SOLANO SUBBASIN
GROUNDWATER SUSTAINABILITY AGENCY

BOARD OF DIRECTORS MEETING

DATE: **Thursday, April 11, 2024**

TIME: **5:00 P.M.**

PLACE: **Berryessa Room**
810 Vaca Valley Parkway, Suite 203
Vacaville, CA 95688

Remote participation available under AB 2449:

Please review insert after agenda regarding AB 2449.

Zoom Information:
https://us02web.zoom.us/j/88312490746?pwd=cDA3N0pUWFdQTWVVNXRtT01sUVdEdz09 Meeting ID: 883 1249 0746 Passcode: 810810
One tap mobile: +16694449171,,88312490746#,,,,*810810#
Dial by your Location: +1 669 900 6833

1. **CALL TO ORDER**

2. **AB 2449 STATEMENT**

3. **PLEDGE OF ALLEGIANCE**

4. **APPROVAL OF AGENDA**

5. **PUBLIC COMMENT**

   Limited to 5 minutes for any one item not scheduled on the Agenda.

6. **CONSENT ITEMS**

   (A) Minutes: Approval of the Minutes of the Board of Directors meeting of October 12, 2023.

   (B) Expenditure Approvals: Approval for March 2024, checking account register (cumulative from October 1, 2023).

7. **<u>BOARD MEMBER REPORTS</u>** *(estimated time: 5 minutes)*

RECOMMENDATION: For information only.

8. **<u>SECRETARY/TREASURER REPORT</u>** *(estimated time: 5 minutes)*

RECOMMENDATION: For information only.

9. **<u>SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY PLAN ANNUAL REPORT</u>** *(estimated time: 30 minutes)*

RECOMMENDATIONS:

1. Receive overview of 2023 Groundwater Sustainability Plan Annual Report.

2. Approve 2023 Groundwater Sustainability Plan Annual Report.

10. **<u>TIME AND PLACE OF NEXT MEETING</u>**

Thursday, June 13, 2024, at 5:00 p.m. at the SCWA offices.

The Full Board of Directors packet with background materials for each agenda item can be viewed on the Agency's website at
www.scwa2.com/resources-management/ground-water/solano-gsa-bod

Any materials related to items on this agenda distributed to the Board of Directors of Solano Subbasin Groundwater Sustainability Agency less than 72 hours before the public meeting are available for public inspection at the Agency's offices located at the following address: 810 Vaca Valley Parkway, Suite 203, Vacaville, CA 95688. Upon request, these materials may be made available in an alternative format to persons with disabilities.

AB 2449 Provides Remote Options for Public Agencies

Despite the end of the COVID-19 pandemic, public agencies still have options available to them if they need to exercise remote participation for members of their legislative bodies. AB 2449 provides that if a quorum of the legislative body participates in person, a member of a legislative body may participate remotely so long as the member provides prompt notice and the need for remote participation falls under one of the statutorily defined exceptions. The member does not need to identify their location nor ensure it is accessible to the public.

Members of legislative bodies can use AB 2449 to participate remotely if there is “just cause” or if “emergency circumstances” exist. “Just cause” is defined as any of the following:

- Providing childcare or caregiving of a parent, grandparent, grandchild, sibling, spouse, or domestic partner that requires the member to participate remotely.
- A contagious illness that prevents attendance in person.
- Tending to a need related to a physical or mental disability.
- Travelling for business of the legislative body or another state or local agency.

“Emergency circumstances” are defined as follows:

- A physical or family medical emergency that prevents a member of a legislative body from attending in person.

Notice Must be Provided to Utilize AB 2449’s Provisions

In order to utilize the provisions of AB 2449, members of a legislative body must inform their public agency at the earliest possible opportunity of their need to participate remotely, which can include before the start of the meeting. The member must also provide a general description of the circumstances that require remote participation. In the case of emergency circumstances, the member must actually request that the legislative body allow them to participate remotely and the legislative body has to take action on this request.

Any member participating remotely because of just cause or emergency circumstances must publicly disclose at the meeting before any action is taken, whether any other individuals 18 years of age or older are present in the room at the remote location with the member, and the general nature of the member’s relationship with any such individuals.

