost control diversions, can rapidly drop water levels and may create adverse conditions for salmonid fry.

- Planned future stream flow levels in the spring/summer/fall will be maintained at low levels.

- Riparian and aquatic habitat restoration on the mainstem Upper Russian River is largely ineffective under the current flood control operations of Coyote Dam.

- Channel incision moving from the main channel into tributary creeks can create numerous fish migration barriers at road crossings, in locations where stream flows rapidly percolate or go subsurface to meet low river water elevation, and in entrenching channels where flow velocities are high.

- A program which integrates watershed monitoring and modeling, non-point source pollution control, instream flow and water supply management, and habitat restoration is needed.

- A program addressing private land and water management should be employed to implement changes demonstrated by a watershed-based monitoring and analysis and should focus on collaborative solutions with agricultural landowners.

PROPOSED SOLUTIONS

The Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program incorporates both immediate changes to agricultural practices as well as watershed-based monitoring and analysis to evaluate sources of non-point source pollutants, causes of reduced stream flow, and the primary factors affecting salmonid habitat loss. The Program includes the following:

- Non-point source pollution control projects on agricultural lands
- Water management improvements and metering of diversions to manage instream flows
- Integrated monitoring and watershed analysis
- Science Advisory Group to review projects, monitor results, and recommend changes
- Landowner outreach and meetings to provide direct input from the agricultural community

<u>Non-Point Source Pollution Control Projects</u>

The California Land Stewardship Institute (CLSI) is a 501(c) (3) non-profit organization, which operates the Fish Friendly Farming (FFF) Environmental Certification Program in the Sonoma, Mendocino, Napa, and Solano County areas. The FFF Program is the designated compliance program for TMDLs for fine sediment and water temperature, the primary listed pollutants in the Upper Russian River area. Through the FFF program, CLSI works with hundreds of agricultural producers.

The FFF program addresses soil and water conservation, erosion control in all areas of the site including roads, water supply, and stream habitats particularly for listed fish species. CLSI works to increase the environmental values and functions on agricultural lands while sustaining economic viability. Through the FFF program, CLSI develops long-term working relationships with agricultural producers.

Working together, CLSI and the farmer produce a detailed and comprehensive Farm Conservation Plan using the FFF template. This plan addresses all aspects of the property and all management practices. This approach reviews all potential sources of fine sediment generation and delivery including vineyard/orchard areas, road, creek channel, and ditch erosion and prescribes BMPs for TMDL compliance actions. The plan also inventories the potential for chemical runoff, all water conservation practices and water supply facilities, the condition of the stream network and aquatic habitats, and many other features. The plan sets forth a long term blueprint to change management practices and implement projects on each farm.

The plan and site is then certified by staff from the National Marine Fisheries Service, the California Regional Water Quality Control Board, and the County Agricultural Commissioner. The FFF certification provides coverage for fine sediment and water temperature TMDL compliance for each producer. In order to maintain the certification, the grower must be recertified every 5 years. Once certified, CLSI works with the grower to implement improvements and complete monitoring. CLSI assists in project permitting, design, and cost share grants (Figure 17). Average sediment loading reductions achieved through the FFF program are 3.5 tons/acre/year.

Instream Flow and Water Management Improvements

Agricultural water supplies in the Upper Russian River are mostly small localized sources developed for individual farms. Although there are two large reservoirs in the Russian River drainage, 90% of this water supply is for urban use. One agency, the Russian River Flood Control and Water Conservation Improvement District (RRFC), holds water rights to 8,000 ac-ft in Lake Mendocino and supplies this water to agricultural producers in the Ukiah and Hopland Valleys of the Russian River drainage.

Individual farm water supplies may consist of small reservoirs, wells, stream diversions, and subsurface drainage collection systems, or a combination of these. With the expansion of wine grape growing in the Upper Russian River area, the effects of water diversions on local stream systems have become controversial. Two species of federally-listed threatened and endangered salmonids inhabit creeks and the Upper Russian River – Chinook salmon and steelhead trout. These species are all cold water fish, requiring gravel-bed, sediment-free streams with cold year-round flows for spawning and rearing of juveniles. Streams require high water quality and adequate riparian shade canopy and flow to provide habitat for salmonids. Agricultural lands, unlike urban lands, can support high quality stream habitat for salmonids. However, if water diversions are too numerous along a stream, the creek can be impacted during certain seasons.

Wine grapes use relatively low amounts of irrigation water, typically 0.5-0.75 ac-ft/acre/year. However, springtime frost control operations require large volumes of water over short periods of time on large acreages of vineyard. Frost problems occur between March 15 and May 15, when tender growth has sprouted on grapevines and freezing temperatures set in overnight in low-lying areas and valleys. Due to air quality concerns in the 1970s, diesel smudge pots are rarely used in vineyards or orchards. Instead, continuous application of water is used. As the water changes from a liquid to a solid state, it releases heat and protects the foliage from frost damage. However, water must be continuously sprinkled over the vineyard, starting before freezing temperatures and extending past sunrise. Frost primarily affects valley floors and low-lying areas; hillside vineyards are not usually affected and don’t have sprinkler systems. Vineyards in valleys and other frost-prone areas usually have large volume sprinklers which apply 50 gallons per minute for a total of 3,000 gallons/hour/acre. All vineyard frost control systems are turned on simultaneously, creating a high instantaneous demand for water in these valley areas.

Frost events can cause several different environmental problems. In areas where most growers directly divert water from a river or creek into the frost control system, instantaneous drawdown from the river can rapidly drop water levels in the waterway. This is most likely to occur during dry spring periods as in 2008. Along the mainstem of the Russian River in Mendocino County and several creeks in the Sonoma County part of this drainage, dead juvenile salmonids were found due to a localized drop in water levels. Growers along the Upper Russian River and many tributaries lack off-stream water storage facilities and therefore have no flexibility in their water systems to reduce the effects of instantaneous drawdown.

Construction of off-stream storage ponds allows for management of diversions to reduce impacts to stream flow.

Another effect of many nights of frost control in a dry year is a lack of irrigation water in the summer. In some locations, water supplies are very limited and frost control can use up that year's supply of water. Replenishment from wells and re-collection of frost water applications through sub-surface systems may provide some additional water but in general, this is insufficient. Recycled municipal wastewater offers an opportunity to supplement and/or replace freshwater supplies, aiding both agriculture and the environment.

Recycled water is available for use in the Ukiah Valley where the City of Ukiah discharges 4,000 acre-ft. of recycled water into the Russian River in the winter. This single source is sufficient to irrigate 3,185 acres of irrigated agriculture, which represents approximately 65% of the RRFC's agricultural use or 15% of all irrigated agriculture the Upper Russian River area. While distribution of recycled water to agricultural producers is often constrained by access, the situation in the Ukiah Valley is nearly ideal. The City's treatment plant is surrounded by agricultural land and directly adjacent to a rail easement that runs through or near agricultural properties from Redwood Valley in the north to Hopland in the south. A lack of off-stream storage and a distribution pipeline limit use of recycled water by agricultural producers.

In spring 2009, CLSI began a review of alternative frost control strategies with growers. These include wind machines, vegetation management, more accurate temperature forecasts, micro-sprinklers, and other approaches. The project will involve a large number of growers and will produce additional technical information for water conservation in frost control.

Figure 17: This road was changed from insloped to outsloped as a Fish Friendly Farming project to reduce fine sediment generation and delivery.

Water management implementation projects include:

- Construction of four phases of off-stream storage ponds for direct diverters in the Upper Russian River over a five to ten year period (Figure 18). These ponds will reduce impacts to listed salmonid species by reducing instantaneous drawdown of creek/river flows during frost control operations. A total of 550 acre-feet of storage is being proposed by growers in the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program, and additional outreach could increase this number. This project will allow for management of the timing of diversions from the Russian River and tributary streams to provide adequate flow for listed salmonids. These ponds will also mitigate drought by increasing flexibility in water management. (Figure 18)
- Ponds will be designed according to the Natural Resources Conservation Service (NRCS) standards and will consist of an excavated pit on flat or nearly flat land ringed with a compacted dirt berm, impermeable liner (if needed), pumps, pipes, and other facilities. All instream diversions will be fitted with fish screens. Ponds will be located away from the banks of creeks and river to avoid flood damage. All ponds will be located on agricultural lands not wildland and therefore the environmental impacts will be minor. Pre-construction soil and subsurface geology will be completed to determine if a liner will be needed and if excavation will be difficult. Growers have volunteered to remove vineyard in 13 locations for ponds and the conceptual designs have been completed.
- Telemetric meters will be installed on all diversions under contract with RRFC.
- Planning, design and construction of off-stream ponds and lateral pipelines for use of 4,000 acre-feet of tertiary treated water from the City of Ukiah. Storage and use of this water for summer irrigation or spring frost control can off-set existing fresh water agricultural diversions and reduce Ukiah's discharge into the Russian River. A public right of way along the western length of the Ukiah/Hopland valleys will be used for the primary pipeline for which RRFC, CLSI, and the City of Ukiah will seek additional funding. This project will increase the reliability of agricultural water supply in these areas and mitigate drought problems.
- Additional phases of water quantity and quality projects will be sought from growers in the Project Area through an extensive outreach program by CLSI, RRFC, and Mendocino County Farm Bureau.
- Water storage ponds will be evaluated during design to maximize use for solar panel installation. Electricity created from solar panels on the pond surface and berm will provide power for water pumping and other uses, and will reduce the need for power from sources producing greenhouse gases. This use of off-stream ponds has gained popularity in California and provides energy conservation and a reduction in greenhouse gas emissions. Funding to install the solar systems will come from other sources.

In July 2009, the Natural Resources Conservation Service (NRCS) approved a proposal from CLSI for a set-aside of $5.7 million in Farm Bill funds for implementation of water management projects in the four watershed area over 5 years. CLSI does not receive any of this funding but signed a cooperator agreement with the NRCS to coordinate outreach, monitoring, and other elements of the program. The water management projects will be implemented through EQIP (Environmental Quality Incentives Program) contracts between NRCS and individual landowners. EQIP provides a 50% cost-share for projects. Projects will be reviewed and ranked by NRCS and CLSI using a pre-determined set of ranking criteria.

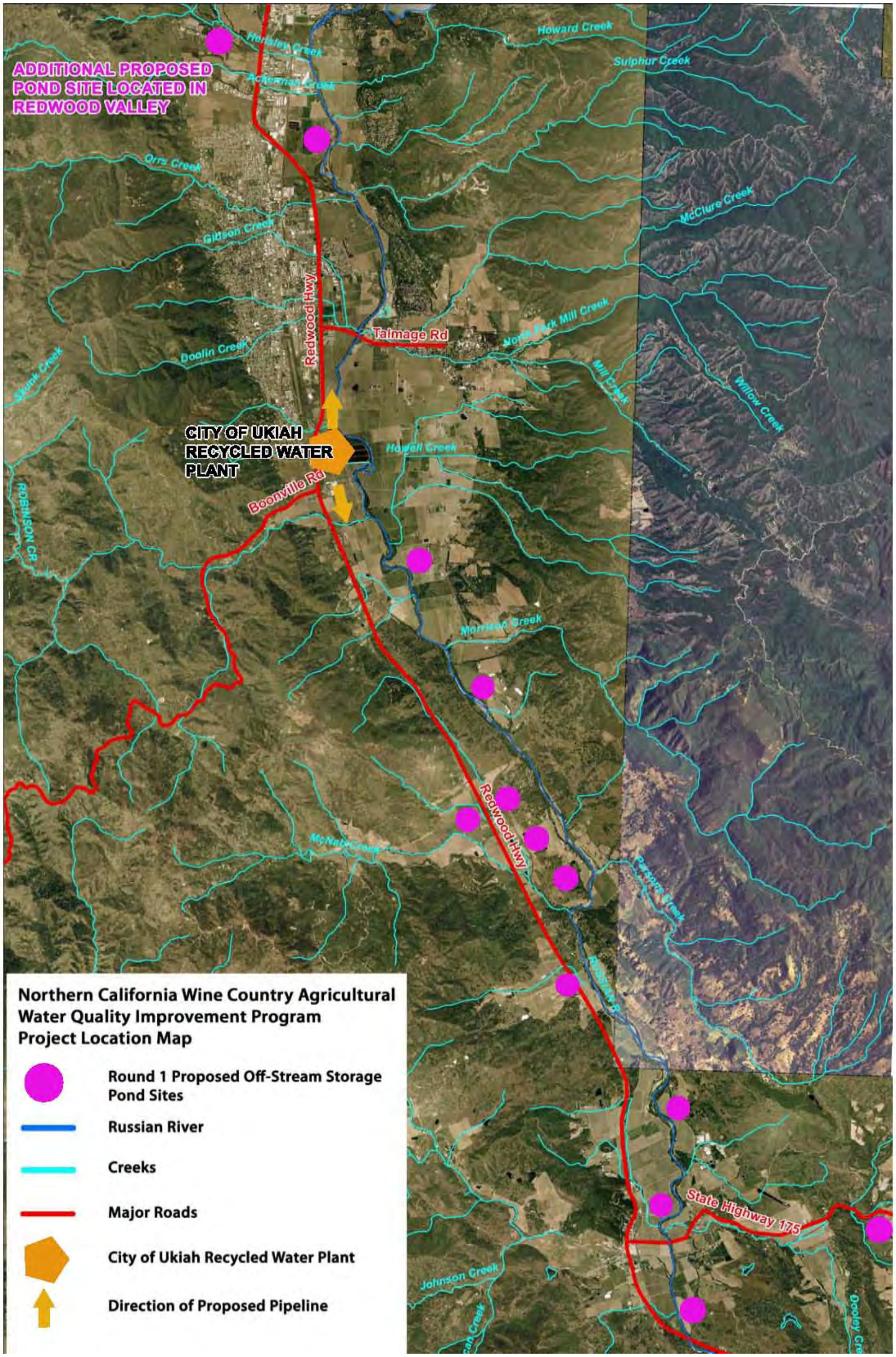


Figure 18: Locations of the first round of water storage ponds

Off stream reservoir with river diversion fitted with fish screen

Figure 19: Construction components of an off-stream storage pond

Integrated Monitoring and Watershed Analysis

Monitoring and assessment of physical conditions in tributary streams and the main Russian River can provide a clearer picture of how the system functions and identify the limiting factors to anadromous fish populations. The Upper Russian River is both a complex and highly altered physical system. Numerous tributary streams drain from steep mountains through rocky canyons and across the alluvial valley to the main river. In many locations, alluvial fans occur at the canyon outlet of the creek (Figure 4). Anadromous fish spawning and rearing habitats are typically upstream from the alluvial reaches. Flow in the lower alluvial reaches can be intermittent in dry years, possibly limiting fish passage.

In the Upper Russian River, groundwater/surface water interactions are key processes defining the timing and magnitude of surface stream flows and therefore stream values for salmonids. There are a number of potential factors limiting stream flow in tributary creeks in the Upper Russian River:

- Surface flow diversions/shallow groundwater wells in the tributary drainage
- Natural infiltration of stream flow in alluvial fans
- Significant entrenchment (18 ft.) in the main channel, which lowers groundwater levels in the alluvial basin and increases infiltration of tributary stream flow

There have been a few assessments of groundwater conditions (Farrar 1986), groundwater monitoring wells (Ca. Dept. of Water Resources), and a study of shallow groundwater levels and riparian tree survival (Jackson & Marcus 2002). Additional focused monitoring and modeling is necessary to determine the effects of each of these factors on tributary stream flow.

Characterizing Existing Tributary Conditions

With the construction of the Coyote Dam on the East Fork of the Russian River in 1959, the Upper Russian River was significantly and permanently changed. Over the past 50 years, the dam has altered the water/sediment balance in the river and resulted in an 18 ft. drop in the channel bottom. Once a wide, shallow alluvial channel (Figure 5), the river is now a deep, narrow channel with bank erosion and flow managed through reservoir releases (Figures 6-9). It is reasonable to assume that in tributaries in the Upper Russian River, stream flow is highly altered due to these significant changes in the river channel. Therefore, monitoring and modeling of conditions in a tributary without numerous surface diversions and groundwater wells is needed to establish existing conditions such that the effects of small agricultural diversions can be evaluated in other tributaries. A comprehensive methodology is needed to construct a water budget for a tributary in this system and determine whether and how revised management of small water diversions might benefit fish habitat.

Selecting Tributaries

Two unimpaired tributaries will be monitored: Morrison Creek, which has only one diversion; and one other tributary—Feliz Creek, Coleman Creek, Robinson Creek, Orrs Creek, Sulphur Creek, or Howell Creek. These tributaries have limited diversions. To aid in selecting a second tributary, a GIS system will be used to analyze geology, topography, soils, vegetation, land use, and other features. Existing rainfall gages and other data sources will also be collected. Land ownership will also be evaluated and owners will be contacted to determine willingness to participate. From this information a second tributary will be selected with a focus on choosing a candidate that differs from Morrison Creek yet is relatively unimpaired by reservoirs, diversions, or agricultural and urban development. It may be desirable to have a tributary on the western side of the valley, or one substantially downstream or upstream of Morrison Creek, or one with geologic differences to characterize the broader set of existing conditions occurring in the Upper Russian River system.

Conceptual Model of Stream Flow

A conceptual model of stream flow duration and timing in the Upper Russian River tributaries has to include variations in rainfall, river stage and reservoir flood release operations over a normal, dry and wet year. The effects on the timing and magnitude of river flow of different impounded water volumes in Lake Mendocino in the fall should also be part of the evaluation. The model should address timing, duration and volume of surface runoff infiltrating into groundwater prior to establishing connected surface flow under a variety of reservoir operations, river stages, and climatic conditions and the resulting duration of the period of connected surface flow. The conceptual model is used to formulate hypotheses about stream flow processes and design field studies.

Synoptic sampling of stream flows at numerous locations in a watershed provides the best real-time data for actual flow conditions. A number of stations would be identified for the installation of stream flow gages in the two tributaries. These stations would be set up during the dry season and field measurements completed. A number of automated rainfall gages would also be installed in the drainage if needed. These types of gages will record information and store it, but require oversight. The stream flow gages also require field measurements to properly interpret the gaging data.

These gaging stations would be distributed in the two tributaries to record the timing of initiation of stream flow and duration, volume, depth and velocity of flow in the upper reaches, lower reaches and confluence with the river channel. This data will characterize the existing timing and magnitude of stream flow in each tributary, under various rainfall events and in relationship to river flow levels and reservoir releases. Shallow groundwater in alluvium next to stream channels, particularly in areas near the river channel should be monitored using piezometers or shallow monitoring wells. Groundwater levels will need to be measured to 15-20 ft. below ground level in the Upper Russian River. Monitoring shallow groundwater levels near alluvial channels will determine when the stream changes from a gaining to a losing reach. The flow in the river will also need to be measured near to the confluence with the tributary creek. Gaging data for upstream reservoir releases and stream flow gaging data at the two river stations will be collected.

A detailed topographic survey will be needed of each tributary, particularly the alluvial reach. Commissioning a LIDAR flight of the watershed may be the cheapest and most accurate way to create a digital detailed topo layer. In addition some channel surveying may be completed on the tributaries and the main river.

In summary for each of the two tributaries, the following will be installed.

- A grid of piezometers or shallow monitoring wells in the alluvial reach of the tributary from canyon outlet to river confluence to measure fluctuations in the shallow groundwater elevation.
- Stream flow gages in the upstream creek canyon, at the canyon exit of the creek, in the creek near the river confluence, and in the river channel near the confluence.

- Complete a topographic survey of the stream channel and river channel near confluence – capture main channel thalweg, creek thalweg, overall floodplain elevation, piezometer/well and gage network locations and relative elevation.
- Rainfall gages in each tributary watershed if needed.

Evaluate Field Data

The stream flow gaging, the GIS, field reconnaissance, river data gaging records and site specific measurements, including the hydraulic conductivity and storability of alluvial material, will allow for a hydrodynamic stream flow model to be set up and be calibrated for each tributary. There are a variety of open access available models which can be used. The model will need to be able to evaluate transmission loss through the bed of the creek into groundwater and how this changes with different sets of river flow/stage and tributary runoff conditions. Reservoir operations must also be included.

Analysis and Recommendations

Characterization of two tributaries with unimpaired flow and little development should provide a basis for understanding stream flow in tributaries in the Upper Russian River under current conditions with an entrenched river channel and various reservoir operations. The hydrodynamic model created can then be used to evaluate developed watersheds with agricultural diversions.

This characterization forms the template for recommending changes to agricultural diversions in other tributaries and for interpreting stream flow gaging in the tributaries with small reservoirs and diversions. It may not be possible to alter the timing and magnitude of small diversions to overcome large system wide changes in dry or low flow years. However, in certain rainfall years, coordinating smaller diversions may make a difference to stream flow levels and produce a benefit for fish. The monitoring and modeling of this complex system is essential to determining how to manage for fishery benefits.

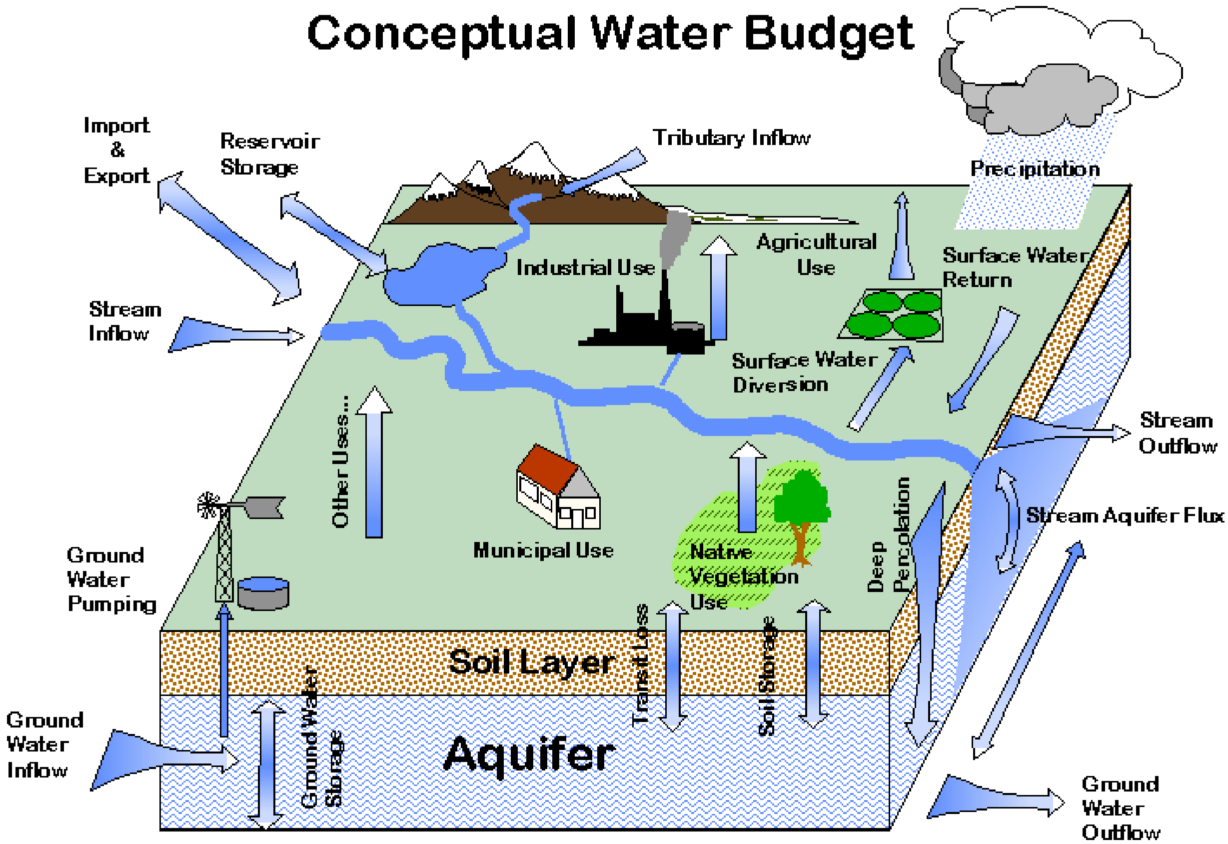


Figure 20: Conceptual Water Budget

At the August 13, 2009 meeting of the frost task force, the National Marine Fisheries Service (NMFS) described their expectations for farmers to address the potential effects of diversions for frost control. Conservation actions were defined in part as preparing a water budget for each tributary stream based on estimates of water supply and demand, and completing metering of diversions and gaging of surface flows as a method for defining these water budgets. It is important to gage stream flow and to monitor subsurface flows to determine the level of detail needed to construct an accurate water budget (Figure 20) for a tributary. This evaluation is needed due to the high level of surface to groundwater interaction common in tributaries in the Russian River watershed. These processes complicate any evaluation of changes in surface flows using only stream flow gages. Further, in many areas tributary surface flow is highly affected by water level in the main Russian River. All of these conditions need to be measured and used in the preparation of a tributary water budget. If a comprehensive methodology is not employed and only stream flow gaging is used, the resulting water budget will have high levels of error and be an ineffective tool in water management. Additionally, if the water budget is not done correctly, surface water diverters can easily be blamed for changes in stream flow resulting from other causes.

