Application Form for 2024 Local Cooperative Solution for Overlying or Adjudicated Groundwater Rights in Scott River and Shasta River Watersheds

Please complete this form if you plan to implement a groundwater local cooperative solution (LCS) for the 2024 irrigation season under the Scott River and Shasta River watersheds emergency regulation. A separate application should be submitted for each type of groundwater LCS proposal. **The form and attachments are due by April 15, 2024.**

How to Submit: To submit your application and associated required materials (see Section 2) you can:

- Use the online form
- Email: DWR-ScottShastaDrought@waterboards.ca.gov
- Mail:

  State Water Resources Control Board
  Division of Water Rights - Instream Flows Unit 1
  1001 I Street - 14th Floor
  Sacramento, CA 95814

Section 1: Applicant Information

Name	Jerry and Elizabeth Giacomelli
Name of Farm, Ranch, or Business	Giacomelli Ranch
[redacted]	

By typing or signing your name below and submitting this form to the State Water Resources Control Board (State Water Board) you hereby certify that the submitted information is true and correct to the best of your knowledge.

Name: *Jerry and Elizabeth Giacomelli* *Date:* 4/12/24

Section 2: Application Checklist

Below is a list of items to include with your application form:

- Application Form (paper or email submittal accepted).
- If working with a Coordinating Entity (Section 4 of application), submit a signed Binding Agreement (paper or email submittal accepted).
- Supporting Information (electronic submittal only). Submit the applicable information based on selected groundwater LCS.
    - Best Management Practices Groundwater LCS (see Section 7 of application)
        - Description of how you will implement of all required components.
        - Map(s) with each well and field labeled.
    - Graduated Groundwater Cessation Schedule LCS (see Section 8 of application)
        - Description of how you will reduce irrigation compared to standard practices on the property (e.g., practice in a similar unregulated year).
        - Map(s) designating the area where diversions will cease by the required dates and well location(s).
    - Percent Reduction Groundwater LCS (see Section 9 of application)
        - Description of verifiable water reduction actions that will be implemented.
        - Spreadsheet with monthly pumping volumes for baseline year and current year. Use one row per irrigation method per field.
        - Map(s) with each well and field labeled.
- A description of metering (Section 6 of application) in place for groundwater well extractions and an agreement to record such extractions daily and report monthly to your Coordinating Entity and/or State Water Board.
- Groundwater Well Information (see Section 5 of application) (paper or email submittal accepted).
- List of Fields, Assessor's Parcel Numbers (APNs), and Water Rights (see Section 10 of application) (paper or email submittal).

Section 3: Requirements for All Groundwater LCS Proposals

- **Deadline:** Proposals must be submitted to the State Water Board by April 15, 2024.
- **Implementation:** Proposals must be implemented during the entirety of the irrigation season (including prior to approval), unless the applicant withdraws the application.
- **Metering:** Proposals must include a description of metering that will be used to measure groundwater well extractions and information on how extractions will be recorded daily and reported monthly to the Deputy Director or Coordinating Entity, as applicable. Please note the Coordinating Entity is required to provide this data to the State Water Board.
    - *Funding for Meters:* The State Water Board has funding and technical support available for some amount of metering and those interested in such assistance should promptly contact State Water Board staff using the "Contact Information" at the end of this application.
    - *Time Schedule for Metering:* If a meter is not currently installed and may not be installed prior to the start of the irrigation season, the applicant must provide information that substantiates the applicant's efforts and actions taken to get a meter installed, and a timeline for meter installation.
    - *Waivers*: Proposals may include information requesting waiver of the metering provisions in the following instances:
        - Groundwater wells that irrigate less than 30 acres. Information supporting the request to waive metering provisions must be provided, including distance of the groundwater well to surface water. The State Water Board may require other information in lieu of monitoring.
        - Metering is not feasible. Substantiation for the infeasibility of installing a meter must be provided.

Section 4: Coordinating Entity

Select only one (1) box below. Please note that a Coordinating Entity is not required. If a Coordinating Entity is not selected, parties will work directly with the State Water Board to provide metering data and ensure performance of the groundwater local cooperative solution. For more information on Coordinating Entity provisions, refer to Section 875(f)(1)(G) in the emergency regulation.

☐ California Department of Fish & Wildlife
Contact: Crystal Robinson
(530) 340-0767
crystal.robinson@wildlife.ca.gov

☐ Shasta Valley Resource Conservation District
Contact: Rod Dowse
(530) 598-1253
rdowse@svrcd.org

☑ Siskiyou Resource Conservation District
Contact: Evan Senf
(530) 643-1585
evan@siskiyourcd.com

☐ Scott River Water Trust
Contact: Chris Voigt
(916) 396-0131
chrisb.voigt@gmail.com

☐ I select not to work with a coordinating entity.

Section 5: Groundwater Well Information

Complete the table below or upload an attachment for groundwater wells that are part of the proposed groundwater LCS.

Well Name	Well Coordinates [1]

For assistance in finding well coordinates, you can use Google Maps (www.google.com/maps).