Members and Public Must have Option to Participate in Meetings both Audibly and Visually

When a member participates remotely, he/she must utilize both audio and visual capabilities to effectuate compliance with the statute. Therefore, members of public agencies cannot use a call in only option to attend meetings, they must be on camera. Additionally, the legislative body is responsible for ensuring that the public can also participate in meetings remotely. This includes providing a way for the public to remotely hear, visually observe, and remotely address the legislative body. Furthermore, members of the public can no longer be required to submit their comments prior to the meeting but instead must be allowed to give comments in real time.

CONSENT ITEMS

SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY BOARD OF DIRECTORS MEETING MINUTES

MEETING DATE: October 12, 2023

The Solano Subbasin Groundwater Sustainability Agency Board of Directors met this evening at the Solano County Water Agency Offices. Present were:

Mayor Steve Bird, City of Dixon
Mayor Ron Kott, City of Rio Vista
Supervisor John Vasquez, Solano County District 4
Supervisor Mitch Mashburn, Solano County District 5
Director Dale Crossley, Reclamation District 2068
Director Spencer Bei, Dixon Resource Conservation District

CALL TO ORDER

The meeting was called to order at 5:00-pm by Chair Supervisor Mashburn.

APPROVAL OF AGENDA

On a motion by Mayor Kott and a second by Spencer Bei the Board unanimously approved by roll call vote the Agenda.

PUBLIC COMMENT

There were no public comments.

CONSENT ITEMS

On a motion by Supervisor Vasquez and a second by Mayor Kott the Board unanimously approved by roll vote the following:

(A) Minutes
(B) Expenditure Approvals

BOARD MEMBER REPORTS

There were no Board member reports.

SECRETARY/TREASURER REPORT

Secretary Chris Lee shared with the GSA Board that he met with Jan Sramek, the CEO of Flannery Associates. Mr. Lee informed the Board that about half of the Flannery parcels are within the Solano Subbasin, but many of the parcels are in areas of limited groundwater. Flannery Associates did express interest in the NBA Water Plus project.

Supervisor Vasquez indicated that the GSA or the Water Agency may want to start looking at groundwater in the upper Suisun Valley, Green Valley, and the western portion of the County. There may also be concerns with septic tanks and potential water quality concerns. Mr. Lee shared that since this is outside of the Solano Subbasin, it may be more appropriate for the Water Agency Board to consider or even a joint County – Water Agency effort. Supervisor Mashburn shared that this may be timely, as there is federal funding to help address climate change impacts and funds to mitigate potential salinity and sea level rise impacts.

GENERAL COUNSEL LEGAL SERVICES

Secretary Chris Lee shared with the GSA Board that a SCWA Board subcommittee comprised of Mayor Moy, Director Kluge, and the General Manager reviewed six applications and unanimously selected Downey Brand for General Legal Counsel Services. Since staff will be recommending Downey Brand as the legal counsel for the Water Agency, Mr. Lee recommends the GSA Board to consider this as well. Downey Brand also represents the Maine Prairie Water District and Reclamation District 2068. Mr. Lee informed the GSA Board that while he doesn't see any conflicts, Downey Brand has a large number of attorneys, should a conflict arise.

On a motion by Director Crossley and a second by Director Bei the Board unanimously approved by roll call vote the following items:

1. Authorize the General Manager to sign Retention Agreement with Downey Brand for General Counsel Legal Services.

2. Authorize General Manager to sign the Conflict Waiver with Downey Brand for General Counsel Legal Services.

AMENDMENT 1 TO JOINT POWERS AGREEMENT CREATING THE SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

Secretary Chris Lee informed the GSA Board that this will likely be a standing item. When the GSA was formed, several entities were included that no longer exist. The existing agreement requires all GSA Board members to unanimously vote for changes to the JPA agreement. Mr. Lee recommended that this be a standing item until it is approved.

AMENDMENT 1 TO GENERAL STAFFING AGREEMENT BETWEEN THE SOLANO COUNTY WATER AGENCY AND THE SOLANO SUBBASIN GROUNDWATER SUSTAINABILTIY AGENCY

Secretary Chris Lee provided some background on the staffing agreement. The existing agreement provides SCWA staff time at no cost to the GSA. At the August 10, 2023, SCWA Board Meeting, the SCWA Board recommended that staff time now be charged to the GSA, since a dedicated funding source has been established. Supervisor Vasquez recommended that all of the prior costs be noted, so that everyone recognizes that SCWA provided a huge value to the GSA.