Fine Sediment

Fine sediment sources in the Russian River likely include sheet and rill erosion from orchards, vineyards, urban development and erosion from concentrated flow sources like culverts, dirt roads, gullies and shallow landslides, and river and stream channel erosion from entrenchment. In the Napa River and Sonoma Creek watersheds, channel erosion has been documented as a major source of fine sediment pollution. As part of evaluating stream flow in the Russian River, channel entrenchment in the river and tributary channels can be documented and quantified. This information can then be used for the fine sediment TMDL by the Regional Board

In the Napa River, creation of a LIDAR layer of the alluvial valley and foothills proved very helpful in evaluating entrenchment. Field surveys of cross-sections of the river channel and lower tributaries can be used in conjunction with the LIDAR to provide an accurate evaluation of sediment quantities produced from channel erosion. This same data set can be used in the hydrodynamic model of stream flow and can help analyze effects of agricultural diversions.

In collaboration with farmers, measurements of sediment accumulated in small reservoirs can be done to provide data for the sediment budget. Analysis of this information to create the sediment budget, sources and annual quantities from each source, and proposed required reductions should be done by the Regional Board.

Science Advisory Group

The Science Advisory Group is essential to gaining the understanding of stream flow processes needed to improve conditions for fish. The Russian River watershed covers one million acres and includes a great deal of variation in physical features. The generation of stream flow in the tributaries of the Russian River is a function of physical features such as rock and soil types, slopes, shape of the drainage, vegetative cover and rainfall patterns as well as human land and water uses. This complexity requires analysis and study of tributary basins prior to determining if agricultural water diversions are having a significant effect on stream flow.

There are very few steam flow gaging records for the tributaries of the Russian River and limited scientific studies documenting factors affecting stream flow. Due to variations between tributaries a study of one tributary cannot be applied to all the tributaries in the drainage. There are several examples of this. Deitch et al 2007 studied stream flow in the Franz Maacama Creek drainage in Sonoma County and related changes stream flow gaging records to the use of water for frost control. While this study indicates a definite need for construction of water storage infrastructure to reduce the instantaneous diversion rate and a reduction in frost water demand through BMP applications in these two tributaries, it cannot be assumed that the same conditions exist throughout the watershed.

In another example, Jackson and Marcus (2002) studied surface stream flow and shallow groundwater levels in two tributaries, Parsons and Morrison Creeks in Mendocino County. This study found the water level in the main Russian River had the greatest effect on surface stream flow in low water years causing infiltration of surface flow into groundwater in the alluvial Ukiah Valley.

The conclusions of both of these studies are valid for the tributaries involved; however, neither one can be applied to all tributaries across the entire Russian River drainage. Unfortunately, during the meetings of the Frost Protection Task Force, representatives of California Department of Fish and Game (CDFG) and the National Marine Fisheries Service (NMFS) made it very clear that they considered frost water diversions and use to pose a problem in all tributaries in the Russian River basin regardless of whether specific data and studies were available to demonstrate this. This situation emphasizes the need for an independent Science Advisory Group to objectively review monitoring proposed by growers or agencies. Monitoring data for stream flow always needs to be interpreted by professionals within the watershed context of where the measurements are completed. Strict Quality Assurance/Quality Control (QA/QC) on the monitoring instruments and their placement needs to be used to assure reliable and accurate data. Depending on the location subsurface water levels may also need to be monitored to provide a complete picture of the hydrology of a tributary basin.

The Science Advisory Group will be made up of 5-10 members drawn from academia and agencies such as the U.S. Geologic Survey and UC Cooperative Extension. Scientists involved in URSA, MRSA, the Russian River Property Owners or the primary agencies- California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), State Water Resources Control Board (SWRCB) and North Coast Regional Water Quality Control Board would not be eligible for inclusion in the Science Advisory Group. This prohibition will maintain the objectivity of the findings of the Science Advisory Group.

The Science Advisory Group will carry out two primary tasks:
1. A review of the physical processes in the Russian River watershed.
2. Specific review of the efforts of URSA and MRSA.

The first task will consist of the following steps:
Articulate conceptual models of flow processes for streams as defined by geomorphic features. These stream types include: small tributaries, canyon streams, alluvial fans, alluvial channels and incised channels.

The conceptual models will consider natural processes and then consider the range of changes due to all developments in the watershed including all of the causes listed for the reduction in populations of steelhead trout and Coho and Chinook salmon (Fed. Register 64:86). This second analysis will consider the Upper Russian and Middle Russian watershed areas separately to provide the most applicable information. Within the Upper and Middle Russian areas regions will be identified where tributaries are expected to have similar processes and conceptual models. The relationship of tributaries to the main Russian River will be considered in the models.

Existing research and all available data will be reviewed and any data gaps will be identified.

The Science Advisory Group will then recommend a methodology for answering the following questions for each group of tributaries with a similar conceptual model:
What effects do direct diversions of stream flow for frost control have on tributary flow and in-stream fish habitat in a high, average and low rainfall year?
What effects do groundwater extractions for frost control have on tributary flow and in-stream fish habitat in a high, average and low rainfall year?
What other land uses, water uses, geomorphic and hydrologic features have major effects on stream flow during the frost control period in high, average, and low rainfall years?

In addition to this first major task, the Science Advisory Group will work with URSA and MRSA to review proposed monitoring programs, monitoring data and proposed conservation actions. A summary report of these findings and actions will be produced no less frequently than yearly. URSA and MRSA will proceed with BMP application and frost water demand reductions, construction of off stream ponds to reduce direct diversions and other conservation actions while the conceptual model analysis is developed.

Continuing the Dialogue with the Resource Agencies

URSA and MRSA will meet quarterly with representatives from the Resource Agencies (CDFG, NMFS, SWRCB) from the Frost Protection Task Force to discuss implementation actions and the findings of the Science Advisory Group. It is the intention of both URSA and MRSA to form a collaborative working relationship with the agencies to implement needed changes to water infrastructure and improve stream flows to sustain both the fishery and agriculture.

Landowner/Grower Involvement

The Upper Russian River watershed is more than 90% private land. Private landowners need to be integrally involved in discussion and decision-making for all aspects of the program. Currently, grower meetings occur every two months, coordinated by URSA (see next section). Over time, landowners may want to form a self-governing Landowner/Water Users Council, either for the entire Upper Russian River area or for specific tributaries. The Council could assure landowner involvement in water management programs.

IMPLEMENTATION

<u>Governance</u>

The Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program will be implemented by a partnership of public and private agencies working with private landowners and regulatory agencies. The partnership consists of the California Land Stewardship Institute, Mendocino County Russian River Flood Control and Water Conservation Improvement District, and the Mendocino County Farm Bureau.

The Mendocino County Farm Bureau (MCFB) is a county chapter of the California Farm Bureau Federation, a statewide organization. The purpose of the MCFB is to protect and promote agricultural interests. MCFB has members throughout the Upper Russian River area, and will provide coordination, outreach, and information to agricultural landowners.

The Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) is a water supply agency which provides water to both agricultural and municipal users in the Upper Russian River. The RRFC provides water to 60 different diverters. The RRFC has been central to recent changes in Coyote Dam releases to provide water for frost control operations without endangering listed fish. RRFC will act as a liaison between agricultural water users and regulators as well as provide significant input and oversight for the monitoring program and water implementation projects.

The California Land Stewardship Institute (CLSI) is a 501(c) (3) non-profit organization. CLSI will administer the program grants and coordinate with the partnership organizations, landowners and agencies. CLSI will interface with landowners for project construction, will oversee the monitoring and coordinate with the Science Advisory Group. The FFF program provides a ready-made network for implementing water conservation and water quality improvement projects. CLSI already coordinates with agricultural producers throughout the Project Area. The FFF program involves significant outreach activities in conjunction with agricultural organizations such as local Farm Bureaus, grapegrowers associations, wine and grape commissions, appellation groups, and others. Many agricultural producers are used to working with CLSI on their farm plans, certifications, and projects. As part of the federal funding through NRCS for implementation of water management projects, CLSI has signed a cooperator agreement to coordinate outreach, monitoring, and other features of the program.

The partnership—CLSI, RRFC, and MCFB—will direct and implement the actions of the Program described in the previous sections. These three organizations have formed a partnership named Upper Russian River Stewardship Alliance (URSA). URSA meets regularly and has a grower meeting every two months. These organizations have formalized their working relationship for the Program with a Memorandum of Understanding (MOU).

The Natural Resources Conservation Service (NRCS) in Ukiah will provide engineering and construction assistance for the program. CLSI submitted a proposal to the NRCS under Section 2510 of the 2008 Farm Bill to provide a specific fund for implementation o f the Northern California Wine Country Agricultural Water Conservation and Water Quality Improvement Program. This proposal was approved in July 2009, and NRCS and CLSI signed a cooperator agreement in August 2009.

In addition to the MOU to define roles and responsibilities in the Upper Russian River program, an MOU with the primary regulatory agencies may also be beneficial to the program. The four primary regulatory agencies—California Department of Fish and Game, National Marine Fisheries Service, California State Division of Water Rights, and the Regional Water Quality Control Board—will benefit from an integrated solution that addresses a variety of environmental problems. The agricultural landowners who volunteer to construct projects and implement BMPs can benefit from a positive involvement of the regulators. The MOU between the partnership organizations and the regulatory agencies would list mutual benefits to the parties and formalize a willingness to work cooperatively to respond to problems and implement improvements. A timeline for improvements will assure the public that progress will be made. While an MOU will not suspend the regulations, it can help the organizations, regulators, and landowners to focus on collaborative, non-regulatory solutions.

TIMELINE

2008 -
- Seek federal, state, and private funding for the Program
- Complete grower outreach and identify first set of projects

2009 -
- Complete MOU
- Form cooperative entity (URSA) and establish grower outreach program and goals for water program implementation and funding
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Complete for Phase 1 ponds:
  - Final engineering for off-stream ponds, wells, or other projects
  - Landowner EQIP contracts
  - County building permits and other permits
  - Bid packages for construction
- Complete construction of Phase 1 off-stream storage ponds
- Establish Science Advisory Group:
  - Review and revise proposed monitoring program
- Seek funding for monitoring program
- Begin scope for Ukiah recycled water use feasibility study; seek funding
- Begin quarterly meetings with Resource Agencies

2010 -
- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Begin engineering for Phase 2 of ponds for off-stream storage, wells, or other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Establish monitoring stations
- Install instruments and complete surveys
- URSA meets regularly and holds landowner meetings regularly
- Science Advisory Group meets to review monitoring and adjust/revise program
- Begin engineering for Phase 2 of ponds for off-stream storage, seek construction funds
- Complete for Phase 2 ponds:
  - Final engineering for off-stream ponds, wells, or other projects
  - Landowner contracts
  - County building permits and other permits
  - Bid packages for construction
- Begin study of recycled water engineering feasibility
- Hold quarterly meetings with Resource Agencies

2011
- Complete construction of Phase 2 ponds
- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs

- Continue monitoring program and meet with Science Advisory Group to review results
- Review findings with resource agencies
- URSA meets regularly and holds landowner meetings regularly
- Begin engineering for Phase 3 of ponds for off-stream storage, wells, or other projects
- Complete for Phase 3 ponds:
  - Final engineering for off-stream ponds, wells, or other projects
  - Landowner contracts
  - County building permits and other permits
  - Bid packages for construction
- Complete recycled water engineering study; seek funds for detailed design, environmental review, and permitting
- Hold quarterly meetings with Resource Agencies

2012

- Complete construction of Phase 3 ponds
- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Continue monitoring program and meet with Science Advisory Group to review results
- URSA meets regularly and holds landowner meetings regularly
- Begin engineering for Phase 4 of ponds for off-stream storage, wells, or other projects
- Complete for Phase 4 ponds:
  - Final engineering for off-stream ponds, wells, or other projects
  - Landowner contracts
  - County building permits and other permits
  - Bid packages for construction
  - Hold quarterly meetings with Resource Agencies

2013

- Complete construction of Phase 4 ponds
- Initiate outreach and sign-ups for AWEP program projects including off-stream ponds, wells, and other projects
- Complete annual Fish Friendly Farming program enrollment for non-point source, habitat, and frost water conservation improvements and complete implementation of BMPs
- Continue monitoring program and meet with Science Advisory Group to review results, provide analysis to resource agencies
- URSA meets regularly and holds landowner meetings regularly
- Hold quarterly meetings with Resource Agencies

FUNDING SOURCES

CLSI, in conjunction with the RRFC, applied for funds from the Natural Resources Conservation Service's Agricultural Water Enhancement Program (AWEP) in April 2009. This set-aside of funds for the NRCS was approved in July 2009. CLSI and its partners also applied to the Expanded Use CWSRF Loan: 2009 Recovery Act for funding. CLSI and its partners will also apply to the North Coast Integrated Regional Water Management Plan for funds for the Upper Russian River program. This program is awaiting changes to the State Bond programs to allow applications.

Funds to match the AWEP program are being sought by CLSI and will cover non-point source pollution control projects and TMDL implementation on 20,000 acres of agricultural lands; construction of additional water management improvements and metering of diversions to increase instream flows; the monitoring and watershed analysis; creation of a Science Advisory Group to review projects and monitoring results and to recommend changes; and extensive landowner outreach and involvement.

ECONOMIC BENEFITS

The economy of the Upper Russian River area is primarily agricultural with wine grapes making up the largest crop. The Mendocino County Department of Agriculture lists acres of wine grapes in the Upper Russian River at 15,539. Of this total acreage, chardonnay makes up about 4500 acres. Chardonnay is a varietal wine grape that is highly susceptible to frost damage. The total value of the grape crop was estimated in 2007 at $67,125,258. Countywide wine grape values now exceed the value of timber.

Wineries and wine tourism are economic values in addition to the wine grape crop and provide thousands of jobs.

The Program addresses water issues directly related to the largest industry and largest employment sector in Mendocino County. The moratorium on using water for frost control proposed by the National Marine Fisheries Service for the 2009 season, if implemented, would have resulted in a major loss of the wine grape crop. Once frozen, the vines do not produce a viable crop. A total loss of crop can occur in grapes without frost protection likely resulting in over $67 million in crop losses in Mendocino County. Assuming that the value of wine is three times that of the grapes and if roughly 30% of the grape crop is processed in Mendocino County for wine then there would be an estimated economic loss of $45,559,500 experienced in the winery sector. In addition, for every dollar of grapes lost, there will be an additional 1.8 dollars lost to the local economy. So $45 million x 1.8 = $81 million in additional economic loss, resulting in a total economic loss of approximately $193 million dollars. (Linegar, 2009). This loss is estimated to put over 5,000 people out of work.

It is important to note that the Upper Russian River is identified as a Disadvantaged Community, with a Median Household Income (MHI) of less than $37,994, which is 80% of the Statewide Census 2000 MHI.

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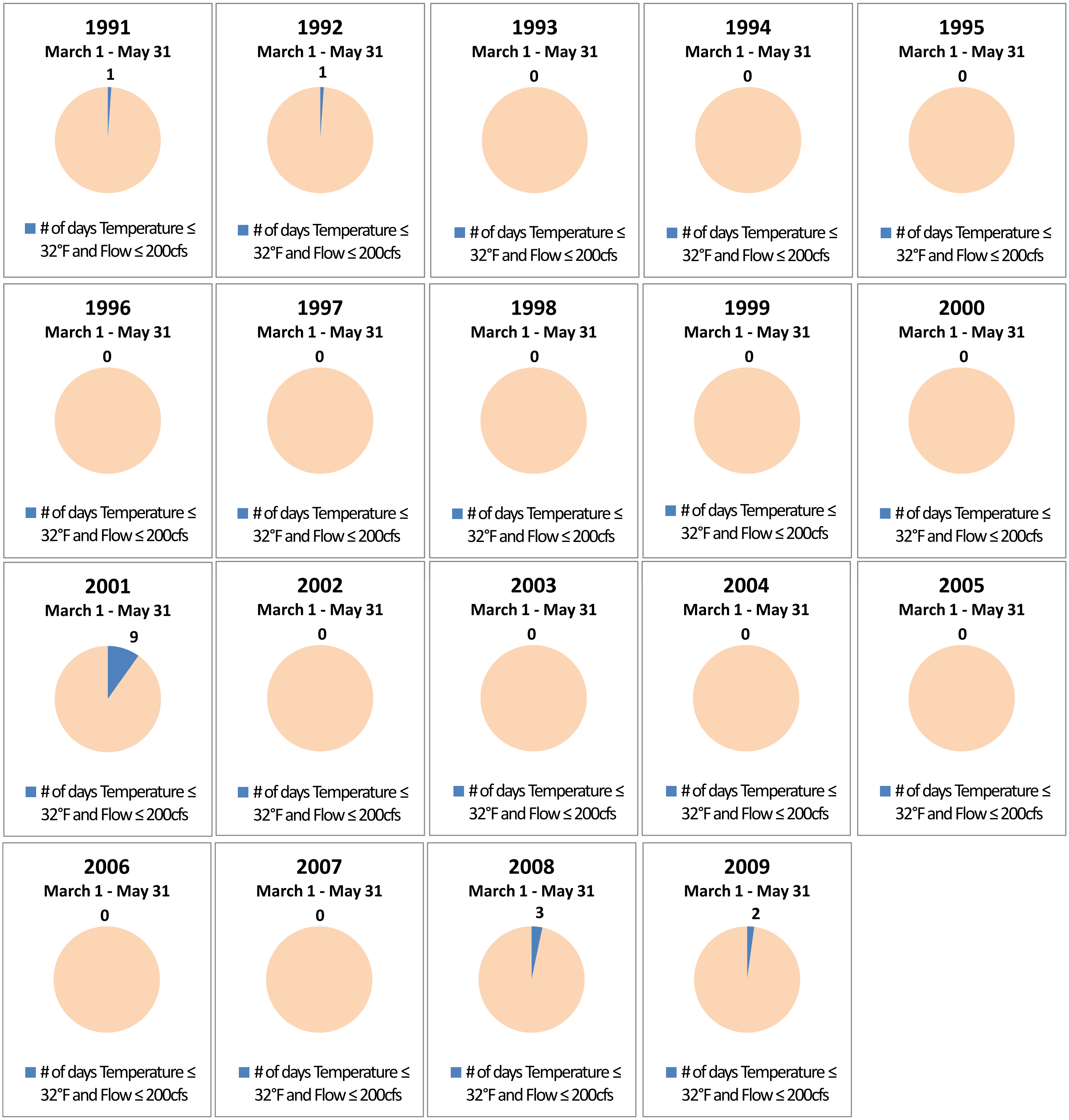
EXHIBIT 3

ANALYSIS OF LOW STREAM FLOWS AND FREEZING TEMPERATURES AT HOPLAND AND HEALDSBURG

Prepared by Wagner & Bonsignore Consulting Civil Engineers

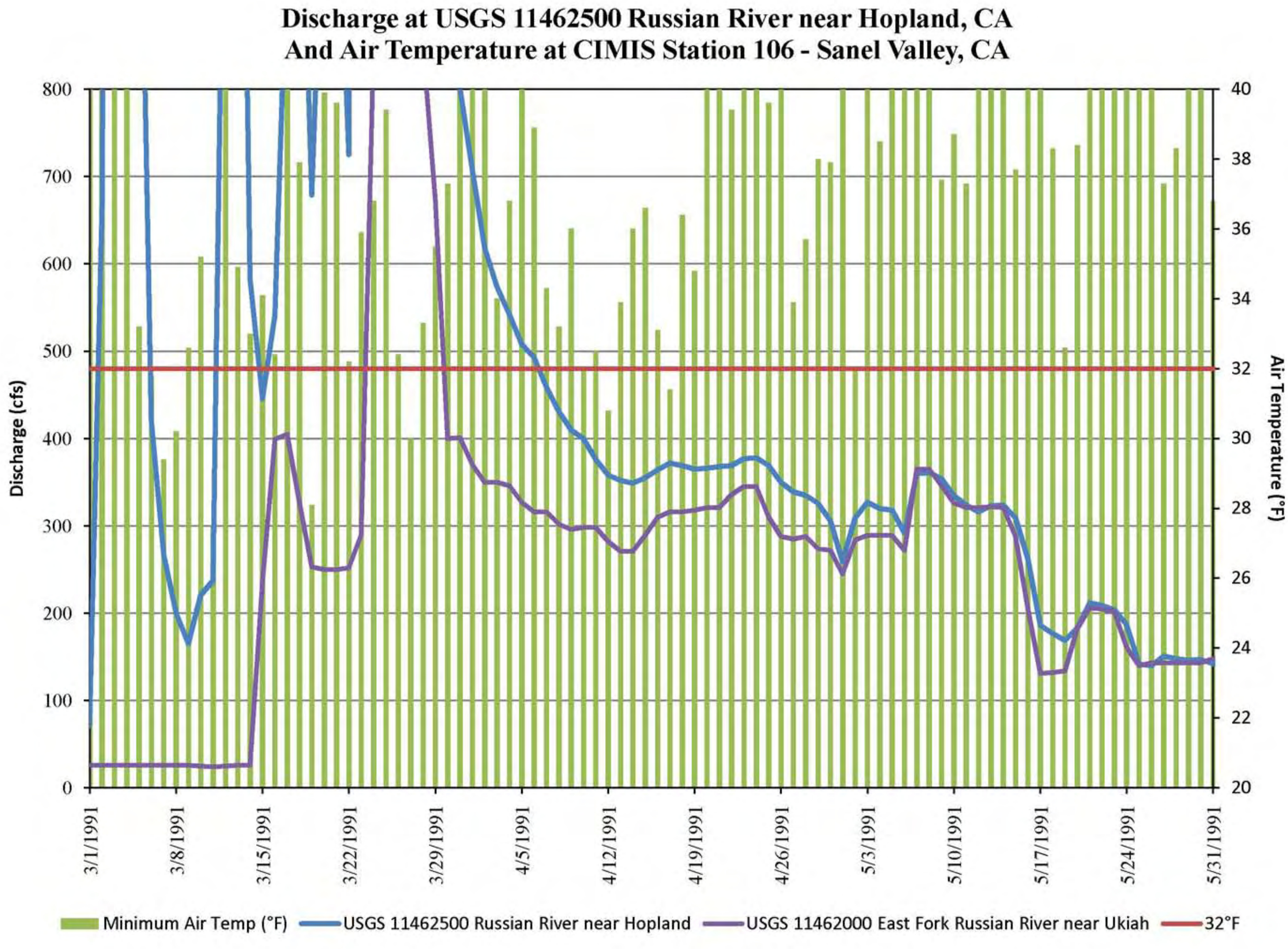
Number of Days Flow on Russian River near Hopland ≤ 200 cfs and Air Temperature at Sanel Valley ≤ 32°F



Notes:

Flow data for USGS 11462500 Russian River near Hopland per U.S. Geological Survey.

Air temperature data for Station #106 Sanel Valley FS per California Irrigation Management Information System (CIMIS).