Upload Well Information

Section 6: Metering Information

Please describe the metering for all groundwater wells covered by this groundwater LCS. Fill in the box below, upload an attachment, or email a document or spreadsheet with this information.

a. Describe how you will record daily extractions and report monthly pumping volumes. Include a description of all water uses associated with each groundwater well that is part of this groundwater LCS.
For example, "the ranch manager will log meter readings at Well 1 and Well 2 and take a picture of the meters each week. They will note what the water is being used for - Well 1 will irrigate 50 acres of grain on fields A and B, 100 acres of pasture on fields E, G, and Z, and Well 2 will irrigate 75 acres of alfalfa on field Y. The manager will send the logs and photos to the Water Board around the first of each month."

b. For groundwater wells that are NOT currently metered, please describe the time schedule and plan to install meters and efforts to obtain a meter before the initiation of groundwater diversions covered by this groundwater LCS. If you want to file for a waiver to the metering requirement please use the box below and include information on why metering of your well(s) should be waived. Be sure to include total irrigated acres, distance of the well(s) from surface water, description of why metering is infeasible, if applicable, and any additional information that supports your waiver request.

On 3/22/24 we received a phone message from Heather Woods of Siskiyou County NRCS. Heather confirmed our application with NRCS for assistance in obtaining the well monitoring requirements. Our application is in for 2025 and if funded would not be ready for install until 2026, depending on the timeing of funding and where it falls in the hay season. We are requesting a waiver from this requirment at this time. 1) We cannot afford the cost on our own, 2) We are starting the 2024 irrigation season and cannot disrupt the equipment used or we will lose our crop and livlihood. Before metering starts we are able to reconcile total gallons applied by using pacific power bills and estimates on irrigation equipment outputs with the assistance of RCD

Upload Attachment

Select the type of groundwater LCS you are applying for and complete the corresponding sections of the application.

- [ ] Best Management Practices Groundwater LCS - Complete sections 7 and 10
- [ ] Graduated Groundwater Cessation Schedule LCS - Complete sections 8 and 10
- [x] Percent Reduction Groundwater LCS - Complete sections 9 and 10

Section 7: Best Management Practices Groundwater LCS

1. Provide the total amount of all irrigated acreage (with units) covered under your proposal for a Best Management Practices Groundwater LCS:

2. Upload an attachment, write in the box, and/or email a description of the irrigation system that will be used under this proposal, specifying details of your low-energy precision application system, soil moisture sensors, and any corners that will be irrigated. (Refer to Section 875(f)(4)(D)(vii) of the emergency regulation.)

3. Provide a map(s) of each field with labels for well(s), type of best management practice, and field crop type. Upload as an attachment or email.

Upload Map(s)

4. Certify the following by initialing or checking each box:

☐ a. I certify the use of a low-energy precision application (LEPA) system on all irrigated acreage covered under this groundwater LCS.

☐ b. I certify to not use end guns for irrigation for the duration of the season.

☐ c. I certify to cease irrigation of corners after June 15, 2024.

☐ d. I certify to use soil moisture sensors to inform irrigation timing, and maintenance of such records, which I will make available for inspection by the Coordinating Entity, if applicable, and/or the State Water Board.

☐ e. I certify that I will further limit irrigation based on water year, in the event of the hydrologic condition noted in i or ii below. If this requirement is triggered, the State Water Board will inform all Best Management Practices Groundwater LCS applicants for the applicable watershed(s). Please note, a yes certification is required for a Groundwater Best Management Practices LCS to be accepted.

   i. Scott River Watershed: Snow pack of 80% or less of the Department of Water Resources California Data Exchange Center's first May snow water equivalent station average (or the average of the first April measurement if May snow pack measurements are not gathered) in Scott River watershed.

   ii. Shasta River watershed: A water year determination of dry or very dry in the Shasta River watershed, as determined under Table 2 of the March 2021 Montague Water Conservation District water operation plan.

Section 8: Graduated Groundwater Cessation Schedule LCS

A Graduated Groundwater Cessation Schedule LCS may be approved if the applicant provides evidence that irrigated acreage is reduced compared to standard practice on the property (e.g., practice in a similar unregulated year). If applicable, please take crop rotation and number of alfalfa cuttings into account. Under this groundwater LCS type, the applicant must select one of two potential irrigation schedules, listed below. See section 875(f)(4)(D)(vi) of the emergency regulation.

1. Provide the total amount of irrigated acreage (with units) under your proposal for a Graduated Groundwater Cessation Schedule LCS:
2. Select the irrigation schedule you certify to implement.

☐ **Option 1:** By the dates below, pumping to irrigate the following percentages of irrigated acres shall cease:

- 15% by July 15,
- 50% by August 15, and
- 90% by August 31, with a maximum of 8 inches of water to be applied to the remaining 10% of irrigated acres during the remainder of the irrigation season. This 10% can be on land previously fallowed.

☐ **Option 2:** By the dates below, pumping to irrigate the following percentages of irrigated acres shall cease:

- 20% by July 20,
- 50% by August 20, and
- 95% by September 5, with a maximum of 6 inches of water to be applied to the remaining 5% of irrigated acres during the remainder of the irrigation season. This 5% can be on land previously fallowed.