On a motion by Mayor Kott and a second by Supervisor Mashburn the Board approved by roll vote the following items:

1. Approve Amendment 1 revisions to General Staffing Agreement between the Solano County Water Agency and the Solano Subbasin Groundwater Sustainability Agency.

2. Authorize Chair to sign Amendment 1 to General Staffing Agreement between the Solano County Water Agency and the Solano Subbasin Groundwater Sustainability Agency.

Director Bei voted no.

UPDATE ON SUSTAINABLE GROUNDWATER MANAGEMENT GRANT PROGRAM

Secretary Chris Lee provided an update on the $4.4-million Sustainable Groundwater Management Grant from DWR. Mr. Lee briefly went over the key funding components of the DWR grant, which include (i) GSP Implementation, Outreach, and Compliance, (ii) GSP Monitoring and Data Management, (iii) Supporting Groundwater Use Management Actions, and (iv) Water Replenishment and Reliability. The Water Agency will be working closely with the Dixon RCD and County staff to put in additional wells and groundwater monitoring. As part of the grant, a web interface will be created to share the data. The grant will look at the interconnection of surface and groundwater. There is also funding to support multi-benefit groundwater recharge projects as well as planning support for the City of Vacaville to look at recycled water. The grant will go through April 2026 and includes 3 fiscal years of funding.

The GSA Board asked several questions, including how does the Solano Subbasin work with the Yolo and Colusa Subbasins. Additionally, does it make sense to consolidate some of the other Solano GSAs such as SID, Vacaville, and North Delta into one GSA for the region. Mr. Lee shared that at a staff level, he already works closely with the Yolo County GSA. The Yolo County GSA also received a large grant from DWR that includes potential work in the Northwest Focus area on the Yolo County side. Director Crossley recommended that Mr. Lee as well as the Solano GSA Board members should meet with the Yolo GSA Board members. Mr. Lee shared that on the Solano side, they have tried to get the various Solano GSA Board members to meet, and scheduling has been very difficult. There was some additional discussion on the conversion of orchards back into row crops, and the ability to do groundwater recharge. Supervisor Mashburn shared that if there is interest in consolidating the Solano GSAs, it would be helpful to have the policy focused Board members from each of the GSAs meet.

TIME AND PLACE OF NEXT MEETING

The time and place of the next meeting is Thursday, November 9, 2023, at 5:00pm.

ADJOURNMENT

The meeting of the Solano Subbasin Groundwater Sustainability Agency Board of Directors was adjourned at 5:42-pm.

Chris Lee
Secretary to the Solano Subbasin
Groundwater Sustainability Agency

Action Item No. 2024-
Agenda Item No. 6B

ACTION OF
SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

DATE: **April 11, 2024**

SUBJECT: **Expenditure Approvals**

RECOMMENDATIONS:

Approve expenditures for the Agency checking account for March (cumulative from October 1, 2023).

FINANCIAL IMPACT:

All expenditures are within previously approved budget amounts.

BACKGROUND:

The Agency auditor has recommended that the Board of Directors approve all expenditures (in arrears). Attached is a summary of expenditures from the Agency's checking account for March (cumulative from October 1, 2023). Additional backup information is available upon request.

Recommended: ______________________________
Chris Lee, Secretary

☐ Approved as recommended ☐ Other (see below) ☐ Continued on next page

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Modification to Recommendation and/or other actions:

I, Chris Lee, Secretary to the Solano Groundwater Sustainability Agency, do hereby certify that the foregoing action was regularly introduced, passed, and adopted by said Board of Directors at a regular meeting thereof held on April 11, 2024.

Ayes:

Noes:

Abstain:

Absent:

____

Chris Lee, Secretary to the
Solano Groundwater Sustainability Agency

SOLANO GSA
Check Register
For the Period From Oct 1, 2023 to Mar 31, 2024

Filter Criteria includes: Report order is by Date.