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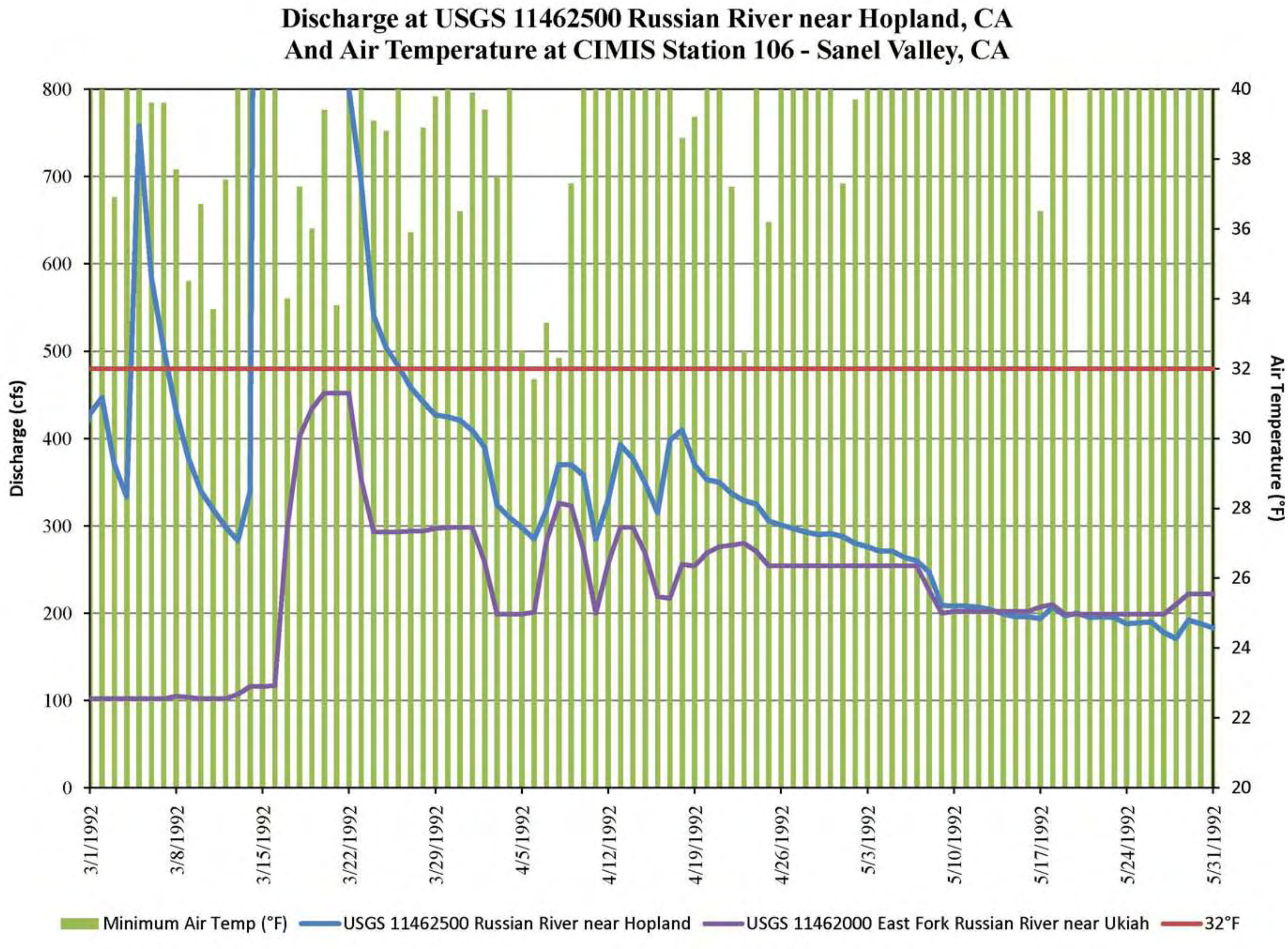
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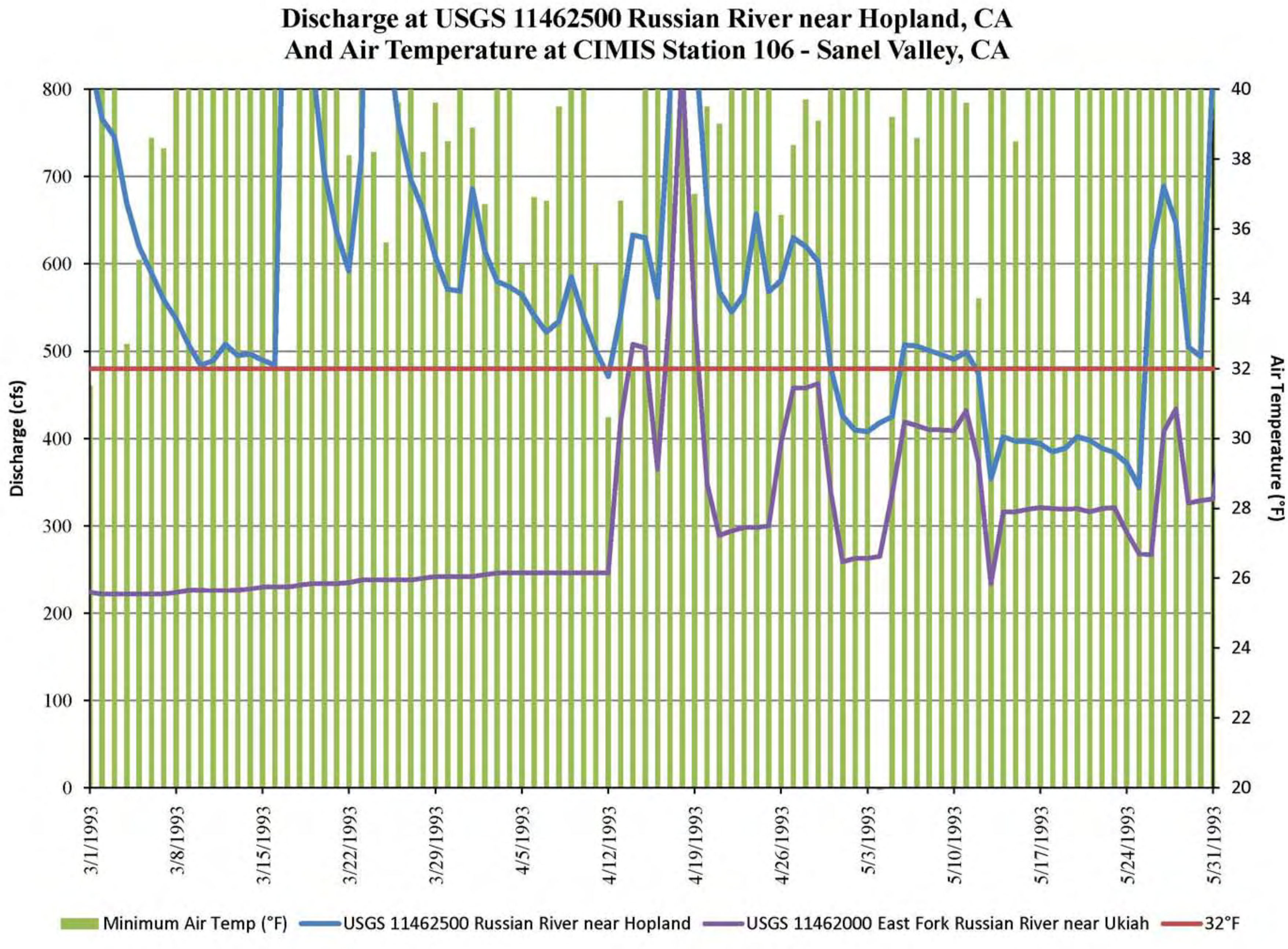
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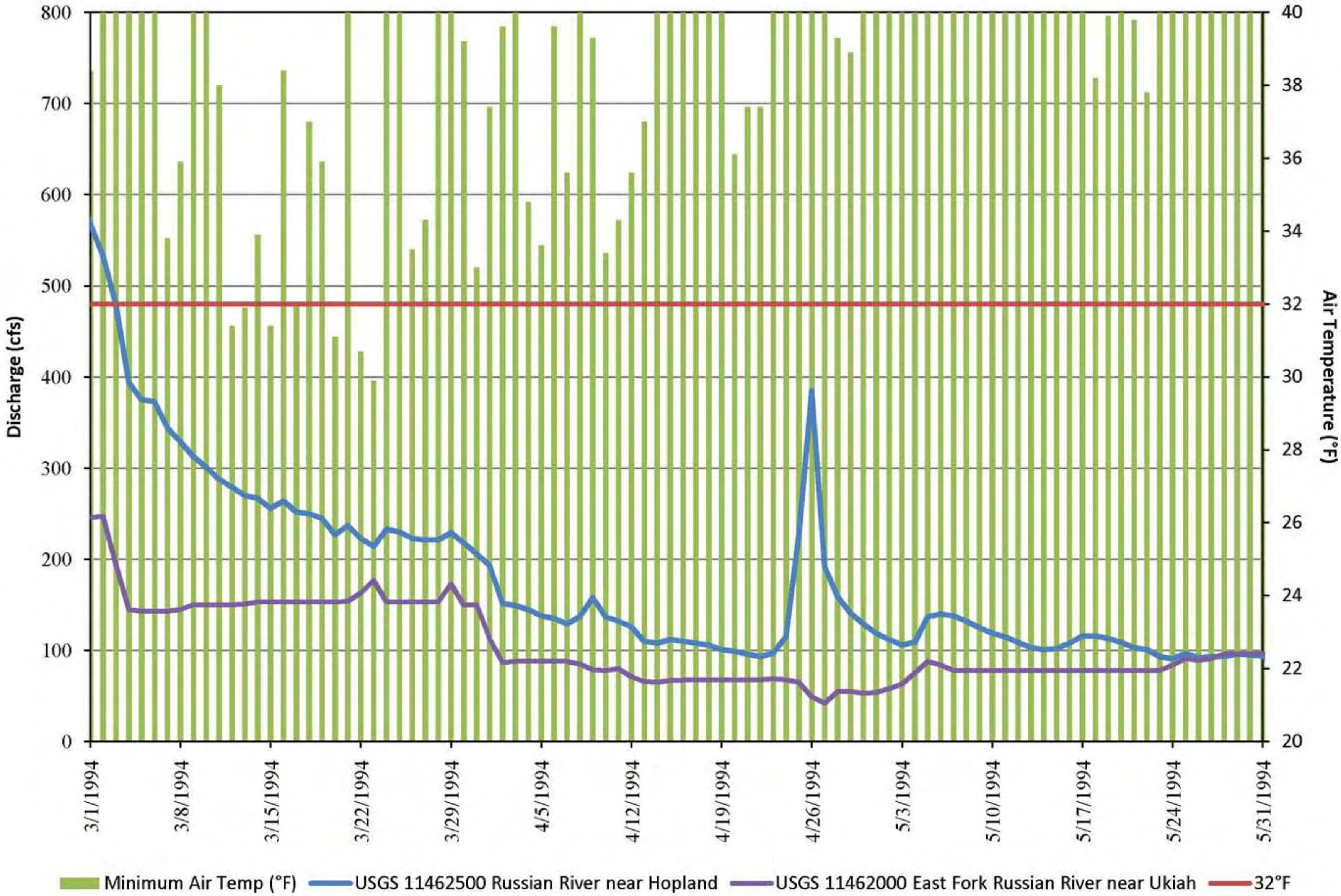

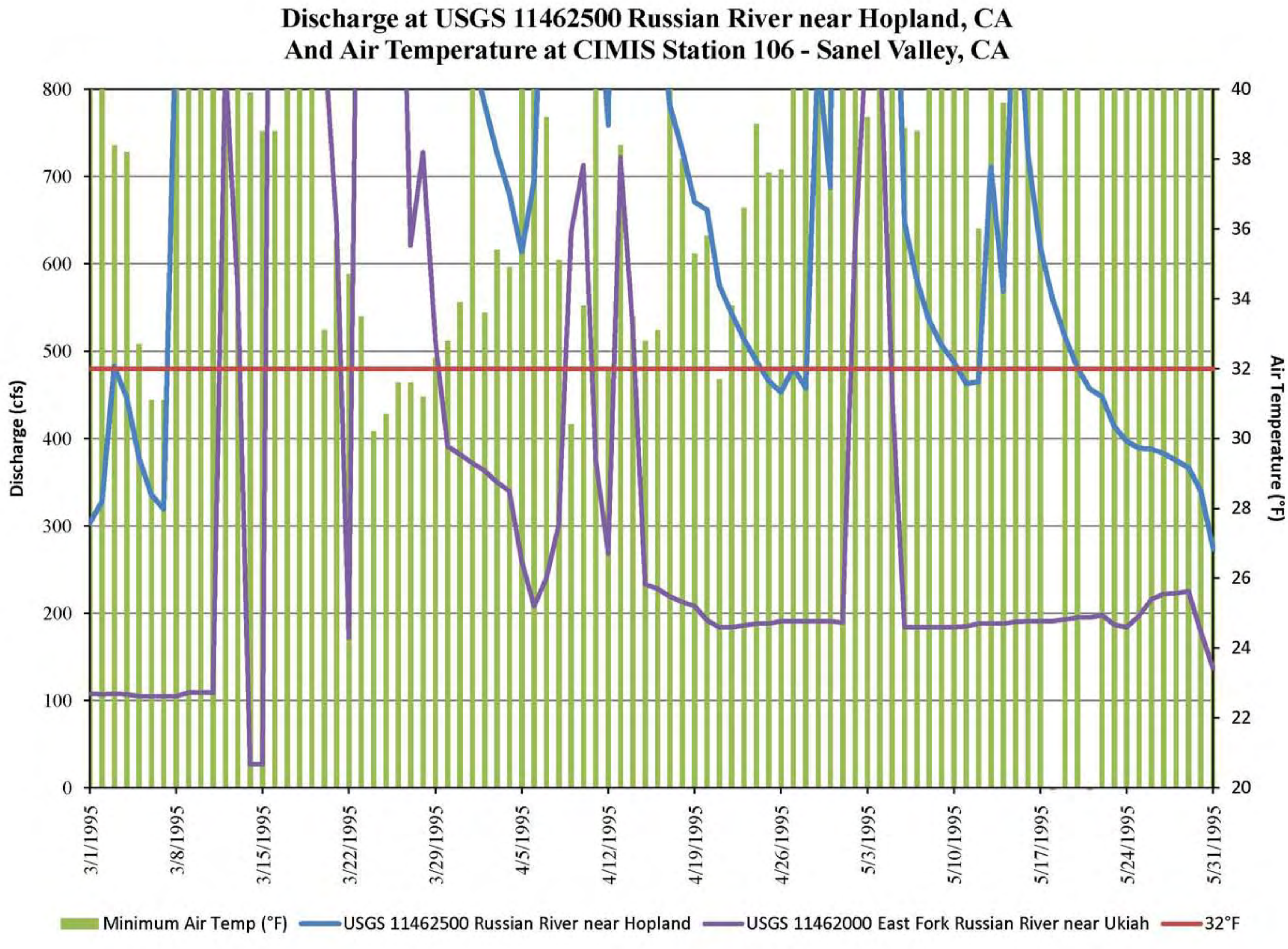

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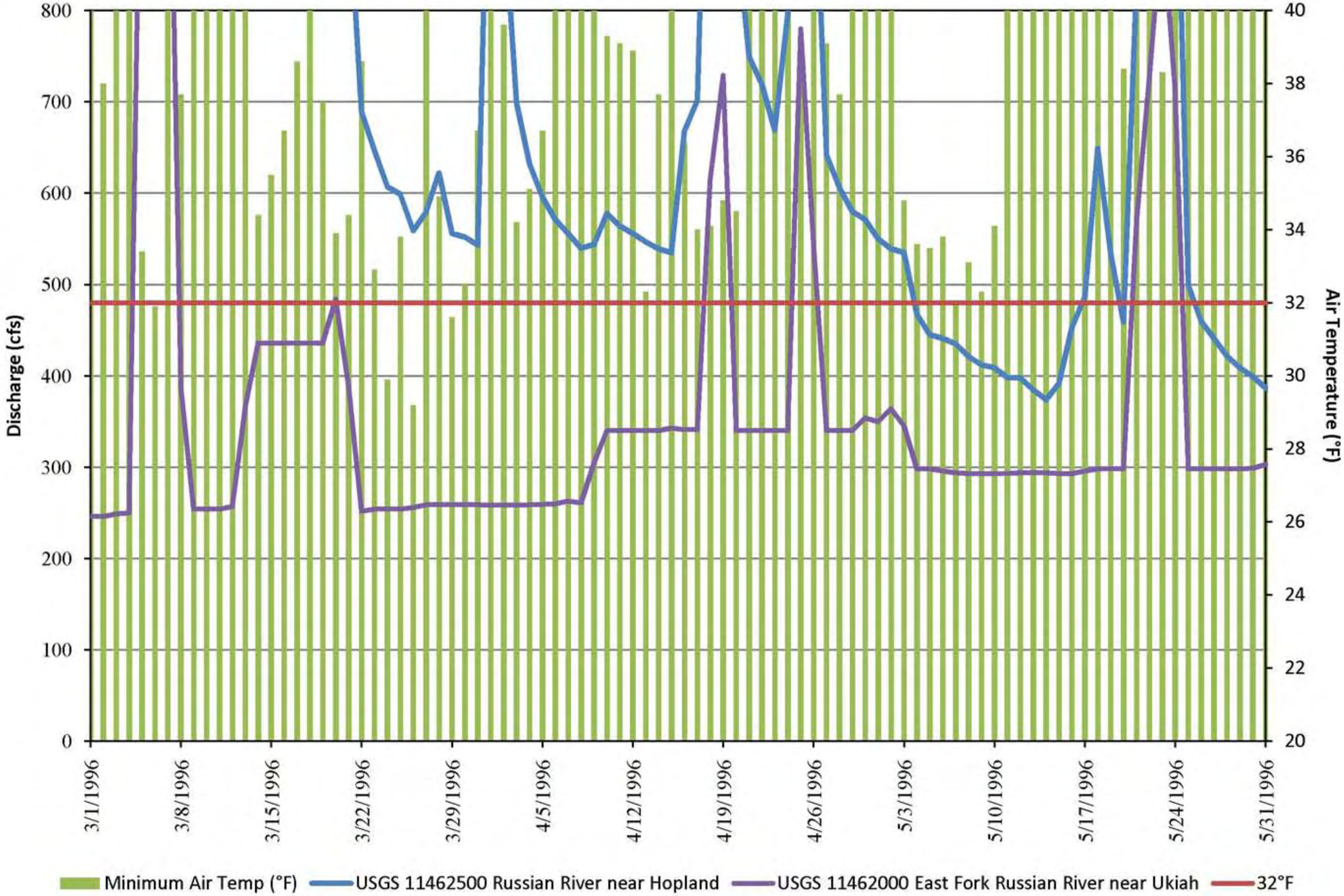

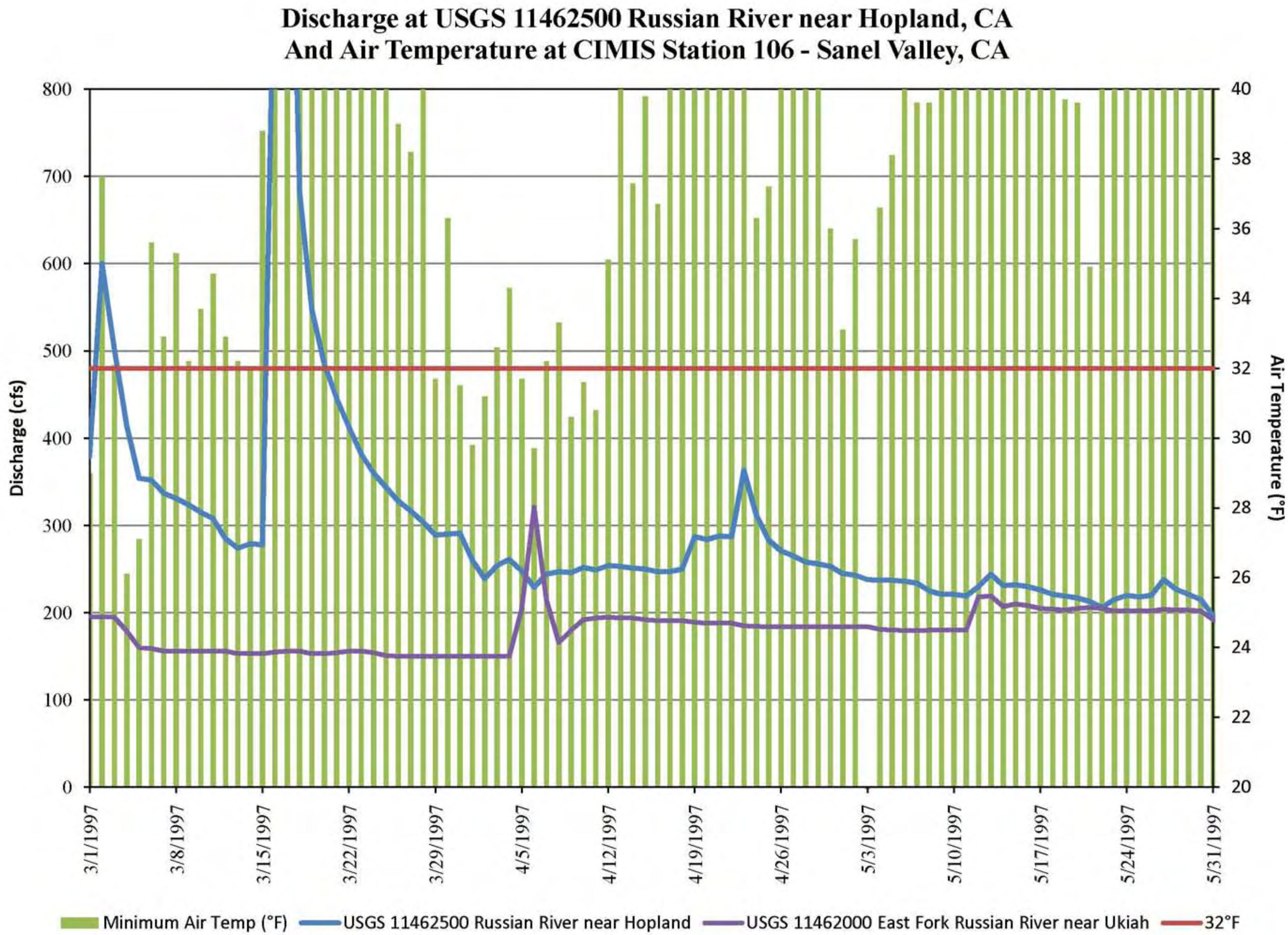
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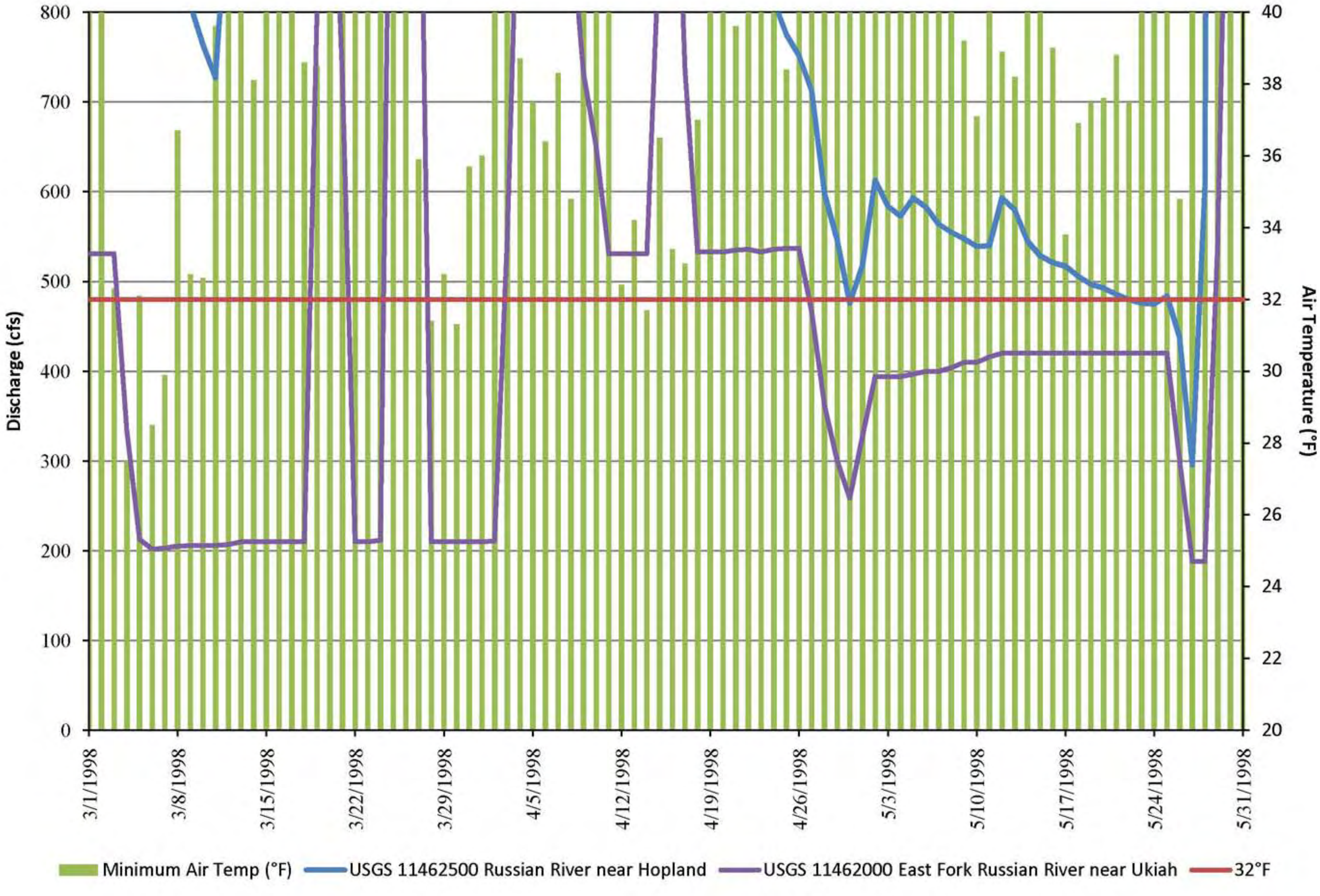