4. Please upload an attachment, write in the box, or email a description that demonstrates that the proposal reduces irrigation as compared to standard practices on the property (e.g., practice in a similar unregulated year). If applicable, please take crop rotation and number of alfalfa cuttings into account.

Upload Attachment

5. Please upload or email a map(s) that identifies which well(s) and field(s) are associated with each cessation date covered by this groundwater LCS.

Upload Map(s)

Section 9: Percent Reduction Groundwater LCS

The applicable percent reduction in groundwater pumping noted below must be demonstrated for the Percent Reduction Groundwater LCS consistent with section 875(f)(4)(D)(v) of the emergency regulation, and summarized below.

- **Scott River Watershed:** A net groundwater pumping reduction of 30% throughout the irrigation season (April 1 – October 31) and a monthly reduction of 30% between July 1 through October 31.
- **Shasta River Watershed:** A net groundwater pumping reduction of 15% throughout the irrigation season (March 1 – November 1) and a monthly reduction of 15% between June 1 through September 30.
- The relevant water use reduction shall be based on a comparison to a baseline irrigation season (i.e., 2020, 2021, 2022, or 2023).
    - BUT, if the previous year baseline is higher than the following applied water rates:
        - 33 inches per year for alfalfa,
        - 14 inches per year for grain, or
        - 30 inches per year for pasture
    - Then the above values shall be used as the baseline UNLESS the applicant provides sufficient additional information supporting an alternative baseline.
- Please provide the total amount of irrigated acreage (with units) under your proposal for a Percent Reduction Groundwater LCS. 153.9 acres
- If you are proposing a Percent Reduction Groundwater LCS, attach or email the following files to the State Water Board and your Coordinating Entity.

a. A description of practices that reduces groundwater pumping and how the State Water Board (or Coordinating Entity, if applicable) can verify those actions.

See attached Spreadsheet 4/12/2024 for preliminary discussion purposes and pdf of Calculating Baseline Irrigation Application Amounts FOR WATER YEAR 2020 - Scott Valley Irrigated ALFALFA Scott Valley Agriculture Water Alliance 4/15/24 and pasture base line ammounts. As well as maps and calculations requested.

Upload Attachment

b. A spreadsheet with monthly pumping volumes for the selected baseline year and current year. Use one row per irrigation method per field.

Upload Baseline Pumping

c. Map(s) with each field labelled.

Upload Map(s)

Section 10: List of Fields, APNs, and Water Rights

List the fields associated with this groundwater LCS application, if each property is owned or leased, and the assessor's parcel number (APN) that contains each field. If a field is on multiple parcels, provide the APN that contains the majority of the field. Alternatively, you may also electronically submit a document or spreadsheet with this information. Each field can only have **one (1)** type of groundwater LCS associated with it.

Irrigated Field Name(s) or Number(s)	Is the parcel owned or leased?	Assessor Parcel Number(s)	Water Right(s)	Groundwater LCS Type
1 &2 well water irrigated	Owned	[redacted]	Other - Explain	Percent Reduction
3 well water irrigated	Owned		Other - Explain	Percent Reduction
4 (2 wells located here) well water irrigated	Owned		Other - Explain	Percent Reduction
5 well water irrigated	Owned		Other - Explain	Percent Reduction
6 well water irrigated	Owned		Other - Explain	Percent Reduction
7 well water irrigated	Owned		Other - Explain	Percent Reduction

Upload Attachment

Submission of Groundwater LCS Proposal to State Water Board

A groundwater LCS may require the applicant to attach or email additional information, such as descriptions, spreadsheets, maps, or other relevant information. State Water Board staff request descriptions be submitted as Microsoft Word (.docx, .doc) or Adobe PDF (.pdf) files as these file formats are easiest for staff to work with applicants to review and revise, if needed. For the same reasons, staff request that applicants submit spreadsheets as Microsoft Excel files (.xlsx, .xls).

Submitting documents in other formats, such as photographs of narratives or narratives via traditional mail may lengthen the review process. If you need assistance, please contact your Coordinating Entity (see Section 4) or State Water Board staff identified in the Contact Information section below.

To submit your application with all required materials (see Section 2), you can:

- Use the online form **Submit**
- Email: DWR-ScottShastaDrought@Waterboards.ca.gov
- Mail:
  State Water Resources Control Board
  Division of Water Rights - Instream Flows Unit
  1001 I Street - 14th Floor
  Sacramento, CA 95814

Contact Information for State Water Board Staff

- Kevin DeLano
  Phone: (916) 319-0631
  Email: Kevin.DeLano@waterboards.ca.gov
- Shay Richardson
  Phone: (916) 341-5337
  Email: Shay.Richardson@Waterboards.ca.gov
- Division of Water Rights – Scott-Shasta Phone Line and Email
  Phone: (916) 327-3113
  Email: DWR-ScottShastaDrought@Waterboards.ca.gov

What's Next?

State Water Board staff will review each groundwater LCS application. If staff identify errors, a need for additional information, or changes that need to be made, they will contact the applicant. Once staff determine the application is substantially complete, it will be posted as pending on the State Water Board's Local Cooperative website for the Scott River and Shasta River watersheds emergency regulation.