Check #	Date	Payee	Cash Account	Amount
1065	11/30/23	AG INNOVATIONS	1020AC	15,054.00
1066	12/7/23	ACWA/JPIA	1020AC	1,620.00
1067	12/28/23	AG INNOVATIONS	1020AC	7,359.03
1068	12/28/23	LUHDORFF & SCALMANINI	1020AC	119,254.3
1069	1/8/24	ASSOC OF CA WATER AGENCIES	1020AC	3,055.00
1070	1/23/24	AG INNOVATIONS	1020AC	3,325.77
1071	2/13/24	LUHDORFF & SCALMANINI	1020AC	107,615.7
1072	2/27/24	AG INNOVATIONS	1020AC	11,523.50
1072V	2/27/24	AG INNOVATIONS	1020AC	-11,523.5
1073	2/27/24	AG INNOVATIONS	1020AC	11,523.50
1074	3/27/24	LUHDORFF & SCALMANINI	1020AC	54,334.55
Total				**323,141.9**

SOLANO GSA
Balance Sheet
March 31, 2024

ASSETS

Current Assets			
1020AC	CHECKING - SP/ADMIN	$ 710,358.03	
1210SC	ACCOUNTS RECEIVABLE - SP/ADMI	68,027.00	
	Total Current Assets		778,385.03
Property and Equipment			
	Total Property and Equipment		0.00
Other Assets			
	Total Other Assets		0.00
	Total Assets		$ 778,385.03

LIABILITIES AND CAPITAL

Current Liabilities			
2020SC	ACCOUNTS PAYABLE-SP/ADMIN	$ 6,884.00	
	Total Current Liabilities		6,884.00
Long-Term Liabilities			
	Total Long-Term Liabilities		0.00
	Total Liabilities		6,884.00
Capital			
39005	Retained Earnings	774,482.73	
	Net Income	(2,981.70)	
	Total Capital		771,501.03
	Total Liabilities & Capital		$ 778,385.03

SOLANO GSA
Operating Budget Report - Administration
For the Nine Months Ending March 31, 2024

		Annual Budget	Current Month Activity	Year to Date Activity	% of
Expenses					
Administrative Expenses					
6090AC	MEMBERSHIPS	$ 0.00	$ 0.00	$ 3,055.00	0.00
6100AC	PPTY TAX ADMIN FEE	0.00	0.00	2,554.85	0.00
6126AC	LEGAL COSTS	10,000.00	0.00	0.00	0.00
6130AC	Project Mgt & Status Updates	70,975.00	0.00	0.00	0.00
6350AC	INSURANCE	0.00	0.00	1,720.00	0.00
6990AC	CONTINGENCY-ADMINISTRA	4,750.00	0.00	0.00	0.00
	Subtotal Admin Expenses	**85,725.00**	**0.00**	**7,329.85**	**8.55**
GSP IMPLEMENTATION					
6141AC	OUTREACH & EDUCATION	75,354.00	0.00	0.00	0.00
6142AC	GSP REPORTING & UPDATES	0.00	54,334.55	367,175.72	0.00
6143AC	MONITORING & DMS MGT	206,170.00	0.00	0.00	0.00
6145AC	GRANT WRITING	19,624.00	0.00	0.00	0.00
6146AC	ON-CALL SIGMA SUPPORT	13,660.00	0.00	0.00	0.00
6147AC	TECHNICAL SUPPORT FOR OU	35,904.00	0.00	0.00	0.00
6148AC	GSP ANNUAL REPORT	118,644.00	0.00	0.00	0.00
6149AC	MODEL UPDATES	33,180.00	0.00	0.00	0.00
6164AC	DWR RESPONSE TO GSP REVI	14,760.00	0.00	0.00	0.00
	Subtotal Other Services	**517,296.00**	**54,334.55**	**367,175.72**	**70.98**
Capital Expenditures					
	Subtotal Capital Expenditures	**0.00**	**0.00**	**0.00**	**0.00**
	Total Expenses	**603,021.00**	**54,334.55**	**374,505.57**	**62.10**
Revenues					
4402AC	INTEREST - MONEY MGMT	0.00	0.00	3,804.87	0.00
4922AC	GSA GSP COST SHARE REVENU	112,482.00	10,000.00	112,304.00	99.84
4924AC	PROP 218 CHARGE	547,291.00	0.00	255,485.22	46.68
	Total Revenues	**659,773.00**	**10,000.00**	**371,594.09**	**56.32**
	Net	**$ 56,752.00**	**$ (44,334.55)**	**$ (2,911.48)**	**(5.13)**

Report Date: April 3, 2024

SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

MEMORANDUM

TO: **Board of Directors**

FROM: **Chris Lee, Secretary to the Board of Directors**

DATE: **April 5, 2024**

SUBJECT: **April General Manager/Secretary Report**

Surface Water Supply Update

Although not under the purview of the Solano Subbasin Groundwater Sustainability Agency, surface water supplies are intricately tied to implementation of the Solano Subbasin Groundwater Sustainability Plan. We had a slow start to the 2023-2024 water year, but precipitation ramped up over the last several months.