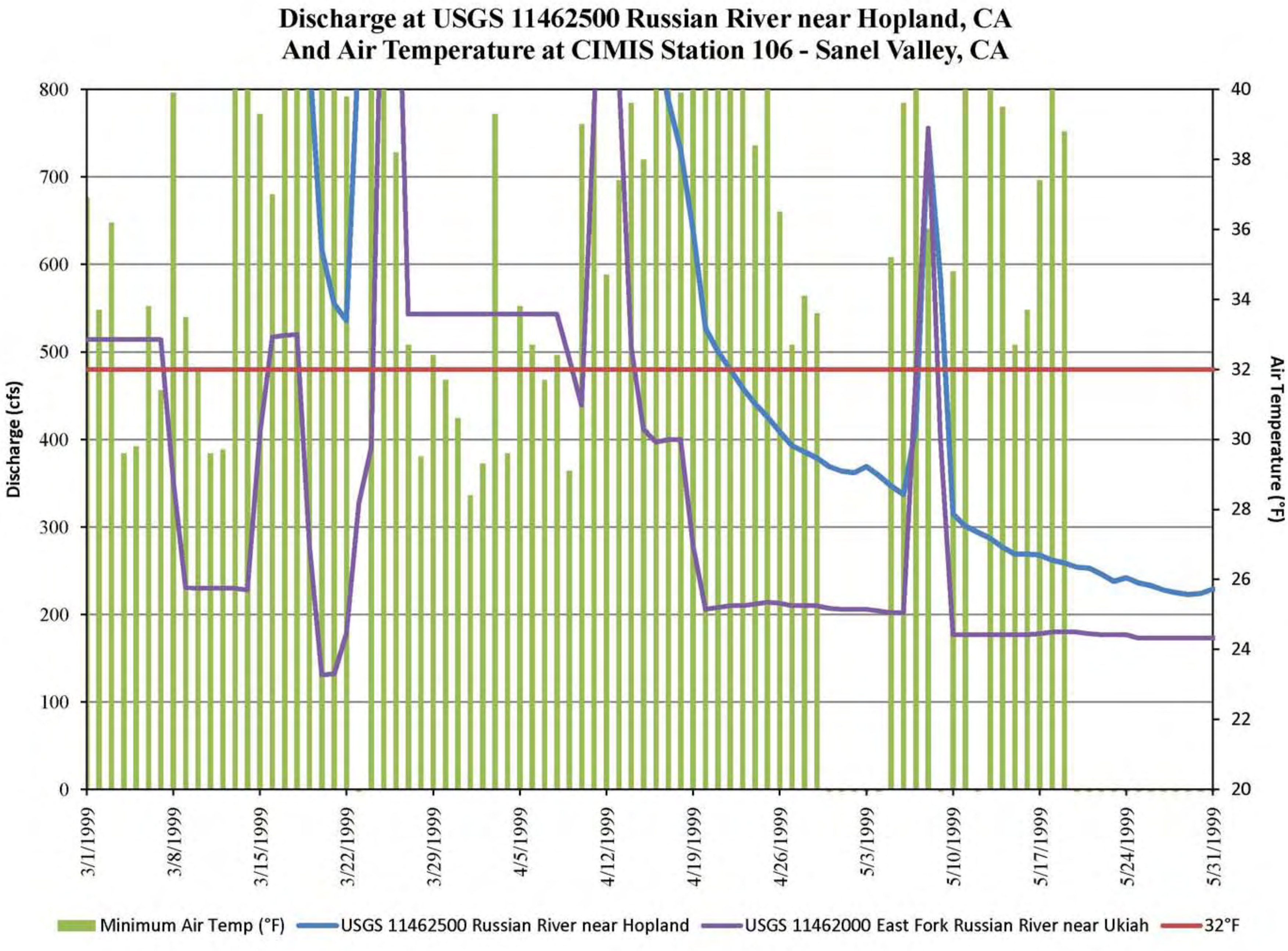
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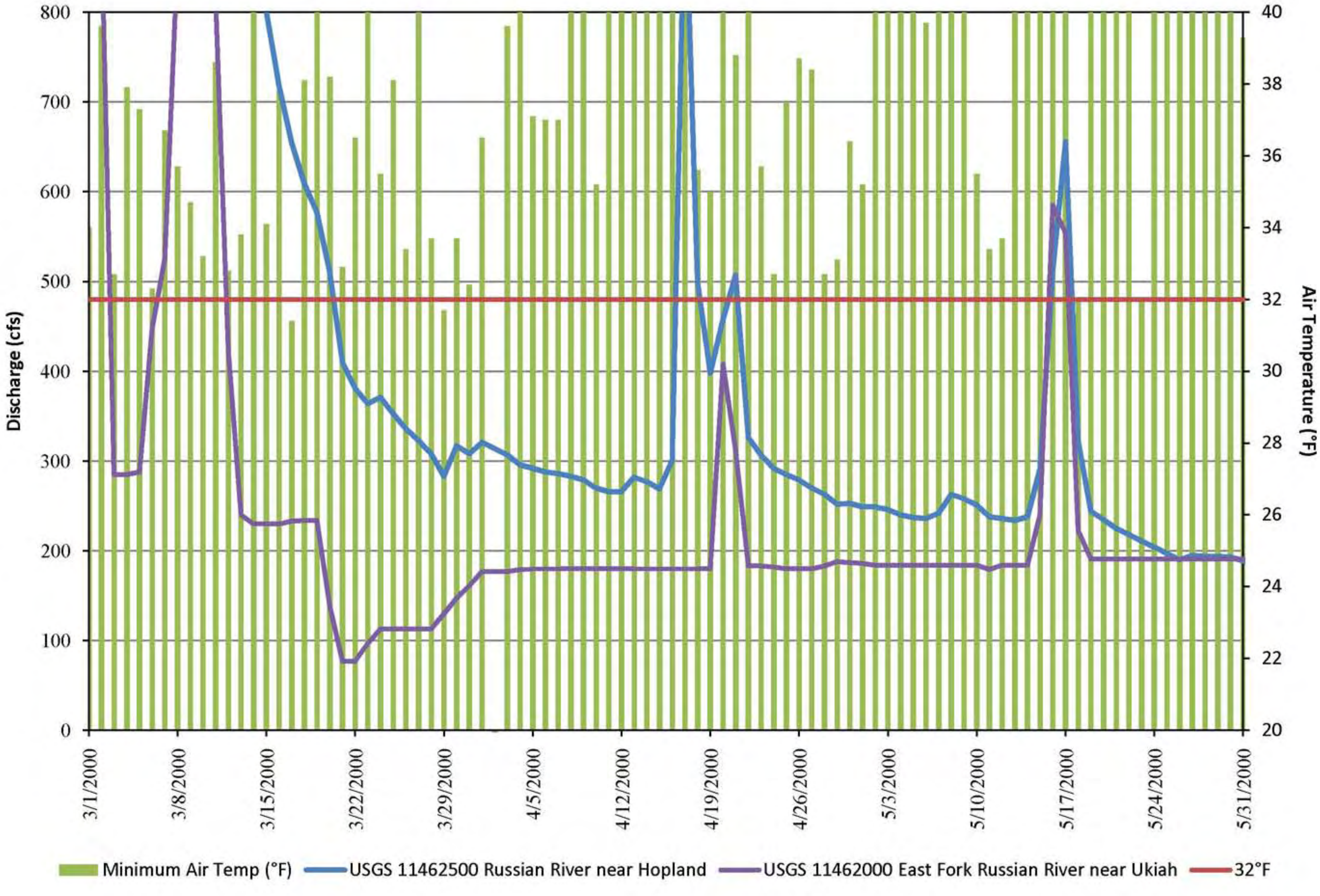

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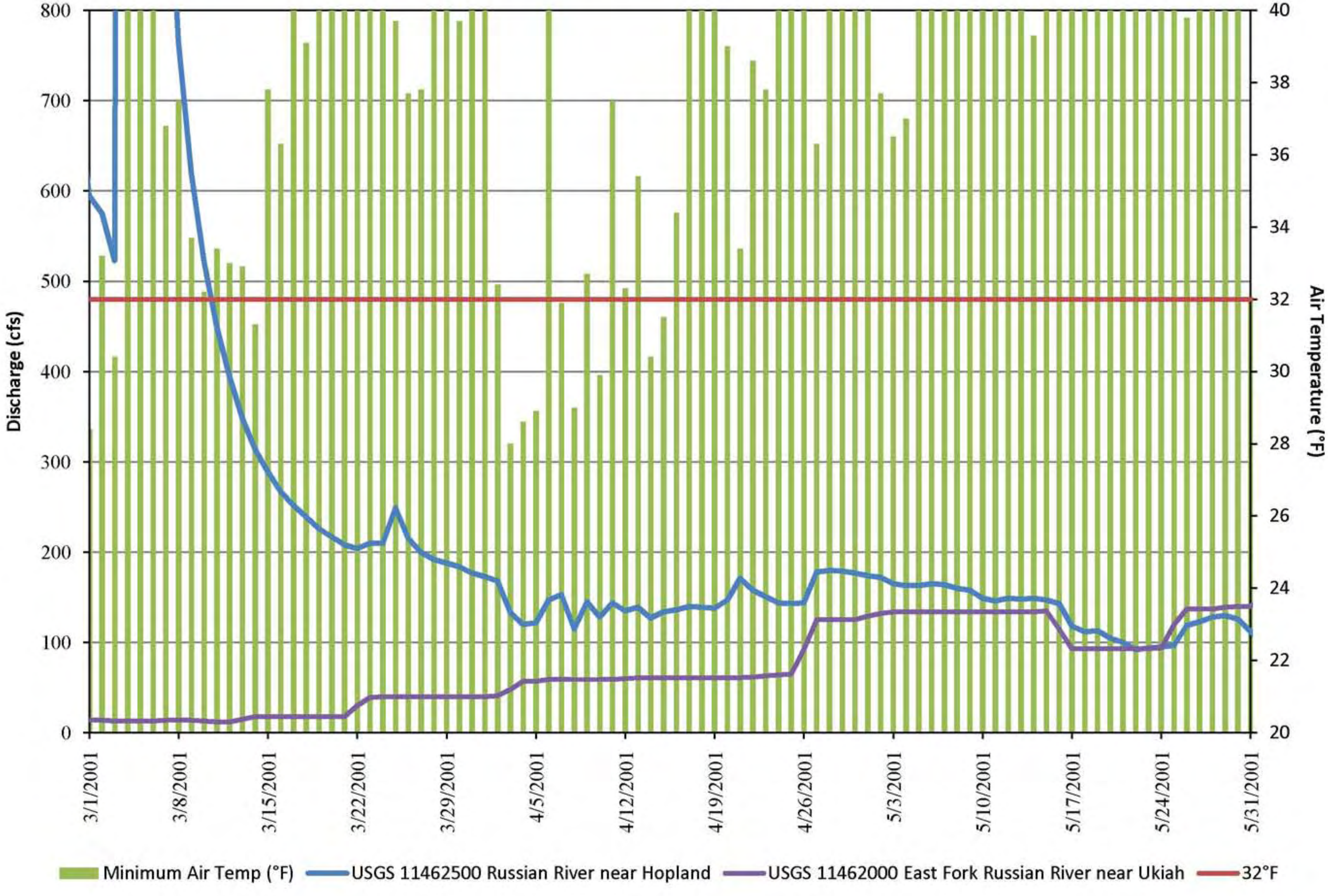

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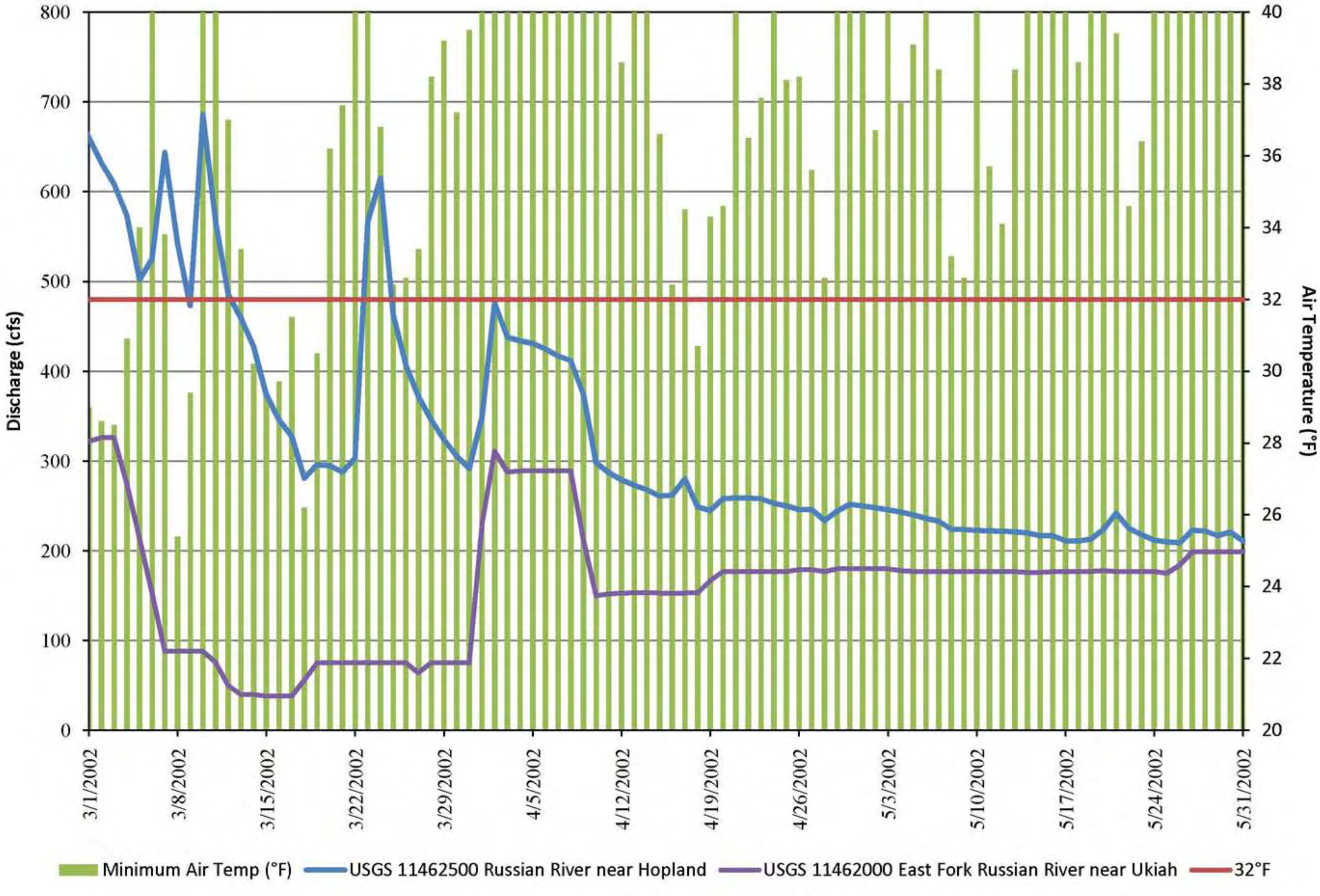

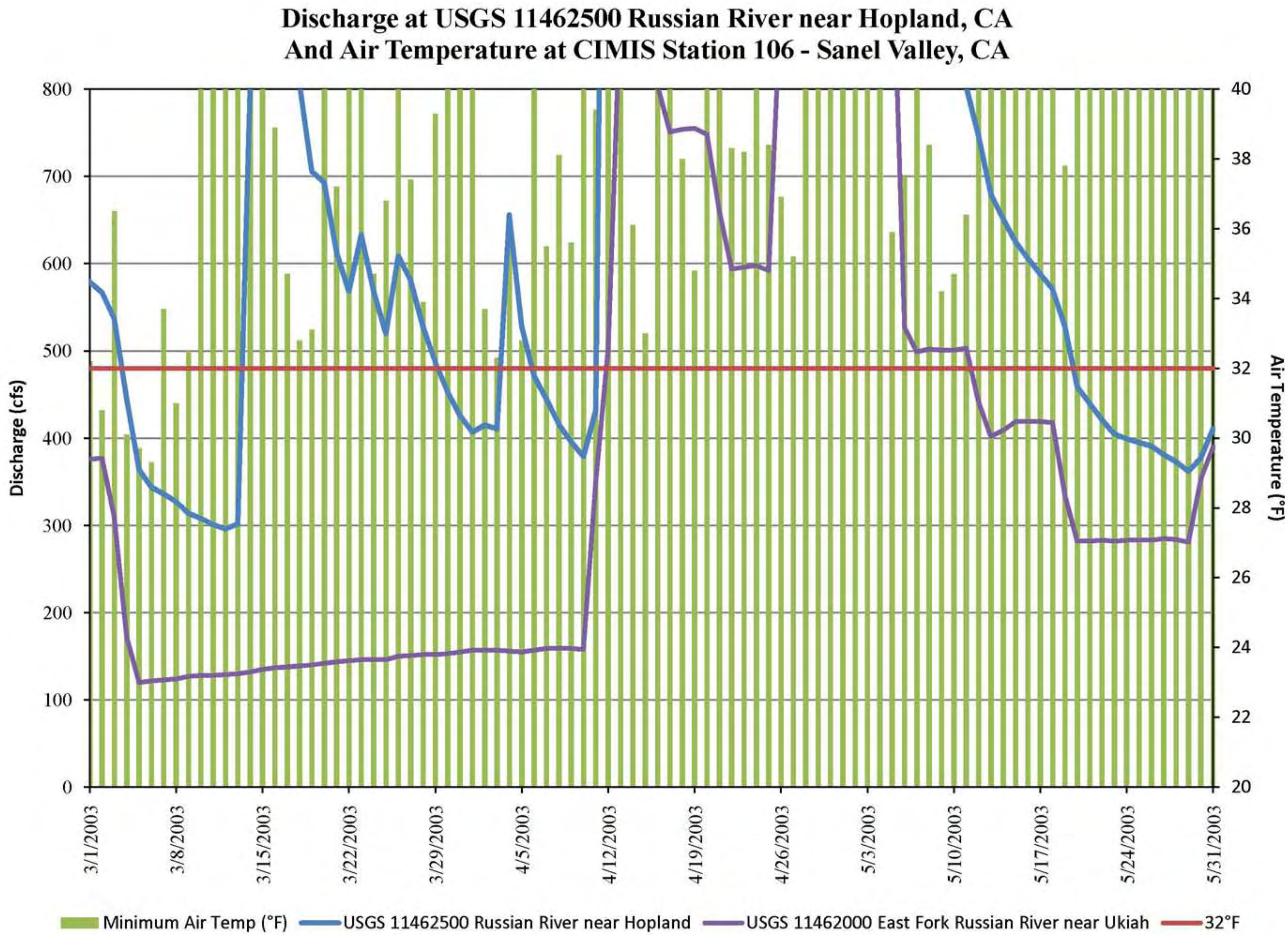
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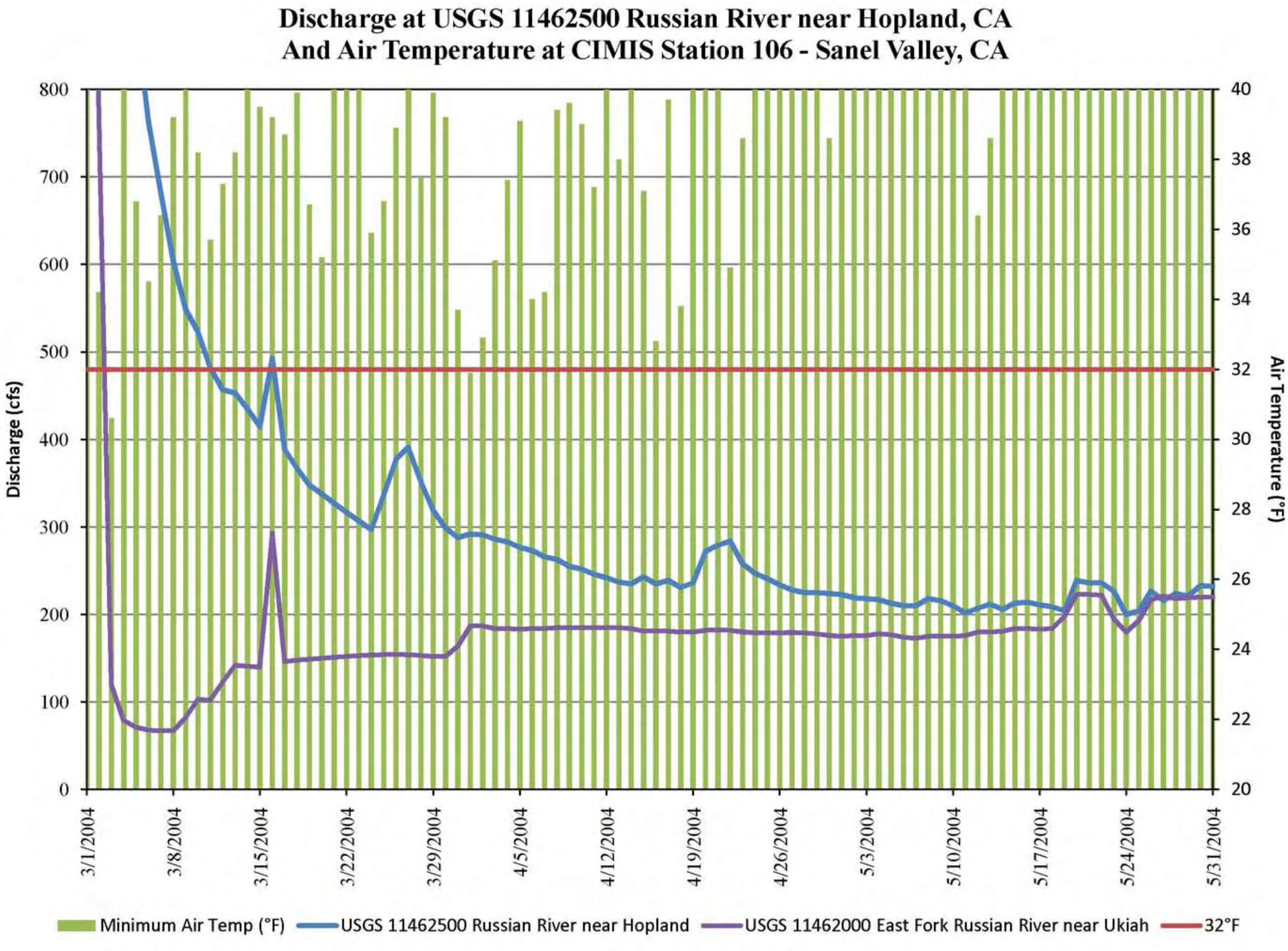
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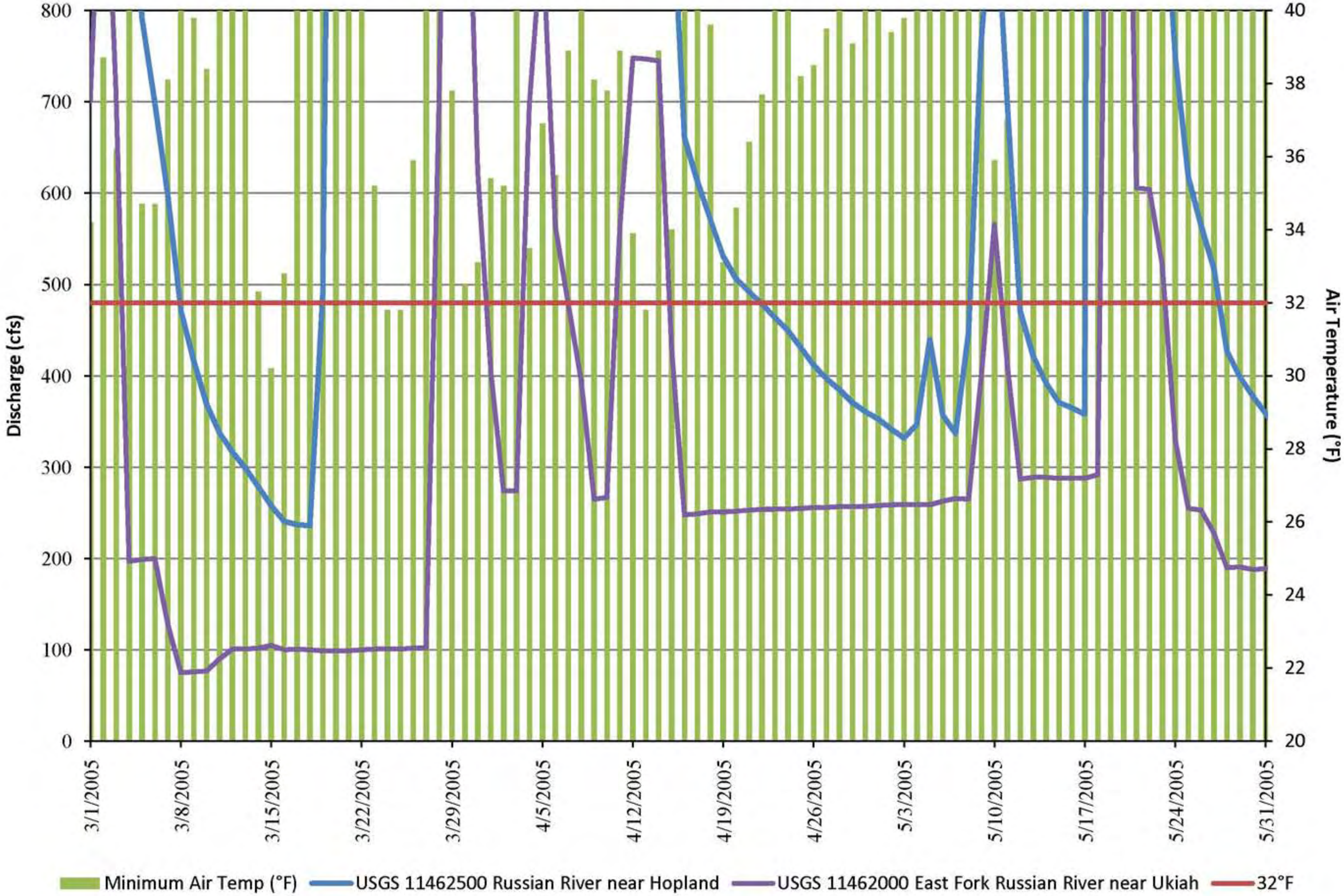
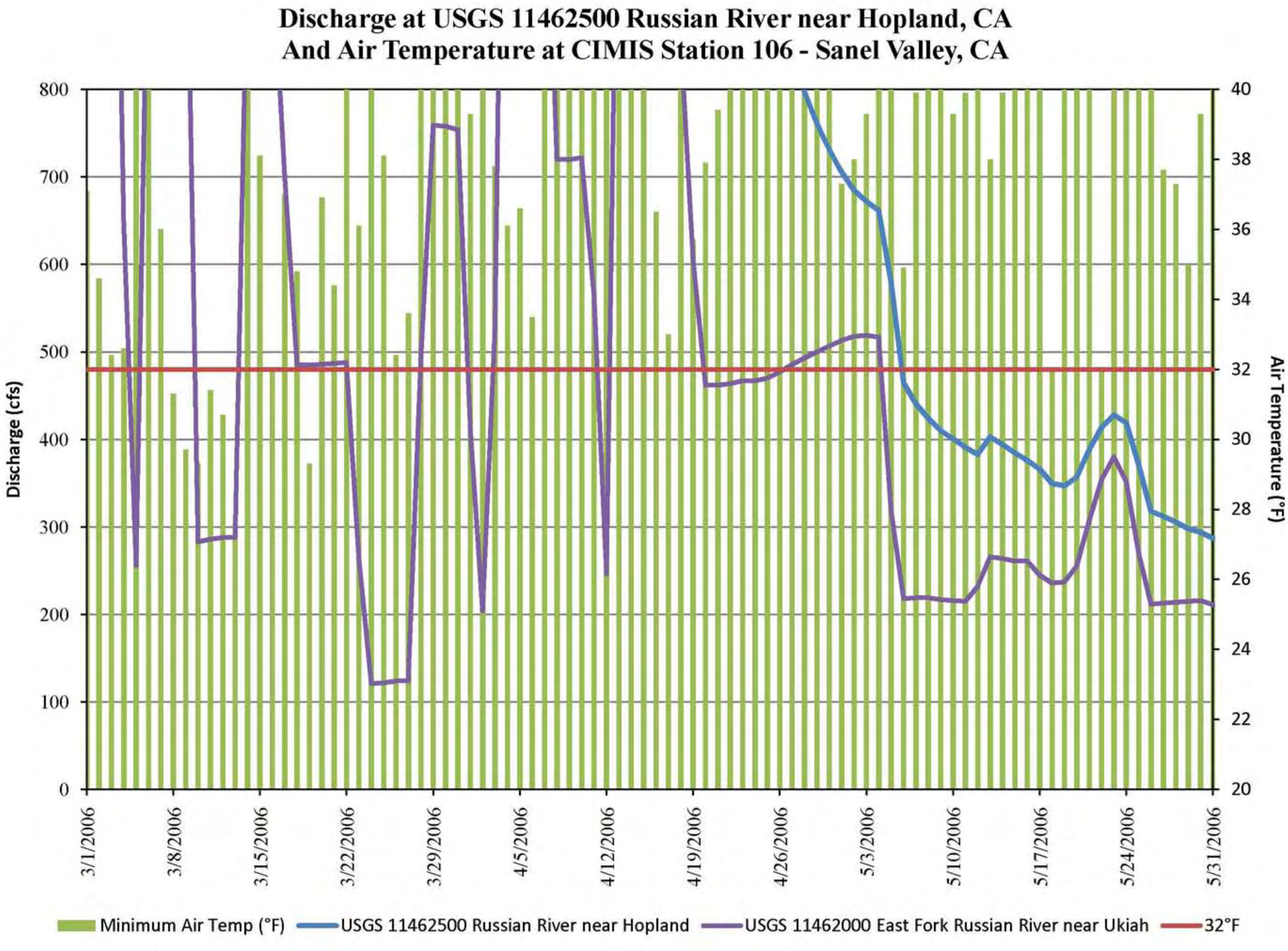
Minimum Air Temp (°F)
USGS 11462500 Russian River near Hopland
USGS 11462000 East Fork Russian River near Ukiah
32°F