SISKIYOU RESOURCE CONSERVATION DISTRICT
P.O. Box 268, Etna, CA 96027
PHONE (530) 467-3975 FAX (530) 467-5617
Email: sisqrcd@sisqtel.net
Website: www.siskiyourcd.com

APPLICATION TO SISKIYOU RCD AS COORDINATING ENTITY for the SCOTT VALLEY GROUNDWATER REDUCTION LOCAL COOPERATIVE SOLUTION

The following request is being submitted pursuant to Section 875, subdivision (f)(D) of the Scott-Shasta Drought Emergency Regulation of the State Water Resources Control Board (SWB). The purpose of this Local Cooperative Solution (LCS) is to document the applicant's proposed reduction in use of overlying or adjudicated groundwater use by a certain amount over the entire irrigation season.

Applicant's Name: Jerry and Elizabeth Giacomelli

[redacted]

Identify Specific Parcels served by overlying or adjudicated groundwater for irrigation, as identified in relevant curtailment order (SO# or SG#). Include irrigated acreage and number of wells.

Table 1 – Parcels, water rights, acreage, and wells to be included in this Agreement

Field Designation	Adjudicated right #	Overlying right?	SWB - SG # or SO# *(optional)*	# irrigated acres	# Wells *(optional)*
[redacted]					
					2

Total irrigated acres to be included in this agreement: 153.9

▶ Attach Map 1 of properties to be included in plan ✓

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I agree to pay the RCD for its time to help prepare my water reduction plan at the rate of $75/hr. When your LCS plan is complete, a Binding Agreement will need to be signed with the RCD as your designated Coordinating Entity. The RCD will need to verify that the plan's actions are being met.

Jerry Traconnelli
Elizabeth Traconnelli
Applicant signature

4/12/2024
Date

Evan Senf
Siskiyou RCD signature

4/12/2024
Date

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Binding Agreement

Contractor Contact Information:

Business:	Siskiyou RCD
Contact Person:	Evan Senf
Address:	PO Box 268/ 450 Main St., Etna, CA, 96027
Phone:	(530) 467-3975
Email:	evan@siskiyourcd.com

Landowner Contact Information:

Business:	Giacomelli Ranch
Contact Person:	Jerry and Elizabeth Giacomelli
Address:	[redacted]
Phone:	
Email:	

Recitals

1. Section 875(f)(4)(D) of the drought emergency regulation provides a specific type of LCS that was determined to be sufficient for approval by the Deputy Director;
2. For overlying or adjudicated groundwater diversions for irrigated agriculture described in sections 875.5(f)(4)(D)(i)-(iii) [Scott River], the Deputy Director may approve a groundwater-basin-wide, groundwater sub-basin-wide, or any number of individual local cooperative solutions where:

    i. The proposal is based on a binding agreement. "Such binding agreement may be made with a coordinating entity with the expertise and ability to evaluate and require performance of the agreement, for example with the California Department of Fish and Wildlife (CDFW), the National Marine Fisheries Service, the Scott Valley and Shasta Valley Watermaster District, a non-profit organization with

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expertise and experience in water-saving transactions or similarly qualified entity."

ii. For the Scott River: "The proposal provides at least: 1) a net reduction in water use of 30 percent throughout the irrigation season (April 1-October 31), as compared to the prior irrigation season; and 2) a monthly reduction of at least 30% in the July 1 through October 31 period, as compared to the prior year or 2020 or 2021. Such reduction may be demonstrated by evidence that provides a reasonable assurance that the change in farming practice or other action results in at least the relevant proportionate reduction. Such evidence may include but is not limited to: pumping reports; actions that will be taken to reduce water use; estimation of water saved from conservation measures or changes in irrigation or planting decisions; and electric bills."

Proposed Local Cooperative Solution: (*Specific action plan to be completed by landowner, see attached LCS application form)*

Binding Agreement Terms
The Landowner is required to adhere to the LCS, as approved by SWRCB. The Landowner has requested that SRCD serve as the coordinating entity. As such, both parties agree to the following:

- For the duration of this binding agreement where SRCD is the coordinating entity, the Landowner shall give SRCD the right to reasonably access the included parcels for the limited propose of verifying execution of the LCS. Any individual not directly employed or contracted by SRCD shall provide pre-notification to, and shall obtain approval by the Landowner before accessing the property,

- SRCD will strive to notify the Landowner a day in advance of visiting the parcels and shall provide the Landowner or designee the ability to participate in monitoring activities,

- It is anticipated that SRCD representatives will visit the property approximately twice per month to monitor the approved LCS, unless inadequacies are discovered, in which case additional field visits will occur until inadequacies are rectified. A monitoring inspection may include verification of any or all of the actions described in the conservation plan and may include inspection checklist/notes/reports and photo verification,

- SRCD will submit the information regarding the verification materials and actions described in this agreement, and conservation plan incorporated by reference, to the State Water Board upon request, for the purposes of verifying compliance with the LCS,