On April 2nd, the Department of Water Resources (DWR) conducted the fourth and final snow survey of the season at Phillips Station. The manual survey recorded 64 inches of snow depth and a snow water equivalent of 27.7 inches, which is 113 percent of average for this location. The April measurement is critical as it is considered the peak snowpack for the season and marks the transition to spring snowmelt into the state's rivers and reservoirs.

DWR's electronic readings from 130 stations placed throughout the state indicate that the statewide snowpack's snow water equivalent is 28.6 inches, or 110 percent of average for this time of year.

California's reservoirs remain in good shape thanks to the state's effort to capture and store as much water as possible from record storms in 2023 and again this year. The State Water Project has increased storage by 700,000 acre-fee at Lake Oroville and by 154,000 at San Luis Reservoir since January 1. Statewide, reservoir levels currently stand at 116 percent of average.

The State Water Project allocation was increased from 25 percent to 40 percent on March 22.

For the Solano Project, the water supply outlook remains unchanged with full allocations for the 2024 Water Year. As of April 5, Lake Berryessa held 1,549,975 acre-feet in storage (99.9% of

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http://www.scwa2.com/resources-management/ground-water/solano-gsa-bod

full capacity), at elevation 439.90, just 0.04 feet below the Glory Hole. The Glory Hole starts to spill at elevation 439.95, with 1 cfs going over the rim. At elevation 440, the spill is at 10 cfs.

Bay Delta Plan Update

At the March Solano County Water Agency meeting, staff gave the Board an overview on an alternative approach to the unimpaired flows in the Bay Delta Plan Update. The Healthy Rivers and Landscape Program (i.e., Voluntary Agreements) is supported by the Governor and the California Natural Resources Agency. Rather than just flow increases, the Healthy Rivers and Landscape Program proposes additional flows, restoration efforts, and scientific monitoring as a more holistic approach to help declining fish species in the Bay-Delta.

A series of workshops on the Healthy Rivers and Landscapes programs are scheduled for the State Water Board on April 24-26. The notice from the State Water Board is attached.

Staff have developed a one-page fact sheet for the Putah Creek Healthy Rivers and Landscape Program so that Board members will have the same messaging available. The fact sheet is attached.

On May 8th, staff will be part of a panel at the ACWA Spring Conference in Sacramento. The program is titled Understanding the Bay Delta Plans' Impacts on Region 4. Staff will present impacts to Solano County and share our Putah Creek Healthy Rivers and Landscpaes Program. Sean Maquire, Board Member, State Water Resources Control Board is also an invited speaker. We want to thank Cary Keaten, General Manager of Solano Irrigation District, and Board Member of Region 4 of ACWA, for helping facilitate this invitation.

If the unimpaired flows alternative moves forward, it would have a devastating impact on groundwater statewide.

Groundwater Sustainability Workshop-April 24, 2024, 5:00-6:30 PM (SCWA/SID BOD Room)

This workshop is an opportunity to help all GSA Board members connect and learn more about the 2023 Annual Report and share updates about the state of the subbasin.

The agenda for the workshop is attached.

Sustainable Groundwater Management Act Implementation Grant

As previously mentioned, we were awarded a $4.4 million Sustainable Groundwater Management Act Implementation (Proposition 68) grant from the Department of Water Resources.