Discharge at USGS 11462500 Russian River near Hopland, CA
And Air Temperature at CIMIS Station 106 - Sanel Valley, CA




Discharge at USGS 11462500 Russian River near Hopland, CA
And Air Temperature at CIMIS Station 106 - Sanel Valley, CA
Discharge (cfs)
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Minimum Air Temp (°F)
USGS 11462500 Russian River near Hopland
USGS 11462000 East Fork Russian River near Ukiah
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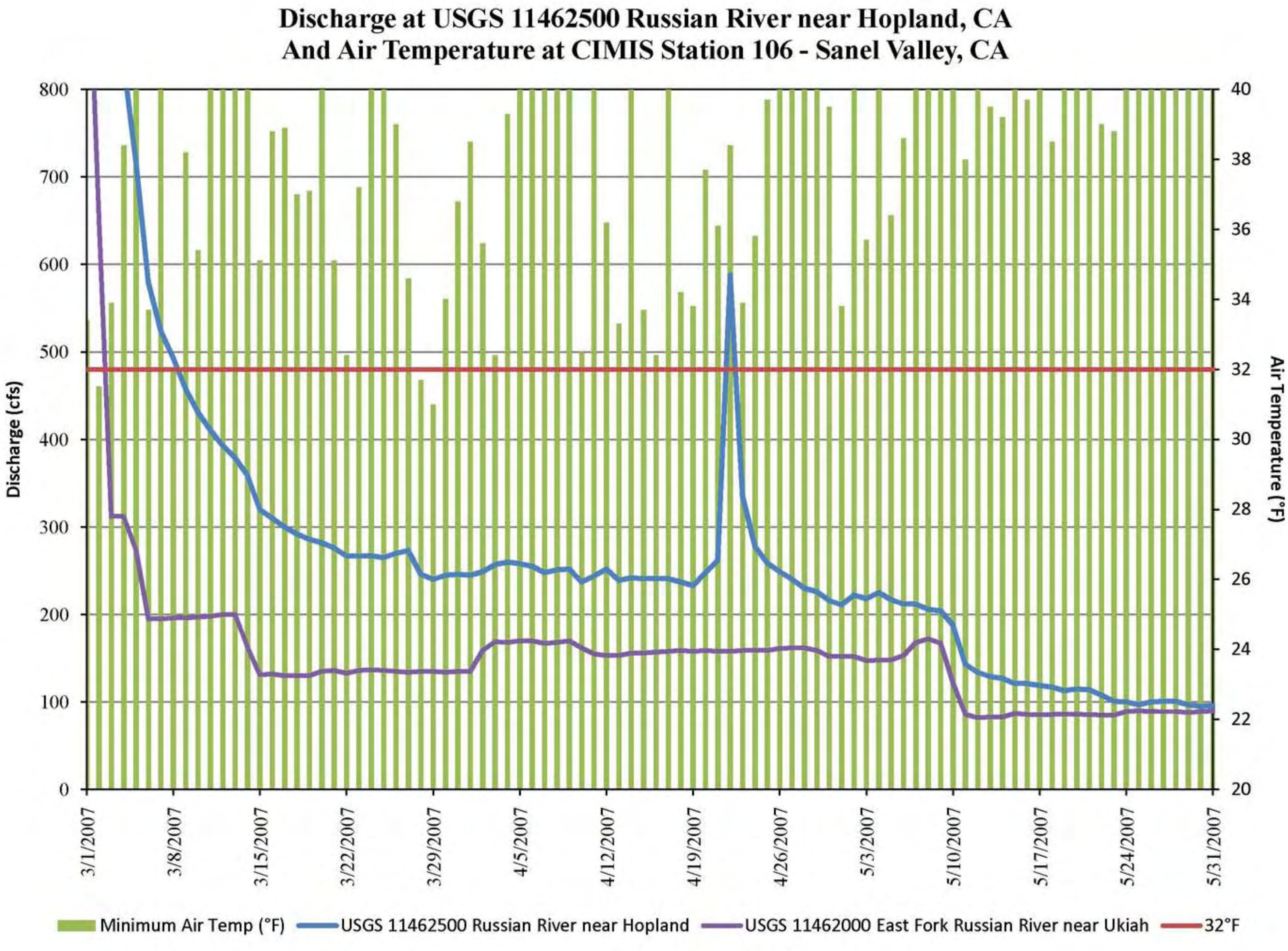
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And Air Temperature at CIMIS Station 106 - Sanel Valley, CA
Discharge (cfs)
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Minimum Air Temp (°F)
USGS 11462500 Russian River near Hopland
USGS 11462000 East Fork Russian River near Ukiah
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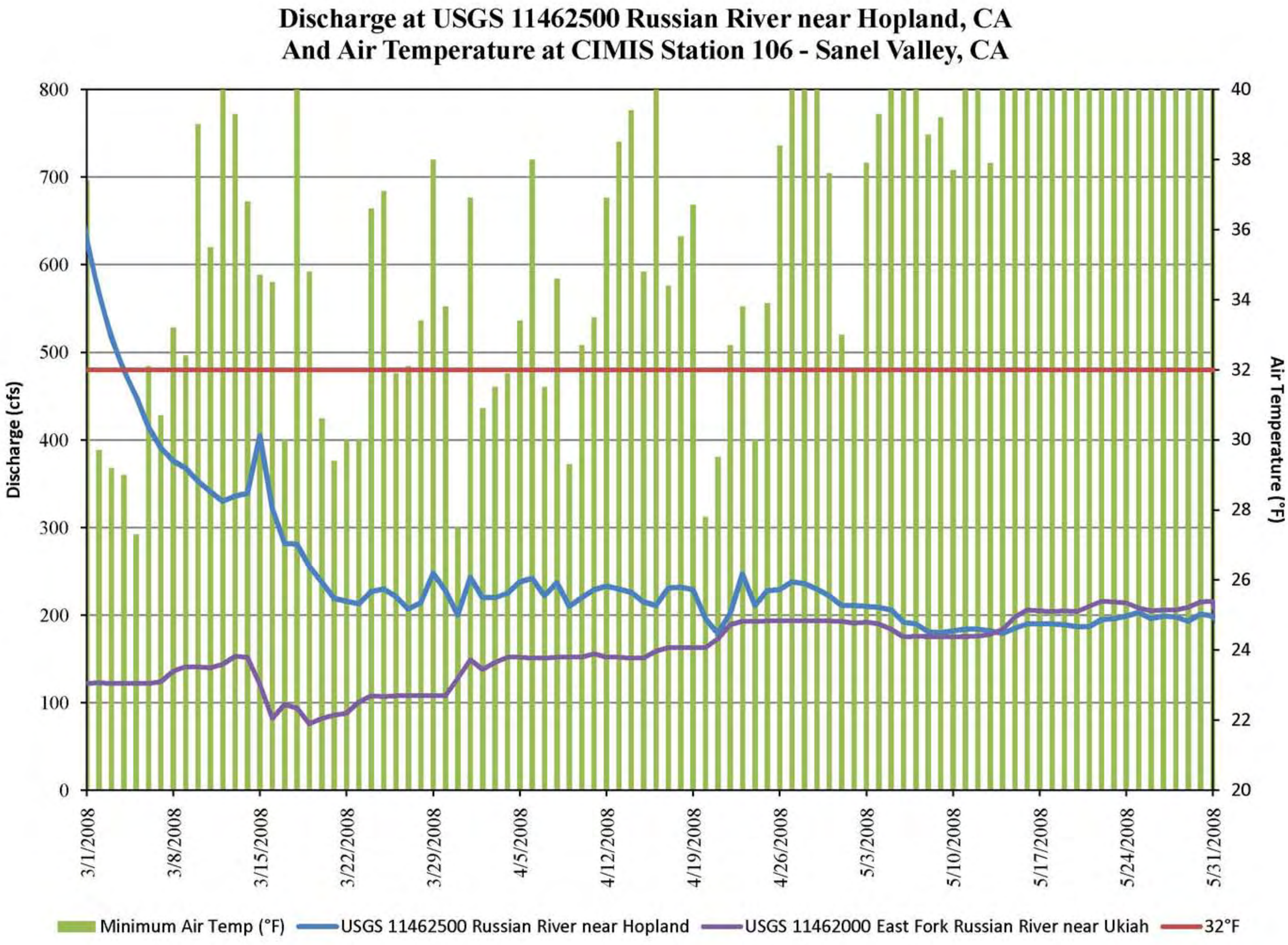
Discharge at USGS 11462500 Russian River near Hopland, CA
And Air Temperature at CIMIS Station 106 - Sanel Valley, CA
Discharge (cfs)
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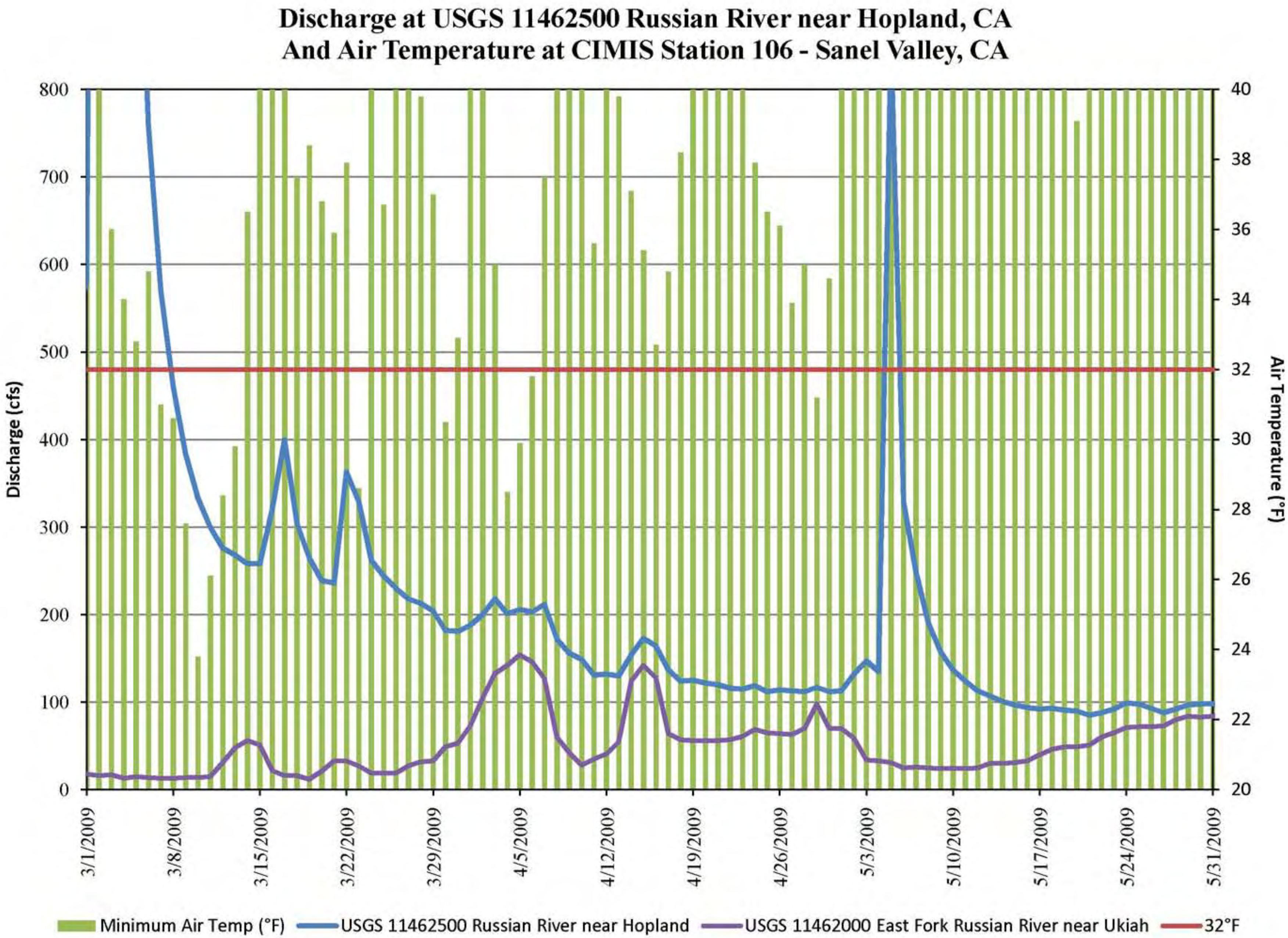
5/31/2008
Minimum Air Temp (°F)
USGS 11462500 Russian River near Hopland
USGS 11462000 East Fork Russian River near Ukiah
32°F



Discharge at USGS 11462500 Russian River near Hopland, CA
And Air Temperature at CIMIS Station 106 - Sanel Valley, CA
Discharge (cfs)
Air Temperature (°F)
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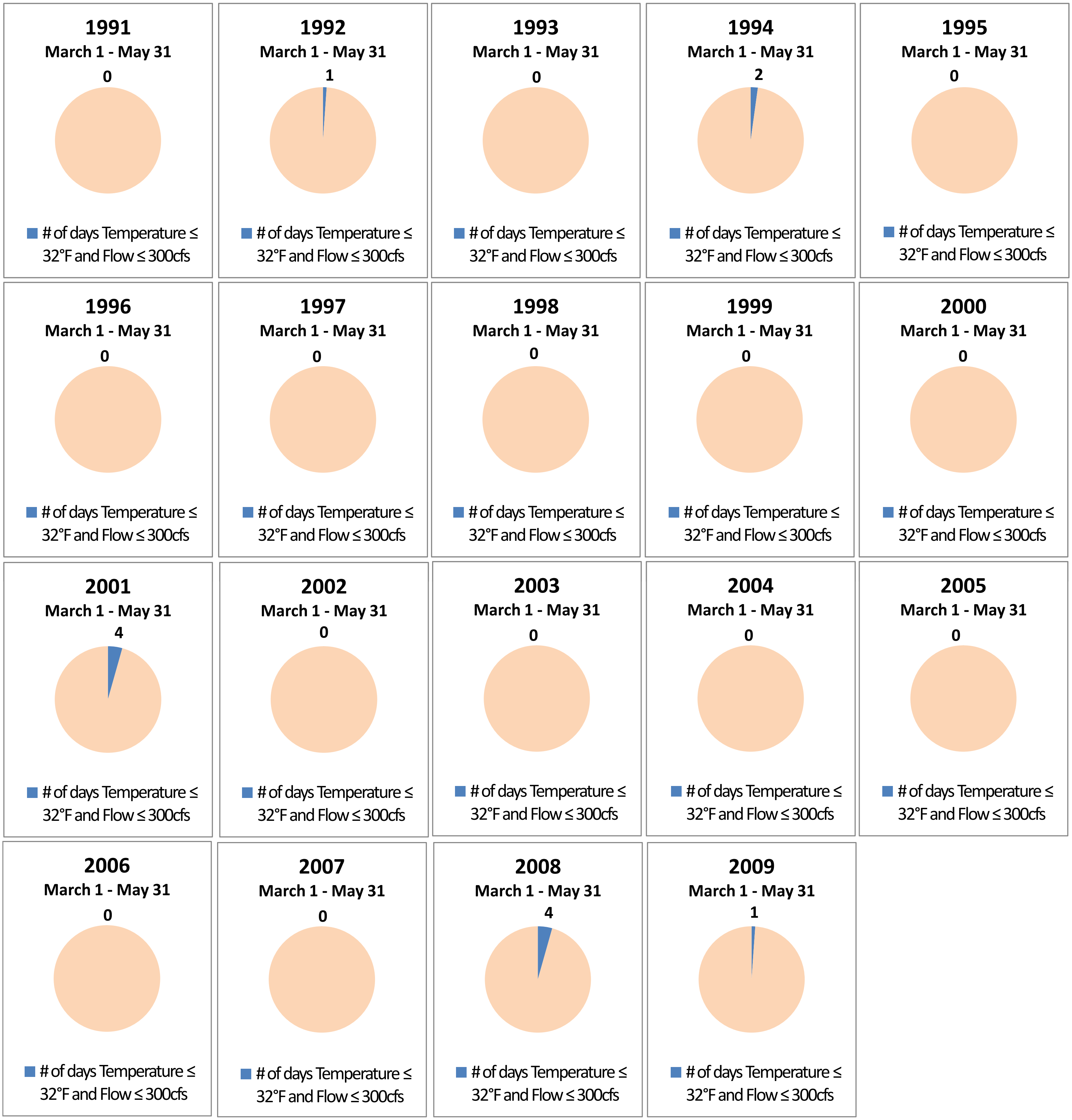
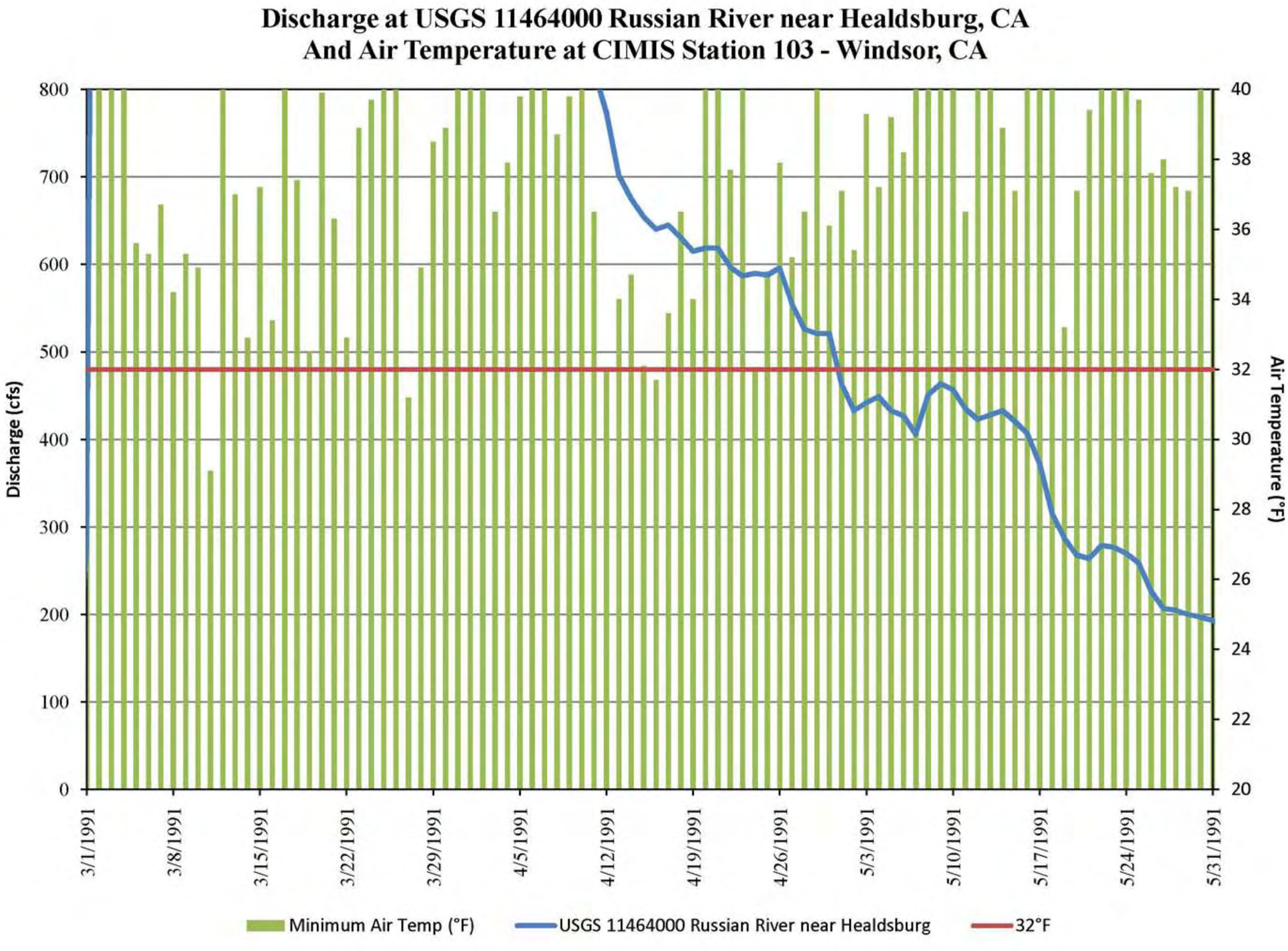
5/31/2009
Minimum Air Temp (°F)
USGS 11462500 Russian River near Hopland
USGS 11462000 East Fork Russian River near Ukiah
32°F

Number of Days Flow on Russian River near Healdsburg ≤ 300 cfs and Air Temperature at Windsor ≤ 32°F



Notes:
Flow data for USGS 11464000 Russian River near Healdsburg per U.S. Geological Survey.
Air temperature data for Station #103 Windsor per California Irrigation Management Information System (CIMIS).


Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
Air Temperature (°F)
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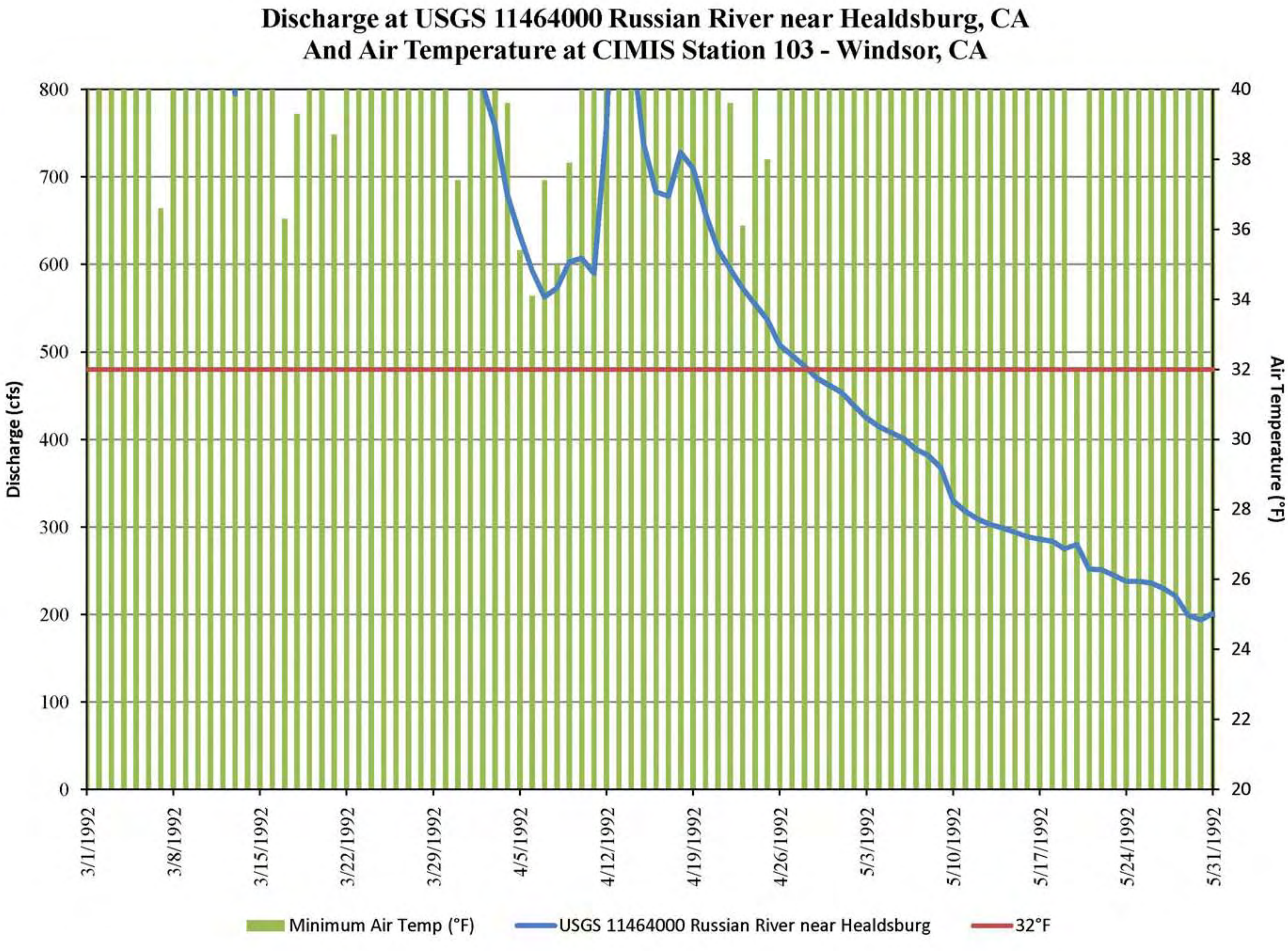
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F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And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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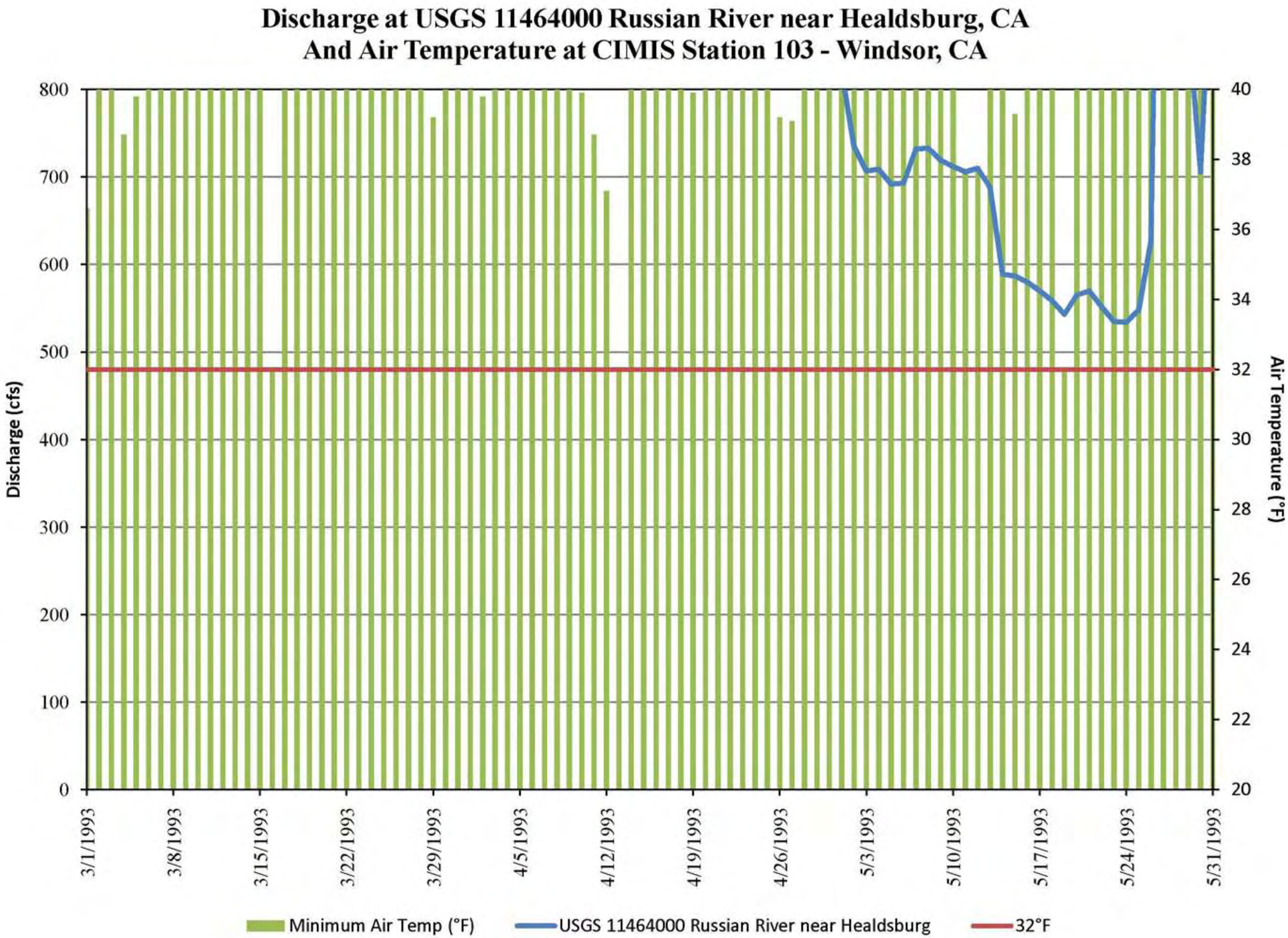
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F


Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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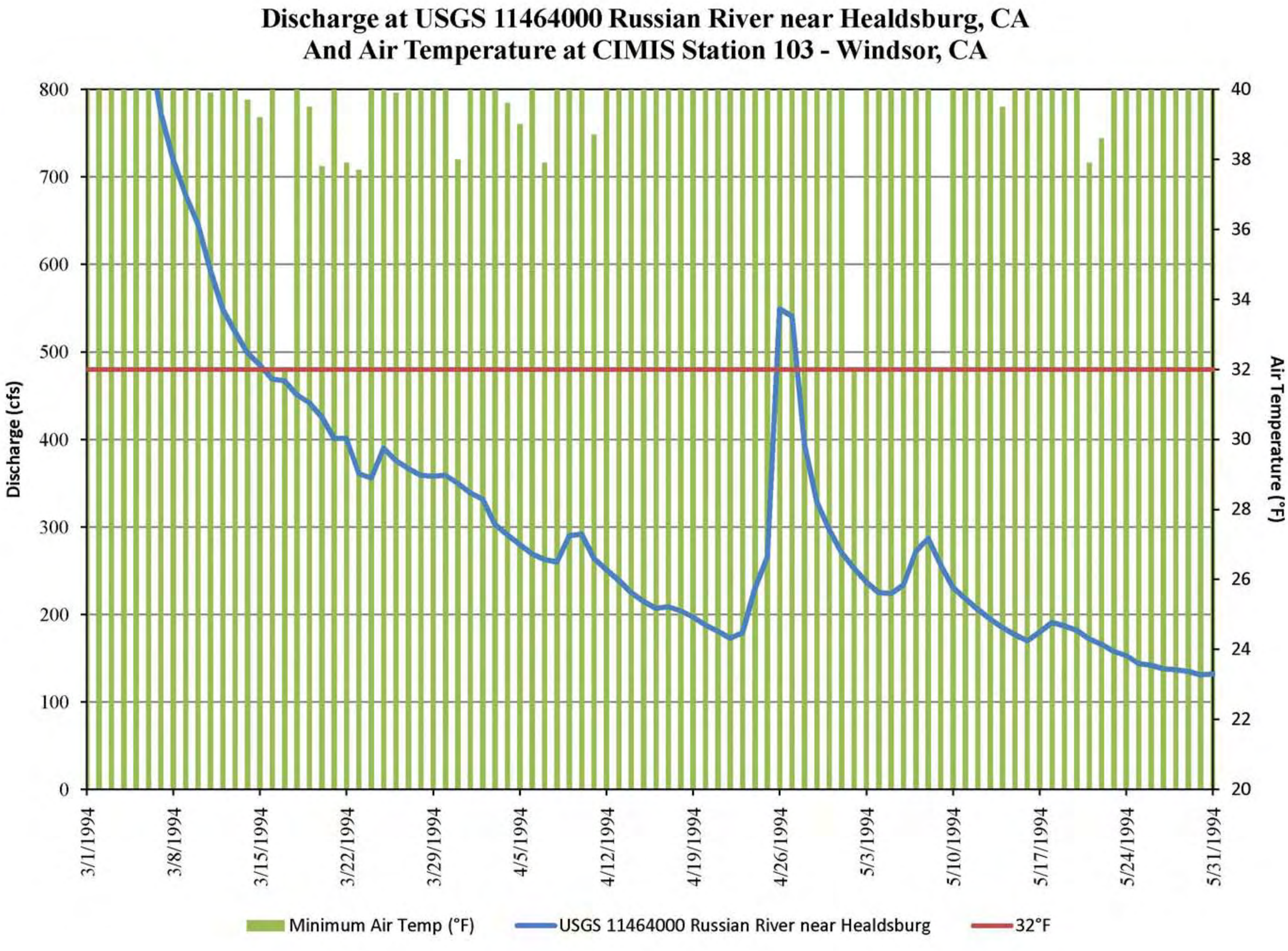
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And Air Temperature at CIMIS Station 103 - Windsor, CA
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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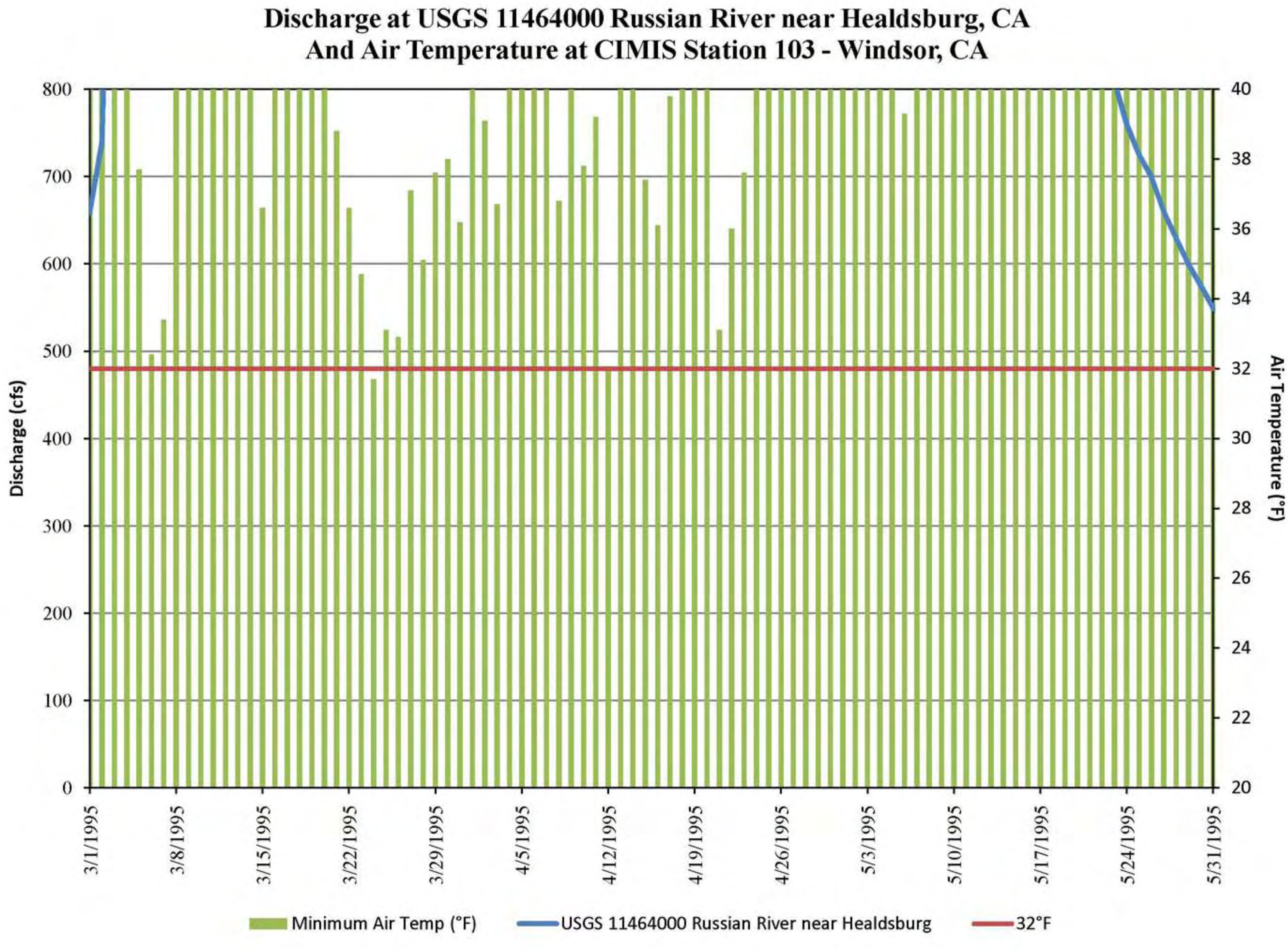
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And Air Temperature at CIMIS Station 103 - Windsor, CA
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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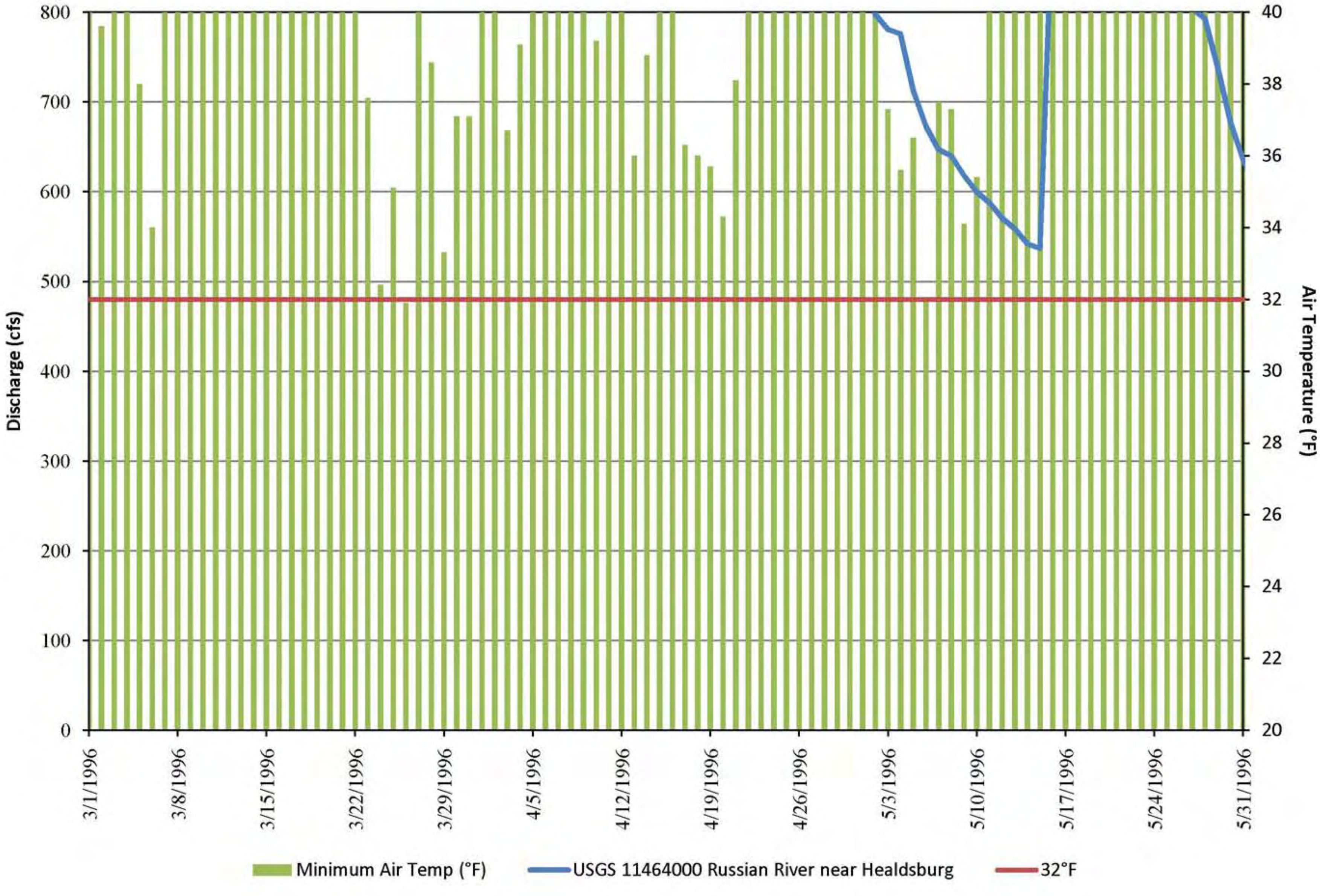
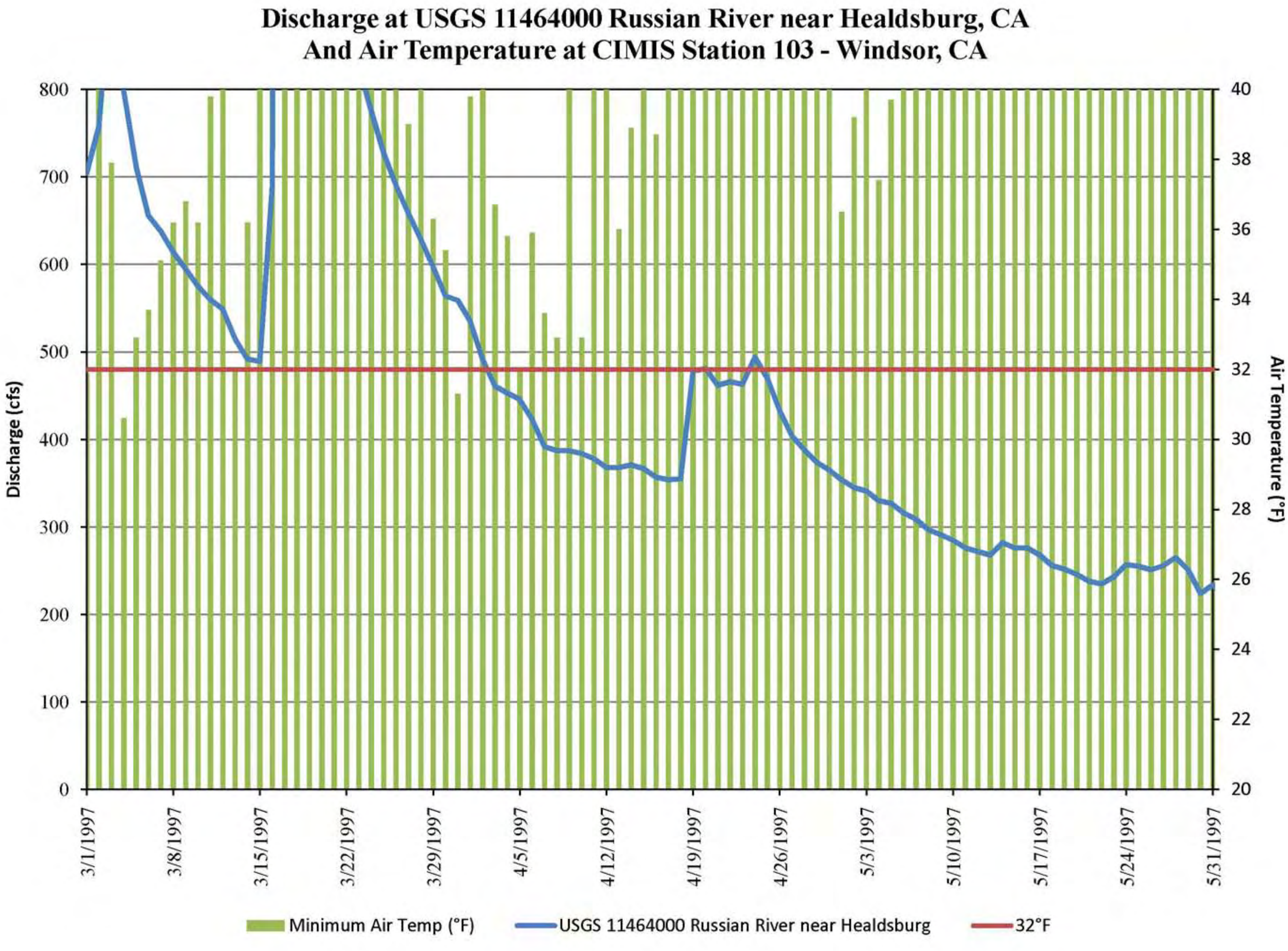
Discharge at USGS 11464000 Russian River near Healdsburg, CA And Air Temperature at CIMIS Station 103 - Windsor, CA