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- This binding agreement is not intended to preclude, harm, or otherwise interfere with the landowner's ability to secure any funding to mitigate the financial impacts imposed by the emergency regulation or proposed conservation practices. SRCD supports the use of funding programs to ameliorate the costs of implementing the conservation practices described in the proposed conservation plan: planning and cooperation under a voluntary LCS should not undermine the ability to receive such funding,

- This binding agreement may be terminated by either party at any time. Both parties agree to take reasonable measures to resolve any concerns related to the performance of the LCS, negative interpersonal interaction, or any unforeseen circumstance prior to invoking termination,

- As the irrigation season unfolds, there may be reason to change the terms of the LCS or this binding agreement with respect to its implementation and verification. Any such changes to the LCS or service agreement will need to be agreed upon by the Landowner and SRWCB. If a Landowner requests SRCD assistance with an updated LCS, the SRCD and Landowner will enter into a new Binding Agreement and,

Payment
In consideration for the services to be performed by SRCD, the Landowner agrees to pay SRCD at the rate of $75.00 per hour for initial consultation and $75.00 per hour for all services rendered after signing of the binding agreement.

Expenses
The Landowner will reimburse SRCD for expenses that are attributable directly to work performed under this Agreement. Any expenses incurred will be approved by the Landowner beforehand. SRCD will submit an itemized statement of Contractor's expenses attached with invoicing.

Terms of Payment
Upon completion of SRCD services under this binding agreement, the SRCD will submit an invoice. The Landowner will pay SRCD the compensation described within 30 days of receiving SRCD's invoice.

Term of Agreement
This agreement will become effective when signed by both parties and will terminate on:

- November 1, 2024, or
- The date a party terminates the binding agreement.

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Website: www.siskiyoured.com

- Monitoring information will be collected by the SRCD and shared with State Water Board as a field report in accordance with their reporting schedule or upon request
- SRCD is not authorized to and will not distribute data or other information regarding work done under this contract to any third party without previous written approval by the Landowner
- Landowner agrees that water saved under the LCS will not be transferred to parcels not included under the LCS, and Landowner will not knowingly or intentionally otherwise take actions outside of the LCS that diminish, in any material way, the overall thirty percent reduction establish by the actions described ion the LSC

Signatures

Evan Senf
SRCD Representative

4/12/2024
Date

Elizabeth Deaconelli
Landowner

4/12/2024
Date

2020 description	Acres	Crop	Application efficiency %	Inches per acre	AF/ac	Water applied (AF) 2020	2024 description	Acres	Crop	Application efficiency	Inches per acre	AF/ac	Water applied (AF) 2024
33.3 Acre pivot field - alfalfa	33.3	alfalfa	75%	43.5	3.6	120.6	grassalfalfa 33.3 acres pivot	33.3	pasture	75	46.7	3.9	129.5
10 acre wheel line field - alfalfa	10	alfalfa	65%	50.2	4.2	41.8	10 acres grass/alfalfa wheel line	10	pasture	85	41.2	3.4	25.5
48.2 acre wheel line - grass	48.2	pasture	65	55.7	4.6	223.7	40.2 - new pivot new seeding alfalfa	40.2	alfalfa	85	21	1.75	70.4
19.5 acre grain	19.5	grain	70	21.4	1.8	34.8	8 ac under wheel line improved - new seeding	8	alfalfa	85	21	1.75	14
11.1 k-line pasture	11.1	pasture	70	51.7	4.3	47.8	19.5 acres alfalfa pivot	19.5	alfalfa	85	30.6	2.5	48.8
21.8 wheeline pasture	21.8	pasture	65	55.7	4.6	101.2	11.1 k- line (improved) pasture	11.1	pasture	80	43.8	3.6	40.5
10 acre big gun - pasture	10	pasture	70	51.7	4.3	43.1	10 ac wheel line pasture	10	pasture	85	41.2	3.4	34
							5 acre big gun	5	pasture	70	50	4.2	20.8
							6.8 fallow	6.8	fallow		0		0
							10 acres pasture under new pivot	10	pasture	85	41.2	3.4	34
Total	153.9					613		153.9					417.5
												% of 2024 levels	**0.681076672**

Calculating Baseline Irrigation Application Amounts
FOR WATER YEAR 2020 - Scott Valley Irrigated ALFALFA

Scott Valley Agriculture Water Alliance

4/15/24

Sources:

1. *California Water Data Exchange Center (CDEC). Department of Water Resources. Monthly average precipitation at Fort Jones, CA.* www.cdec.water.ca.gov.
2. *Orloff, S., Harter, T., Snyder, R., and Hanson, B. UC Cooperative Extension Siskiyou County and LAWR UC Davis. Alfalfa Water Use in the Scott Valley: Resolving the Discrepancy Between Theory and Practice.* PowerPoint presentation. 2011-2012.
3. *University of California Agriculture and Natural Resources. Drought Tip: Field Irrigation Water Management in a Nutshell. September 2019.*
4. *Zaccaria, Daniele, PhD. Agriculture Water Management Specialist, UC Davis. Personal communication, 4/12/24.*

Overview: Approximate irrigation baselines for Scott Valley irrigated alfalfa can be determined based on four factors:

1. The evapotranspiration (ET) of alfalfa (how much water the plants use) during growing season.
2. Rainfall occurring during the growing season (and resulting infiltrated rainfall into the crop root zone).
3. Soil moisture that can be accessed by the roots.
4. Irrigation application efficiency rates for different irrigation systems.

Approximate baseline for water application can be determined by dividing crop ET (minus effective rainfall, minus existing stored soil moisture) by the application efficiency rate.

Establishing Alflafl evapotranspiration (ET): Alfalfa ET was determined in 8 fields across 4 years in the Scott and Shasta valleys by Orloff et al. (2007-2010). See Figure 1 below. The average cumulative alfalfa ET for Scott and Shasta was on average 37 inches for the growing season over the course of the study period.

Region	Site	Year	Age of Alfalfa	Seasonal ET (inches)	Reference ET (inches)
Scott Valley/Shasta Valley	EN	2007	2	39.6	44
	EN	2008	3	32.8	42.6
	EN	2009	4	33.8	40.4
	FI	2009	5	36.1	37.4
	SH	2009	4	38.8	40.4
	AP	2010	5	37.3	37.4
	FI	2010	2	34.7	37.4
	FA	2010	6	38.8	41.1
				Ave: 36.5	Ave. 40.1

Figure 1. Orloff et al recordings of Alfalfa ET and Reference grass ET (ETo) for Scott and Shasta valleys at 8 sites between 2007-2010.

Establishing application efficiency: The UC Davis Drought Tips Fact Sheet titled "Irrigation water management in a nutshell" outlines application efficiency rates for various irrigation systems. See Figure 2 below. Efficiencies range from 90 percent (LEPA pivot systems) to 45 percent (furrow irrigation). "Side-roll" refers to "wheel line" systems.

Box 1 – Application Efficiency

Some extra water must be added to the soil in addition to the amount needed to adequately replenish water used by the crop since the last irrigation or rainfall. Such extra water is required to compensate for losses from the irrigation systems that occur through deep percolation, surface runoff, evaporation, wind-drift, and nonuniform water application. Because of losses occuring during irrigation application, application efficiency is always less than 100 percent.

Application efficiency is defined as the ratio of ***water beneficially used by the crop to the total water applied***, where "beneficial use" includes water used for crop evapotranspiration, frost protection, salt leaching, canopy cooling, etc. Application efficiency provides an indication of how well an irrigation system performs its objective of applying water in adequate amounts and uniformly throughout the field, and allowing it to be stored in the crop root zone to meet the crop water requirements. No irrigation system can achieve 100% application efficiency, but adequate system design, regular maintenance, and careful irrigation management can minimize water losses, thus increasing the relative portion of applied water that is beneficially used by plants. Some irrigation methods perform relatively better than others in terms of the water application rate matching the soil intake rate and for the evenness with which water is distributed throughout the field (distribution uniformity). Table 3 shows potential values of application efficiency for properly-designed and well-managed irrigation systems.

Table 3. **Ranges of potential application efficiency (Eff_A) of well-designed and well-managed irrigation systems**

Irrigation method/system	Potential Eff_A (%)
Sprinkler	
LEPA	80–90
linear move	75–85
center pivot	75–90
traveling gun	65–75
side-roll	65–85
hand-move	65–85
solid-set	70–85
Surface	
furrow (conventional)	45–65
furrow (surge)	55–75
furrow (with tailwater reuse)	60–80
basin	60–75
precision level basin	65–80
Microirrigation	
bubbler (low head)	80–90
microspray	85–90
micropoint source	85–90
microline source	85–90
surface drip	85–95
subsurface drip	90–95

Source: Adapted from Howell 2003.

Figure 2. Application efficiency rates as found in UC-ANR Drought Tips Fact Sheet published in 2019.

Establishing total water needs of alfalfa: The equation for calculating total water needs during the growing season is: alfalfa ET (which Orloff et al established as 37 inches during the growing season) minus "effective rainfall" (the rain that percolates and doesn't run-off), minus stored soil moisture.

Establishing effective rainfall for Scott Valley during 2020 growing season: According to California Data Exchange Center, 2020 was a very dry year: 7.38 inches total for the water year (Oct 2019-Oct 2020) (see Figure 3). During the growing season we got 3.08 inches. That means effective rainfall of 1.8 inches (60% of total in-season rainfall).

Water Year (WY)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	WY Total
2014		0.53	0.48	0.78	2.58	4.12	0.28	0.79	0.20	0.35	0.01	1.94	12.06
2015	3.10	1.16	4.61	1.24	5.68	0.78	0.36	1.43	0.32	0.41	0.41	0.07	19.57
2016	0.56	0.81	7.13	6.30	1.58	4.87	1.10	0.48	0.70	0.00	0.04	0.00	23.57
2017	6.19	2.34	4.10	7.44	6.65	2.57	1.86	0.58	0.58	0.01	1.00	0.16	33.48
2018	0.36	2.42	0.59	2.21	0.63	1.91	1.83	2.17	0.04	0.02	0.00	0.00	12.18
2019	0.46	2.83	3.36	3.42	5.30	1.20	1.38	1.27	0.00	0.00	0.58	1.01	20.81
2020	0.32	0.65	2.54	0.79	0.00	0.00	0.58	1.08	0.88	0.40	0.14	0.00	7.38

Figure 3. CDEC rainfall data for Water Year 2020 at Fort Jones. Not pictured here is rainfall for October 2020, which was 0.