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And Air Temperature at CIMIS Station 103 - Windsor, CA
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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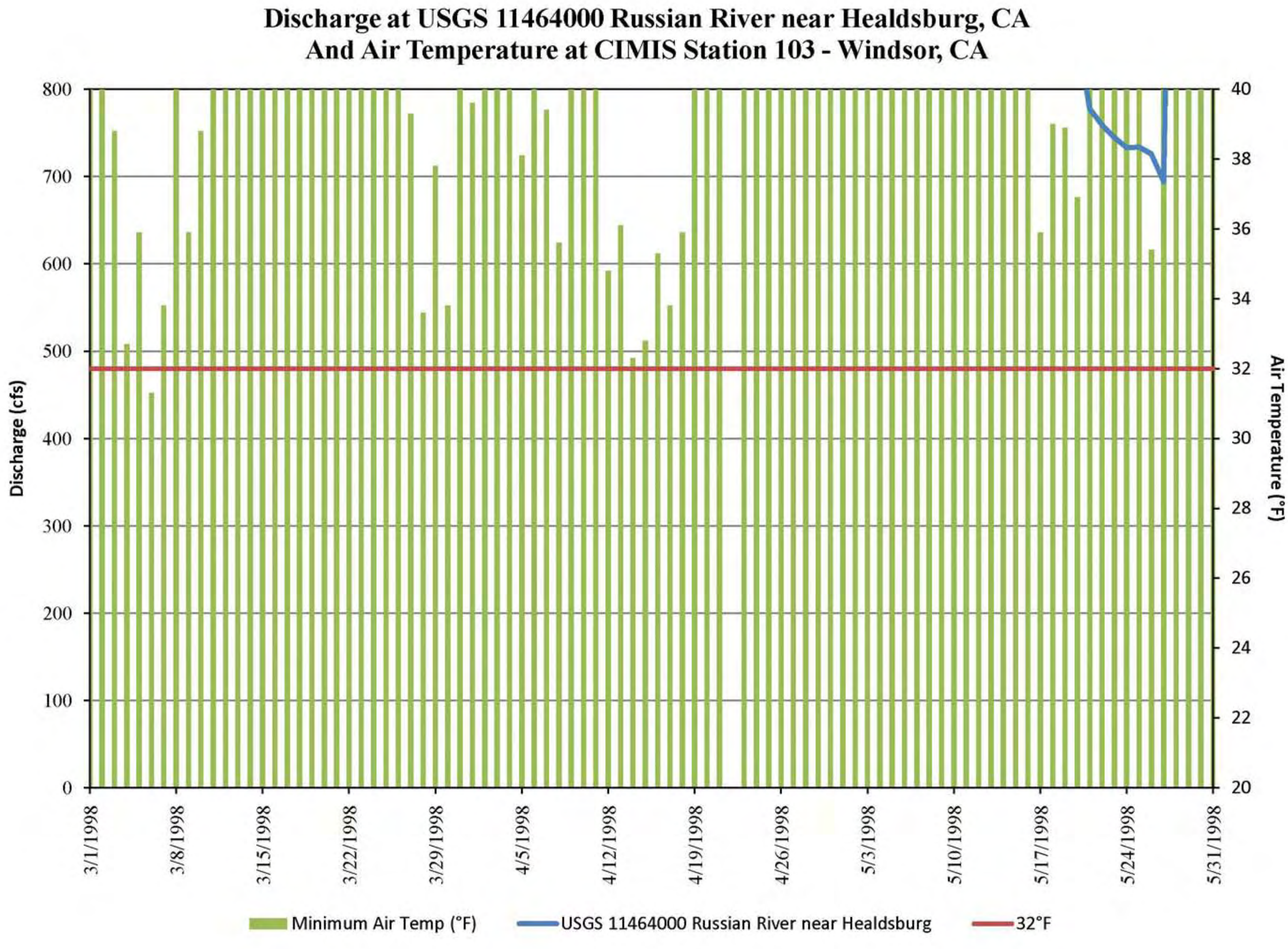
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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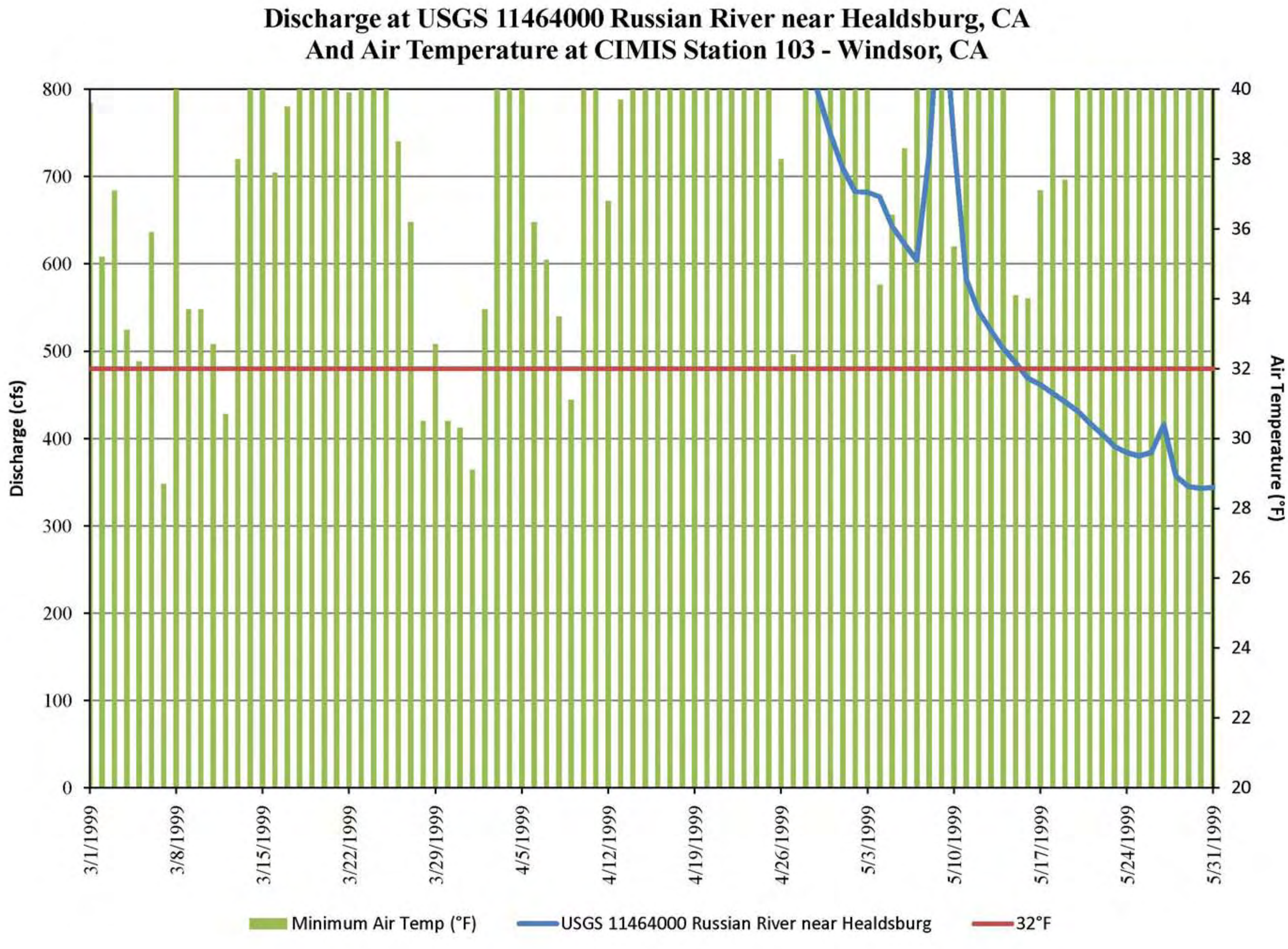
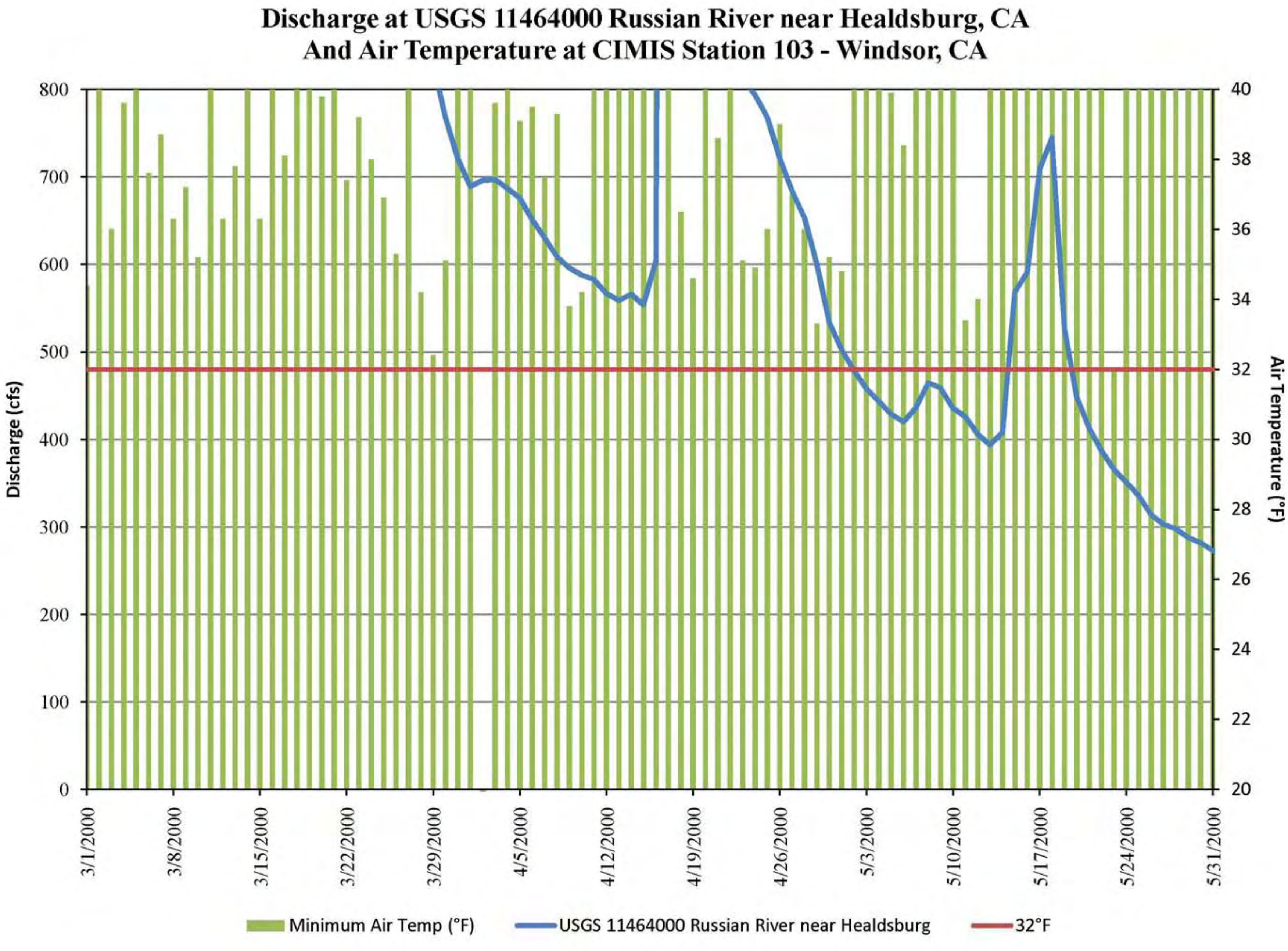


SWRCBH014.xls, Healdsburg Chart 1999



Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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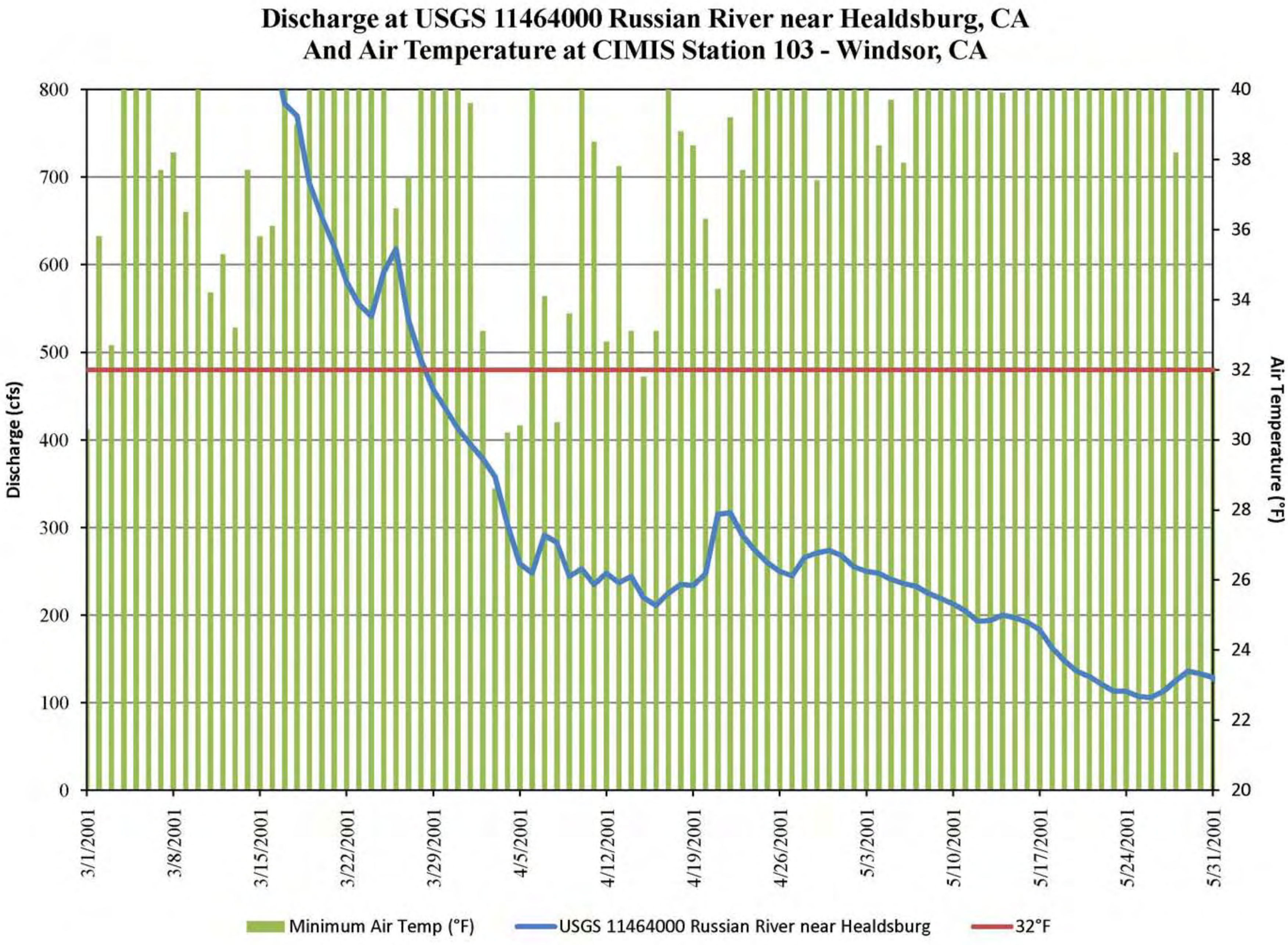
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And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
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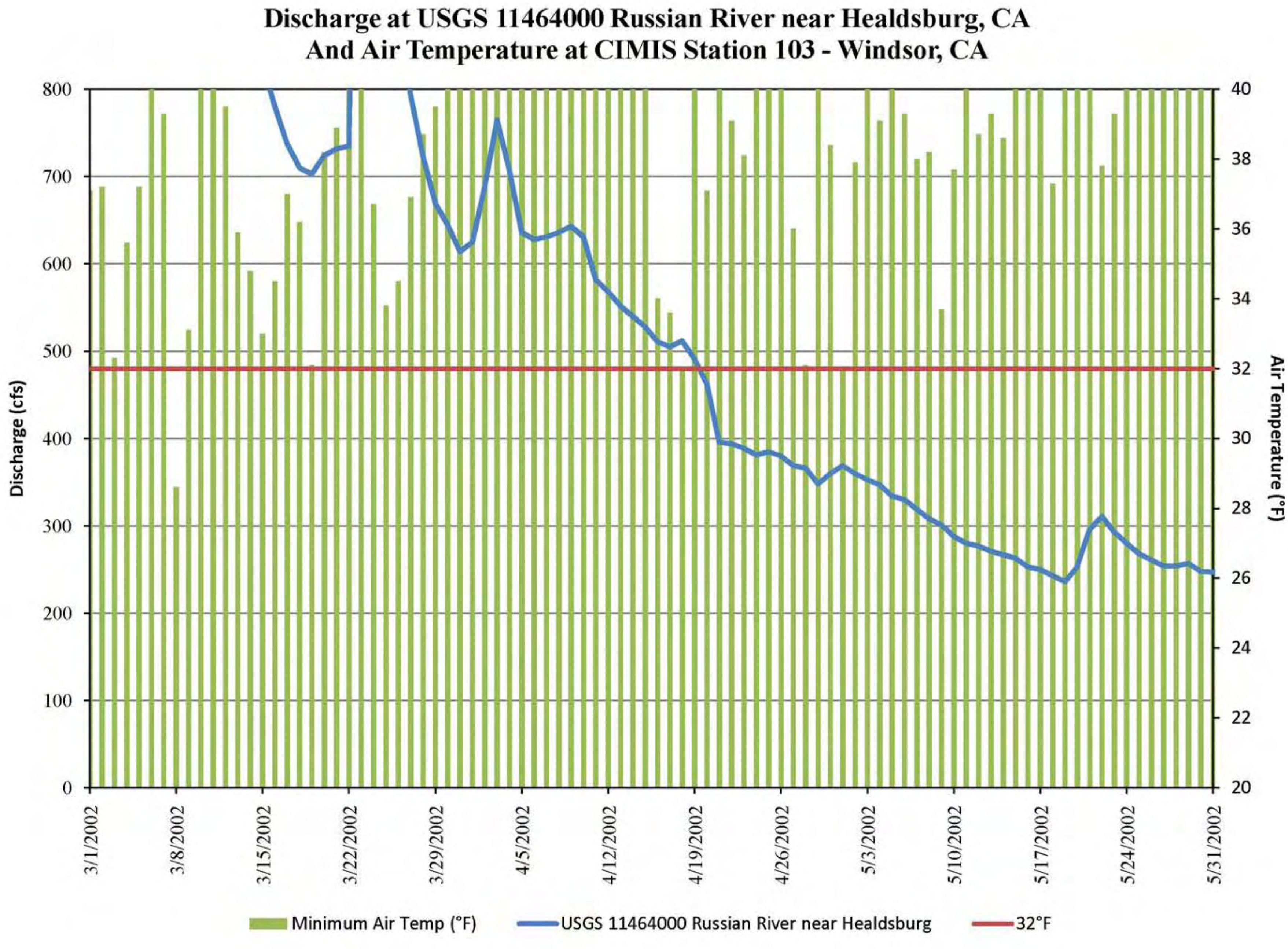

Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA
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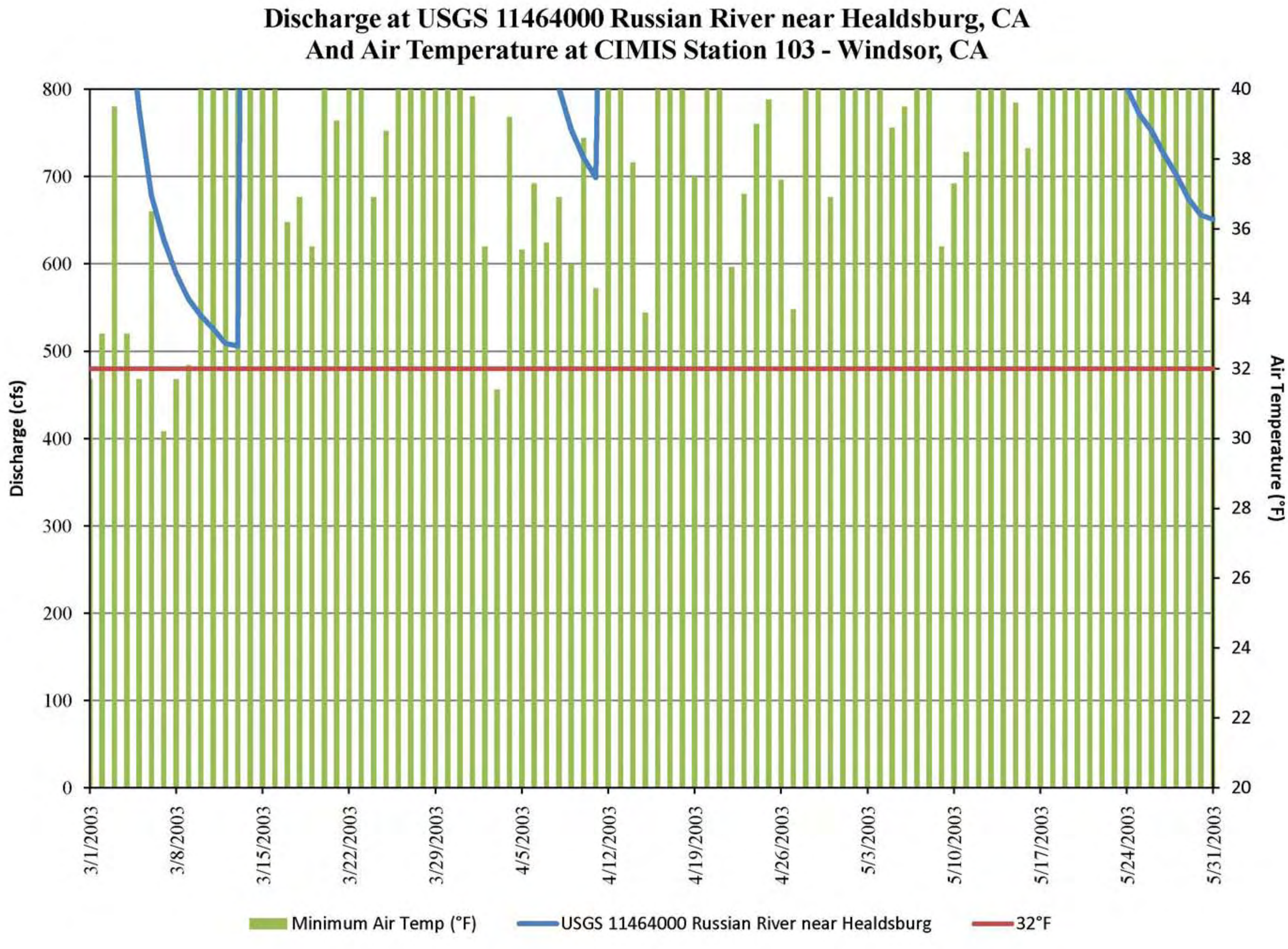
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F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And Air Temperature at CIMIS Station 103 - Windsor, CA
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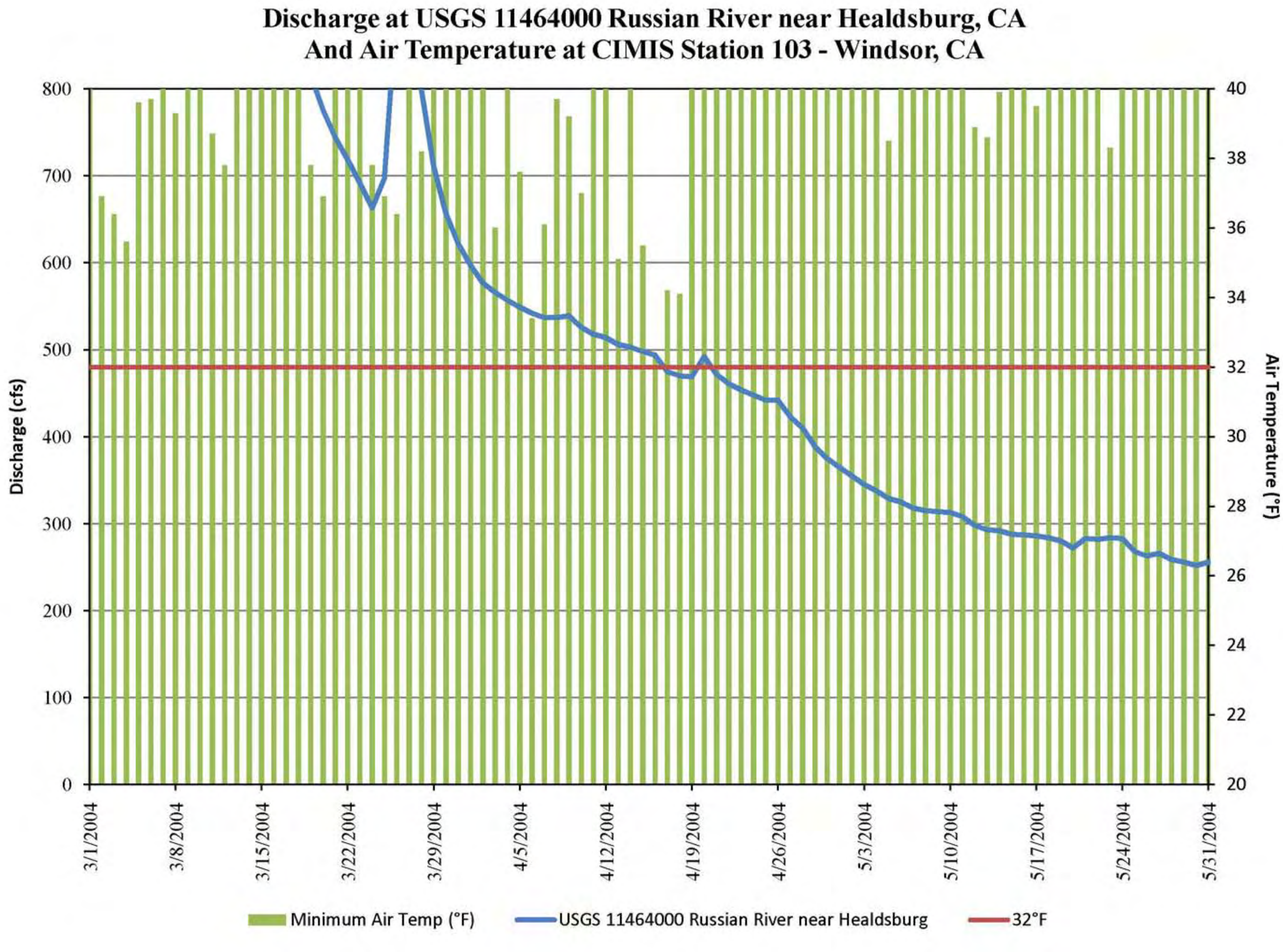
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F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And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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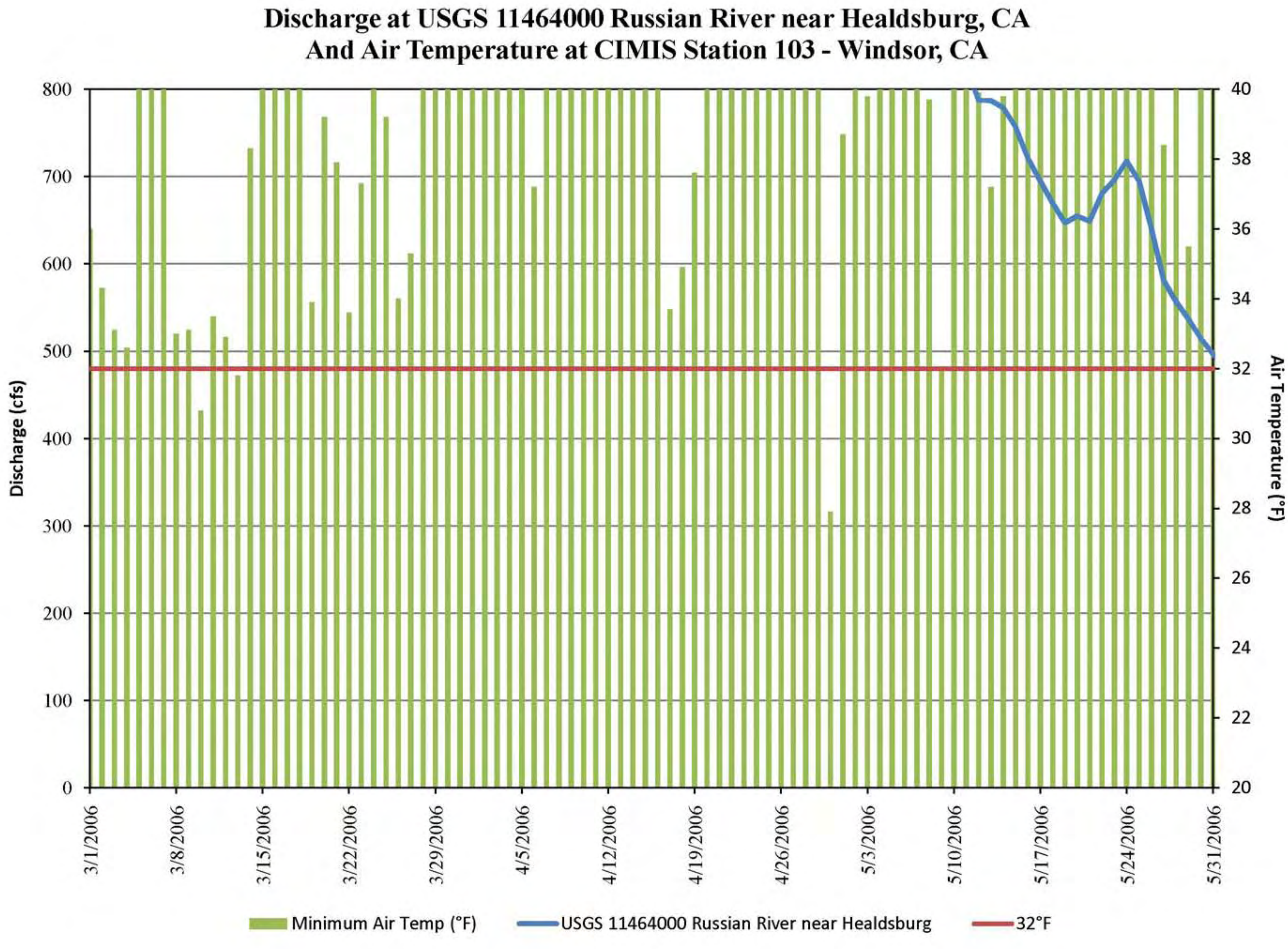
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F

Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA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And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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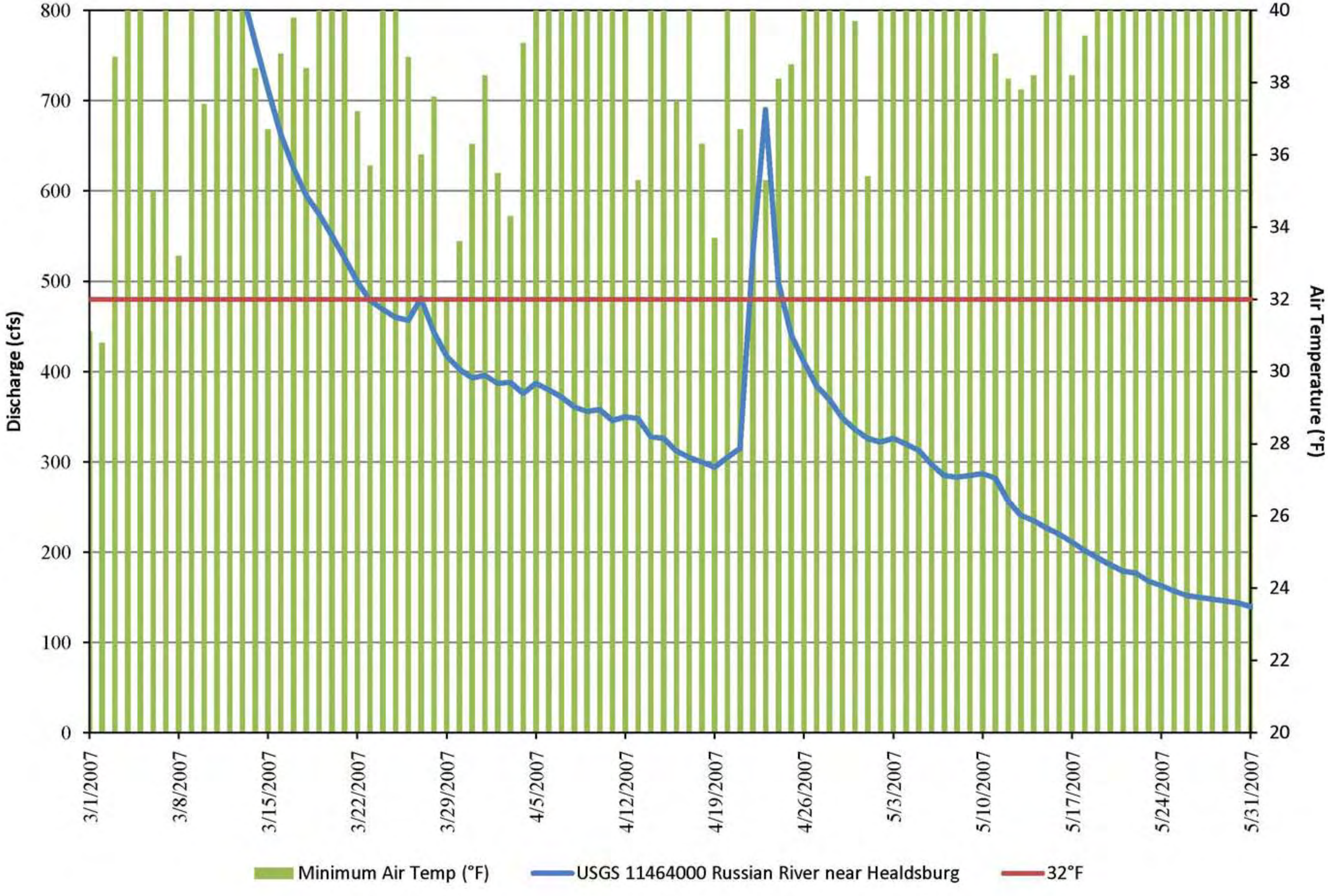
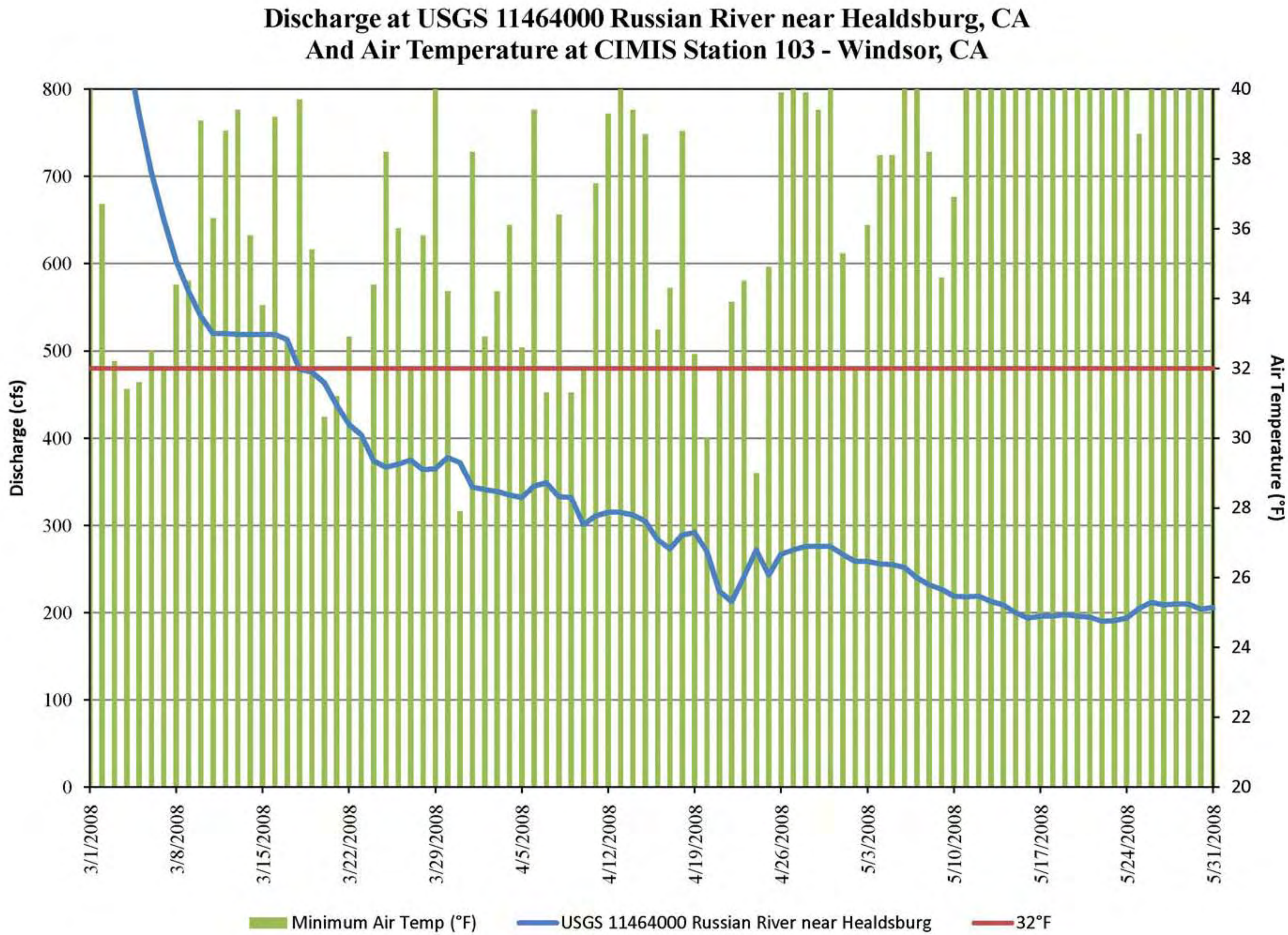
Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F

Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA

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And Air Temperature at CIMIS Station 103 - Windsor, CA
Discharge (cfs)
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4/12/2008
4/19/2008
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Minimum Air Temp (°F)
USGS 11464000 Russian River near Healdsburg
32°F

Discharge at USGS 11464000 Russian River near Healdsburg, CA
And Air Temperature at CIMIS Station 103 - Windsor, CA

Exhibit 4
Summary Description of the Status of Salmonids in the Russian River

<u>Status of Salmonids in the Russian River</u>

Sean White
General Manager
Russian River Mendocino County Flood Control and
Water Conservation Improvement District

STEELHEAD TROUT

<u>Life History</u>

Adult steelhead generally begin returning to the Russian River in November or December, with the first heavy rains of the season, and continue to migrate upstream into March or April. While adult steelhead have been observed in the Russian River during all months of the year, the peak migration period is from early January through March (Entrix 2001). Flow conditions are suitable for upstream migration in most of the Russian River and larger tributaries during the majority of the spawning period in most years. Sandbars blocking the river mouth in some years may delay entry into the river. However, during the times the sand barrier is closed, the flow is probably too low and water temperature is too high to provide suitable conditions for migrating adults further up the river (CDFG 1991).

Most spawning takes place from January through April. Steelhead spawn and rear in tributaries from Jenner Creek near the mouth, to upper basin streams including Forsythe, Mariposa, Rocky, Fisher and Corral creeks. Steelhead usually spawn in the tributaries, where fish ascend as high as flows allow (USACE 1982). Gravel and stream flow conditions suitable for spawning are prevalent in the Russian River mainstem and tributaries (Winzler and Kelly 1978), although large mainstem dams, gravel mining, and sedimentation have diminished gravel quality and quantity in many areas of the mainstem.

After hatching, steelhead spend from one to four years in freshwater. Fry and juvenile steelhead are extremely adaptable in their habitat selection. Requirements for steelhead rearing include adequate cover, food supply, and water temperatures. The mainstem above Cloverdale and canyon reaches of many tributaries provide the most suitable habitat, as these areas generally have excellent cover, adequate food supply, and suitable water temperatures for fry and juvenile rearing (SCWA 2003).

Emigration usually occurs between February and June, depending on flow and water temperatures. Sufficient flow is required to cue smolts to migrate downstream. Most Russian River smolts are age 2+ (SCWA unpublished data) Excessively high water temperatures in late spring may inhibit smoltification in late migrants (Entrix 2001).

<u>Distribution</u>

Steelhead occupy all of the major and most of the smaller tributaries in the Russian River watershed. Many of the minor tributaries may provide spawning or rearing habitat only under specific hydrologic conditions. Steelhead use the lower and middle mainstem Russian River primarily for migration to and from spawning and nursery areas in the tributaries and the mainstem above Cloverdale (SCWA 2003). The majority of spawning and rearing habitat for steelhead occurs in the tributaries (Entrix 2001).

Although no comprehensive surveys have been conducted across the basin, steelhead appear to be widely distributed throughout the watershed. Relatively healthy populations have been documented in Mark West, Santa Rosa, and Millington creeks (Cook and Manning 2002). Steelhead have also been documented in Sheephouse, Austin, Ward, Green Valley and Mill creeks (CDFG unpublished data). The anecdotal information presented in the literature does suggest that the historical steelhead populations were likely very large, and although steelhead are presently widely distributed in the basin, the overall population is likely depressed compared to historic levels.

In summer and fall 2001 a flow-related habitat study was conducted by the U.S. Army Corps of Engineers, National Marine Fisheries Service, California Department of Fish and Game, North Coast Regional Water Quality Control Board, Sonoma County Water Agency, and Entrix. The study evaluated habitat value for steelhead along the Russian River and Dry Creek under a range of water release rates from Coyote and Warm Springs dams. Observations made during the flow study indicated that potential spawning and summer rearing habitat for steelhead was present in the upper main stem of the Russian River.

To augment these findings, the Sonoma County Water Agency conducted the *Upper Russian River Steelhead Distribution Study* during the summer and fall of 2002 (SCWA 2003). The study area extended 66 miles along the Russian River from Ukiah to Healdsburg. Dive surveys were conducted to count fish at randomly selected river segments. Steelhead were observed in all study reaches; however, their distribution and numbers varied substantially. A total of 1,436 steelhead were observed in 37 sample segments in four reaches (Ukiah, "Canyon", Alexander Valley and Healdsburg). Steelhead were found in the upper portion of the Ukiah reach, throughout most the Canyon reach, and infrequently in the Alexander Valley and Healdsburg reaches. The fish composition of the study reaches included 12 native and non-native fish species. Steelhead composed <1% to 5% of the counted fish.

The largest numbers of steelhead were observed in the Canyon reach (265 steelhead/km) followed by the Ukiah reach (37 steelhead/km). Fish numbers were determined by visually counting fish during dive surveys and are not population estimates. The Ukiah reach was located in Ukiah Valley area and was the upstream limit of the study area. The reach was defined as beginning at the confluence of the East and West Forks of the Russian River and terminating at the Highway 101 Bridge near Hopland.

The fish composition of the Ukiah reach included several native and non-native fish common in the Russian River. A total of 20,117 fish were counted during dive surveys in 12 segments. Cyprinids (minnow species) and Sacramento sucker dominated the composition at 54% and 36% of the fish observed, respectively. A total of 224 steelhead were observed in the reach contributing 1% of the fish counted. Steelhead were present in 3 segments located in the upper one-third of the reach and were correlated with the distribution of riffle and cascade habitats.

Three age classes of steelhead were present in the Ukiah reach. Age 1+ steelhead were the most abundant (64%) followed by young-of-the-year (35%) and age 2+ fish (1%). The disproportionately high frequency of 1+ fish suggests a relatively large population of resident steelhead.

Abundance

The historical estimate for steelhead in the Russian River has been cited in a number of reports ranging from 50,000 to 57,000 fish (CDFG 1965, Vestal and Lassen 1969, Prolysts and Beak 1984, Steiner 1996, CDFG 1996, CDFG 2002).

The estimate of 50,000 steelhead has its origins in Evans (1959) and Hinton (1963). Evans (1959) conducted a fish rescue operation at the base of Coyote Dam on March 26, 1959, and captured 375 adult steelhead. Several additional steelhead were observed below the dam but not captured. From this one day of fish rescue work, Evans stated that “It indicates in all probability perhaps 2,000 or more steelhead may be present at the base of the dam in the course of a normal annual run.” No additional supporting data were provided to support this claim. Hinton (1963) also used the same 2,000 fish estimate for the East Branch in 1959, and 800 to 1,000 steelhead in 1960. CDFG’s estimates were based on half hour counts of steelhead jumping at the dam made by local wardens in 1959 and 1960 and the rescue of adult steelhead at the dam on one day in each year. CDFG personnel also participated in “brief surveys” of Dry and Santa Rosa creeks, and came up with a figure of 8,000 steelhead in Dry Creek, and 5,000 in Santa Rosa Creek. No data or other supporting information was provided in the source documents to validate these numbers. The numbers used for the run size for these three creeks (East Branch of the Russian River, Dry, and Santa Rosa) were later expanded to the entire Russian River on the basis of proportionate stream mileage and drainage area to arrive at the estimate of 50,000 steelhead in the Russian River (SCWA 2004).

The 57,000 fish estimate is linked to an anecdotal estimate that references a 1957 in-river harvest of 25,000 steelhead from a total adult return of 57,000 fish. This number is cited directly or indirectly in numerous documents including: NCRWQCB (2000), CDFG (2002), Steiner (1996). The source of this number is Christensen (1957). The Christensen citation is from the sports page of a local newspaper in which the author estimated the number of fish he believed were caught during the 1956/57 steelhead run. The estimates provided by Christenson are not based on any data. (SCWA 2004).

Despite a complete absence of valid population data for Russian River steelhead, there is general agreement that the population has declined in the last 30 years (CDFG 1984, CDFG 1991).

CHINOOK SALMON

Life History

Russian River Chinook salmon *(Oncorhynchus tshawytscha)* follow the fall-run life history pattern, which is an adaptation to avoid summer high water temperatures. Fall-run adult salmon migrate from the ocean to spawn in rivers and large tributaries in late summer and fall. Adult Chinook salmon begin returning to the Russian River as early as August, with most spawning occurring after Thanksgiving. Chinook may continue to enter the river and spawn into January (Entrix 2001).

Spawning occurs shortly after arriving at the selected spawning grounds. Adults create a nest, called a redd. Females deposit between 2,000 and 17,000 eggs that settle into the rocky substrate of the redd. Redds are usually located at the head of riffles with large gravel to cobble substrate to ensure oxygenated water flows to the eggs. Adults die soon after spawning.

Eggs hatch within 4 to 6 weeks and young salmon emerge from the substrate in spring. Unlike steelhead and Coho, the young Chinook begin their outmigration soon after emerging from the gravel. Freshwater residence, including outmigration, usually ranges from two to four months. Chinook move downstream from February through June (SCWA 2004). Juvenile Chinook salmon may rear in the mainstem of rivers or estuaries during spring before water temperatures increase in the summer. Young salmon are called smolts while they are acclimating to salinity in preparation for entering the ocean. The smolt process occurs during the first year and is usually complete by late spring or summer.

Once accustomed to saltwater, smolts head out to the ocean where they spend between 1 to 5 years maturing before returning to their natal stream to spawn and complete their lifecycle. While ocean residence can range from one to seven years, most Chinook return to the Russian River as two to four-year-old adults (SCWA unpublished data)

Distribution

Historic spawning distribution is unknown, but suitable habitat formerly existed in the upper mainstem and in low gradient areas of tributaries. Chinook currently spawn in the mainstem and larger tributaries, including Dry Creek.

Day (1960) attempted to document Chinook salmon spawning in the Russian River. The methods for the study did not entail a systematic search of potential spawning areas, and appears to have been limited to observations made by biologists taking temperature readings at two locations on the river (one at the base of Coyote dam, and the second at Talmage Road bridge in Ukiah, and by wardens making observations in the Cloverdale to Jenner Reach).

SCWA conducts annual surveys to determine the distribution and abundance of Chinook redds (SCWA 2008). During all years surveyed (2002-2007) the majority of the Chinook salmon spawning occurred in the upper Russian River mainstem and in Dry Creek. The Ukiah reach, located at the upstream end of the Russian River study area, typically had the highest frequency of redds. Density has been as high as 15.5 redds/rkm in 2002. During dry years however frequencies in the Canyon and Alexander Valley reaches were higher than in the Ukiah reach.

In the Dry Creek and Ukiah reaches the abundance of redds generally increased with proximity to the upstream terminal ends with dams (SCWA 2008). The pattern of abundance of redds in both these reaches was similar each year. The upper half of the Dry Creek reach contained greater than 80% of the redds annually. This trend was not quite as strong in the Ukiah reach where the upper half of the reach contained greater than 62% of the redds annually.

Abundance

During the 1940’s and 50’s, the general consensus among biologists familiar with the river was that few Chinook inhabited the river, and those that did were the results of stocking activities. Chinook salmon were first stocked into the basin in 1881, when 15,000 fry were planted in the Russian River, and additional 15,000 Chinook fry were stocked into “Skaggs Springs.” An additional 25,000 Chinook fry were stocked into the Russian River in 1907 (USCFF 1910). Plantings occurred sporadically from that time through 1959. Between 1959 and 1960, 2.25 million fry and 500,000 eyed eggs were planted in the river by CDFG. In 1964, CDFG planted late winter run Chinook fry from the Green River in Washington in an attempt to produce a run of Chinook that would return to the river later in the fall after the water temperature cooled to more appropriate levels. In 1982 CDFG attempted to establish a run at the Warm Springs Fish Hatchery. Approximately 2 million fry and smolts were released from the hatchery between 1982 and 1996. Adult returns to the hatchery ranged between 0 and 304 fish during this time. CDFG ended its Chinook hatchery program in 1996.

The historical records of Chinook salmon in the Russian River that do exist are sparse, but most indicate that the population was never very large. Sources in the 1940's and 1950's stated that few, if any, Chinook inhabited the river. Rich et al. (1944) and Shapovalov (1955) stated that Chinook salmon did not inhabit the Russian River. Murphy (1946) noted that “other” salmon (other than Coho) occasionally enter the Russian River. Pintler and Johnson (1956) reported that although Chinook salmon were occasionally caught in the lower river, they were rare. Hinton (1963) stated that the Chinook salmon runs were increasing in response to heavy stocking practices between 1956 and 1960. Hinton (1963) reported that angler catch of Chinook salmon was approximately 25-50 in 1959, 200 to 250 in 1960, and 500 to 600 in 1961. He concluded that the Chinook run in the Russian River in 1961 was 1,000. Jensen (1973) in an internal memo reported that CDFG plants of Chinook salmon resulted in a minor fishery, but that the fish were unable to reproduce successfully. CDFG (1991) stated that it is not known if Chinook maintained a self-sustaining population in the Russian River. But if it did, then there was "likely only about 100 spawners." Additional sources provide estimates for Chinook salmon in the Russian River (e.g., CDFG 1965 – 1,000; Winzler and Kelly 1978 – 500, Jones 1993 – 40 to 125). Steiner (1996) concluded that very few Chinook remained in the Russian River basin.

This general consensus persisted until rigorous field studies of Russian River Chinook began in the late 1990s. In 1999 SCWA installed a video based fish counting system in the fish ladders at the Mirabel inflatable dam. Although this system was originally intended to assess the efficacy of the ladders, it immediately became more useful for counting returning Chinook adults. Since its installation, annual Chinook counts at Mirabel have recorded between 1,400 to 6,100 adults (SCWA 2004).

Genetics analysis of Russian River Chinook salmon was conducted by the Bodega Marine Lab (BML). BML completed microsatellite analyses to assess the affinity of Russian River Chinook with Warm Springs Hatchery, Central Valley, and other coastal populations of Chinook. Genetic analysis concluded that the Russian River Chinook population is not a remnant of the Warm Springs Hatchery population, nor are they closely related to the Central Valley populations. The Russian River Chinook did cluster closely with Eel River Chinook; however, the two populations are distinct from one another with a bootstrap value of 919. Further, Hedgecock et al. (2002) states that "Chinook in the Russian River do appear to belong to a diverse set of coastal Chinook populations."

COHO SALMON

Life History

The Coho salmon (Oncorhynchus kisutch) life history is quite rigid, with a relatively fixed three-year life cycle. Most Coho enter the Russian River in November and December and spawn in December and January. Spawning and rearing occur in tributaries to the lower Russian River.

After hatching, young Coho will spend about one year in freshwater before becoming smolts and migrating to the ocean. Freshwater habitat requirements for Coho rearing include adequate cover, food supply, and water temperatures. Primary habitat for Coho includes pools with extensive cover. Outmigration takes place in late winter and spring. Coho salmon live in the ocean for about a year and a half, return as three-year-olds to spawn, and then die. The factors most limiting to juvenile Coho production are high summer water temperatures, poor summer and winter habitat quality, and predation.

Distribution

Historic populations occurred in approximately 20 tributaries of the lower Russian River, including Dry Creek. There are also anecdotal historical accounts of Coho from tributaries of the upper most end of the Russian River including Forsythe, Mariposa, Rocky, Fisher, and Corral creeks. The mainstem below serves primarily as a passage corridor between the ocean and the tributary habitat.

As recently as 2007, juveniles from wild populations have been observed in Green Valley, Dutch Bill, and Felta Creeks. Tragically, the populations in Green Valley and Dutch Bill creeks appear to have since been extirpated (Joe Pecharich, pers. comm 2009). Felta Creek supports the only remaining wild Coho population in the Russian River watershed. Coho from the on-going hatchery based recovery program have been planted in tributaries to Dry Creek as well as Green Valley, Dutch Bill, and Sheephouse Creeks.

Abundance

There are no historical estimates for Coho salmon prior to 1975. Although some researchers (Steiner 1996) theorized that the commercial fishery in the lower Russian River during the late 1800's was composed primarily of Coho salmon, the time of year that many of the fish were captured argues against this. In 1888, 58 percent of the fish shipped to San Francisco were captured January through May, suggesting that steelhead were a large portion of the catch. Although the information from 1889 through 1892 states that only Chinook salmon were captured in Sonoma County, these data do not specifically state that the catch was in-river (tables displaying catch data use the qualifier "…in the shore or boat fisheries…." Thus, it does not rule out that Coho were part of the in-river catch.

Few other reports of Coho salmon were found in the literature. Rich et al. (1944) stated that runs of Coho salmon were small and sporadic. Conversely, in 946 good catches of Coho salmon near Duncans Mills (Murphy 1946). Shapovalov (1944) observed that Coho salmon enter the river in "small numbers." Lee and Baker (1975) cite CDFG (1965) as the source for their estimate of 7,000 Coho in the river with an annual harvest of 2,000 fish. CDFG (1965) does not provide supporting data for their numbers. Anderson (1972) placed the average annual run of Coho salmon at 5,000 fish. The USACE (1982) reported that 300 Coho salmon inhabited Dry Creek prior to the construction of Warm Springs Dam, but again, no supporting data are provided to validate the numbers.

The Don Clausen Fish Hatchery produced and released an average of about 70,000 ages 1+ Coho salmon each year (1980-1998). Hatchery production ceased in 1999 (Entrix 2001). Currently, Coho salmon in the Russian River are believed to be threatened with extinction. Several agencies, including the CDFG, NOAA-Fisheries, USACE, and SCWA, are involved in a captive broodstock program designed to increase the number of Coho returning to basin streams. Wild Coho salmon are captured and taken to the Warm Springs Fish Hatchery were they are reared to maturity and spawned at the hatchery. The young are reared in the hatchery for several months then released into streams that historically supported Coho salmon, where they will hopefully emigrate to the ocean and return to spawn. Although surveys for the captive broodstock program found that Coho salmon are more widely distributed than was previously thought, their numbers are likely very low compared to historical levels.

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