Establishing water supplied through existing soil moisture: Soil moisture content could reasonably be expected to be 60% of the winter rainfall, which was 4.3 inches. Therefore, 2.6 inches of soil moisture was likely accessed by alfalfa roots systems (deeper than pasture root systems).

Calculating applied water needs for alfalfa: crop ET – effective rainfall – soil moisture / application efficiency rate.

Scenario 1: alfalfa irrigated by a wheel line sprinkler system that is 75% efficient. This % can vary.

Crop ET: 37 inches
Total water need (subtracting rain and soil moisture): 37 inches – 1.8 inches – 2.6 inches = 32.6 inches.
Application efficiency rate: 75%
Total irrigation water needed for growing season (32.6 / .75) = 43.5 inches

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Scenario 2: alfalfa irrigated by center pivot sprinkler system that is 80% efficient. This % can vary.

Crop ET: 37 inches
Total water need (subtracting rain and soil moisture): 37 inches – 1.8 inches – 2.6 inches = 32.6 inches.
Application efficiency rate: 80%
Total irrigation water needed for growing season (32.6 / .80) = 40.8 inches

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Scenario 3: alfalfa irrigated by flood irrigation (basin irrigation)* that is 55% efficient. This % can vary.

Crop ET: 37 inches
Total water need (subtracting rain and soil moisture): 37 inches – 1.8 inches – 2.6 inches = 32.6 inches.
Application efficiency rate: 55%
Total irrigation water needed for growing season (32.6 / .75) = 59.3 inches

*Note that flood irrigation often applies more water, but has no wind drift and can have low evaporation loss. If runoff rates are low, then a high percentage of water unused as ET will percolate back into the water table.

Scenario 4: alfalfa corners irrigated by K-line or traveling gun that is 75% efficient. This % can vary.

Crop ET: 37 inches
Total water need (subtracting rain and soil moisture): 37 inches – 1.8 inches – 2.6 inches = 32.6 inches.
Application efficiency rate: 75%
Total irrigation water needed for growing season (32.6 / .75) = 43.5 inches

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Calculating Baseline Irrigation Application Amounts
FOR WATER YEAR 2020 - Scott Valley Irrigated ALFALFA

Scott Valley Agriculture Water Alliance

4/15/24

Sources:

1. *California Water Data Exchange Center (CDEC). Department of Water Resources. Monthly average precipitation at Fort Jones, CA.* www.cdec.water.ca.gov.
2. *Orloff, S., Harter, T., Snyder, R., and Hanson, B. UC Cooperative Extension Siskiyou County and LAWR UC Davis. Alfalfa Water Use in the Scott Valley: Resolving the Discrepancy Between Theory and Practice.* PowerPoint presentation. 2011-2012.
3. *University of California Agriculture and Natural Resources. Drought Tip: Field Irrigation Water Management in a Nutshell. September 2019.*
4. *Zaccaria, Daniele, PhD. Agriculture Water Management Specialist, UC Davis. Personal communication, 4/12/24.*

Overview: Approximate irrigation baselines for Scott Valley irrigated pasture can be determined based on four factors:

1. The evapotranspiration (ET) of pasture (how much water the plants use) during growing season.
2. Rainfall occurring during the growing season (and resulting infiltrated rainfall into the crop root zone).
3. Soil moisture that can be accessed by the roots.
4. Irrigation application efficiency rates for different irrigation systems.

Approximate baseline for water application can be determined by dividing crop ET (minus effective rainfall, minus existing stored soil moisture) by the application efficiency rate.

Establishing Pasture evapotranspiration (ET): Pasture ET was determined in 8 fields across 4 years in the Scott and Shasta valleys by Orloff et al. (2007-2010). See Figure 1 below. Because "Reference ET" (far right column) is a determination of well-watered, unstressed, irrigated grass pasture, it can be used synonymously with "pasture ET." The average cumulative pasture ET for Scott and Shasta was on average 40 inches for the growing season over the course of the study period. This is the amount of water the irrigated grass pasture used during the growing season under well-watered, non-stressed conditions.

Region	Site	Year	Age of Alfalfa	Seasonal ET (inches)	Reference ET (inches)
Scott Valley/Shasta Valley	EN	2007	2	39.6	44
	EN	2008	3	32.8	42.6
	EN	2009	4	33.8	40.4
	FI	2009	5	36.1	37.4
	SH	2009	4	38.8	40.4
	AP	2010	5	37.3	37.4
	FI	2010	2	34.7	37.4
	FA	2010	6	38.8	41.1
				Ave: 36.5	Ave. 40.1

Figure 1. Orloff et al recordings of Alfalfa ET and Reference grass ET (ETo) for Scott and Shasta valleys at 8 sites between 2007-2010.

Establishing application efficiency: The UC Davis Drought Tips Fact Sheet titled "Irrigation water management in a nutshell" outlines application efficiency rates for various irrigation systems. See Figure 2 below. Efficiencies

range from 90 percent (LEPA pivot systems) to 45 percent (furrow irrigation). “Side-roll” refers to “wheel line” systems.

Box 1 – Application Efficiency

Some extra water must be added to the soil in addition to the amount needed to adequately replenish water used by the crop since the last irrigation or rainfall. Such extra water is required to compensate for losses from the irrigation systems that occur through deep percolation, surface runoff, evaporation, wind-drift, and nonuniform water application. Because of losses occuring during irrigation application, application efficiency is always less than 100 percent.

Application efficiency is defined as the ratio of ***water beneficially used by the crop to the total water applied***, where “beneficial use” includes water used for crop evapotranspiration, frost protection, salt leaching, canopy cooling, etc. Application efficiency provides an indication of how well an irrigation system performs its objective of applying water in adequate amounts and uniformily throughout the field, and allowing it to be stored in the crop root zone to meet the crop water requirements. No irrigation system can achieve 100% application efficiency, but adequate system design, regular maintenance, and careful irrigation management can minimize water losses, thus increasing the relative portion of applied water that is beneficially used by plants. Some irrigation methods perform relatively better than others in terms of the water application rate matching the soil intake rate and for the evenness with which water is distributed throughout the field (distribution uniformity). Table 3 shows potential values of application efficiency for properly-designed and well-managed irrigation systems.

Table 3. **Ranges of potential application efficiency (Eff_A) of well-designed and well-managed irrigation systems**

Irrigation method/system	Potential Eff_A (%)
Sprinkler	
LEPA	80–90
linear move	75–85
center pivot	75–90
traveling gun	65–75
side-roll	65–85
hand-move	65–85
solid-set	70–85
Surface	
furrow (conventional)	45–65
furrow (surge)	55–75
furrow (with tailwater reuse)	60–80
basin	60–75
precision level basin	65–80
Microirrigation	
bubbler (low head)	80–90
microspray	85–90
micropoint source	85–90
microline source	85–90
surface drip	85–95
subsurface drip	90–95

Source: Adapted from Howell 2003.

Figure 2. Application efficiency rates as found in UC-ANR Drought Tips Fact Sheet published in 2019.

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2017	6.19	2.34	4.10	7.44	6.65	2.57	1.86	0.58	0.58	0.01	1.00	0.16	33.48
2018	0.36	2.42	0.59	2.21	0.63	1.91	1.83	2.17	0.04	0.02	0.00	0.00	12.18
2019	0.46	2.83	3.36	3.42	5.30	1.20	1.38	1.27	0.00	0.00	0.58	1.01	20.81
2020	0.32	0.65	2.54	0.79	0.00	0.00	0.58	1.08	0.88	0.40	0.14	0.00	7.38

Figure 3. CDEC rainfall data for Water Year 2020 at Fort Jones. Not pictured here is rainfall for October 2020, which was 0.

Establishing water supplied through existing soil moisture: Soil moisture content could reasonably be expected to be 60% of the winter rainfall, which was 4.3 inches. Pasture roots systems can vary, but 12 inches can be used as an estimate. Orloff determined root systems extract about 2 inches of water per foot of roots.

Calculating applied water needs for pasture: crop ET – effective rainfall – soil moisture / application efficiency rate.

Scenario 1: pasture irrigated by a wheel line sprinkler system that is 75% efficient. This % can vary.

Crop ET: 40 inches
Total water need (subtracting rain and soil moisture): 40 inches – 1.8 inches – 2 inches = 36.2 inches.
Application efficiency rate: 75%
Total irrigation water needed for growing season (36.2 / .75) = 48.3 inches

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Scenario 2: pasture irrigated by center pivot sprinkler system that is 80% efficient. This % can vary.

Crop ET: 40 inches
Total water need (subtracting rain and soil moisture): 40 inches – 1.8 inches – 2 inches = 36.2 inches.
Application efficiency rate: 80%
Total irrigation water needed for growing season (36.2 / .80) = 45.3 inches

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Scenario 3: pasture irrigated by flood irrigation (basin irrigation)* that is 55% efficient. This % can vary.

Crop ET: 40 inches
Total water need (subtracting rain and soil moisture40 inches – 1.8 inches – 2 inches = 36.2 inches.
Application efficiency rate: 55%
Total irrigation water needed for growing season (36.2 / .55) = 65.8 inches

*Note that flood irrigation often applies more water, but has no wind drift and can have low evaporation loss. If runoff rates are low, then a high percentage of water unused as ET will percolate back into the water table.

Scenario 4: pasture corners irrigated by K-line or traveling gun that is 75% efficient. This % can vary.

Crop ET: 40 inches
Total water need (subtracting rain and soil moisture): 40 inches – 1.8 inches – 2 inches = 36.2 inches.
Application efficiency rate: 75%
Total irrigation water needed for growing season (36.2 / .75) = 48.3 inches