Components of the grant are:

Monitoring and Data Management Enhancements

- Monitoring Enhancements and Addressing Monitoring Data Gaps
- Data Management System Enhancements
- Interconnected Surface Water and Groundwater Dependent Ecosystems

Supporting Groundwater Management Actions
- Improving Understanding of Basin Water Use
- Local Water Conservation and Management
- Groundwater Management Policy-Positioning for the Future

Water Supply Replenishment and Reliability Projects
- Recharge Study-Targeted Augmentation
- Localized Groundwater Conditions Evaluation
- City of Vacaville Recycled Water Planning

GSP Implementation, Outreach, and Compliance Activities
- Prepare Annual Reports
- GSP Amendments and Five-Year Update

We received the final grant agreement on February 9, 2024. Staff are working with LSCE to determine what funds/actions can be utilized for the remaining fiscal year and what will be forecasted for the coming fiscal year.

GSP Implementation Actions

The following Groundwater Sustainability Plan Implementation Actions were worked on for September, either by staff, consultants (Ag Innovations and Luhdorff & Scalmanini [LSCE]), or a combination of both:

- Technical Support for Solano Subbasin Stakeholder Outreach and Engagement Efforts
  - Coordination and planning for multi-benefit recharge projects
  - Planning and discussions of RainMAR pilot projects
- Monitoring Network Coordination Support and Addressing Data Gaps
  - Data Management System support related to monitoring activities
  - Continual development of Web Application
- Model Updates and Application
  - Coordination with RCDs on Irrigated Lands Program and groundwater use data
  - Open Evapotranspiration data compilation
- Meeting Support
  - Solano Project Team Meeting and other meeting preparation/attendance
- SGMA technical assistance
  - Preliminary recharge outreach opportunities and planning
  - Coordination with UC Davis on Wolfskill experimental orchard well
- Prepare for, facilitate, and take notes in the Solano Collaborative meetings
- Updates and maintenance of Solano GSP website
- Supported work toward the Groundwater Sustainability Annual Report for the Subbasin.
- Synthesized plan for Groundwater Sustainability Workshop with the GSA Collaborative and prepared plan for meeting presentation and logistics.
- Updated the Spanish webpage on SolanoGSP.com. Added a website translation feature to increase accessibility throughout SolanoGSP.com.

- Scheduled date for a Solano Subbasin Virtual Town Hall for Wednesday, May 22 from 5:30 pm - 7 pm. Began planning outreach and drafting the agenda for this public meeting.
- Scheduled, facilitated, and took notes for the Solano Subbasin GSP Project Team March meeting.

Solano Groundwater Sustainability Plan Website

Continuous updates are being made to the Solano Groundwater Sustainability Plan website. The address for the website is: http://www.solanogsp.com

State Water Resources Control Board

NOTICE OF BOARD WORKSHOP ON PROPOSED VOLUNTARY AGREEMENTS RELATED TO SACRAMENTO/DELTA UPDATE TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY/ SACRAMENTO-SAN JOAQUIN DELTA ESTUARY

NOTICE IS HEREBY GIVEN that the State Water Resources Control Board (State Water Board or Board) will hold a multiday public workshop to discuss voluntary agreements (VAs) proposed by water users and state and federal agencies currently being considered in the process to update the Sacramento River and Delta components of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan).[1] The purpose of the workshop is for the VA parties to provide a detailed overview of the VA proposal, receive input and answer questions from Board members, and receive input from the public.

Although a quorum of the Board is expected to be present at the workshop, the State Water Board will not take any formal action. The workshop will include both a physical meeting location and an option to participate remotely as described below.

April 24–26, 2024, beginning at 9:00 am
Joe Serna Jr. CalEPA Building
Coastal Hearing Room
1001 I Street, Second Floor
Sacramento, CA 95814

And via Video and Teleconference

BACKGROUND

In 2022, the State Water Board received a Memorandum of Understanding (MOU) proposing VAs for updating and implementing the Bay-Delta Plan. In September 2023, the State Water Board released a draft Staff Report evaluating the VAs (see Chapter 9 and Appendix G) and other possible alternatives for updating the Bay-Delta Plan. The State Water Board has not made a decision regarding whether to incorporate the VAs into the proposed Sacramento/Delta updates to the Bay-Delta Plan. This workshop, along with other comments received during the process to consider Sacramento/Delta updates to the Bay-Delta Plan, will inform whether and how to incorporate the VA proposal into the Sacramento/Delta updates to the Bay-Delta Plan.

[1] The Tuolumne River components of the VA proposal are being considered separately. See the State Water Board's website for additional information.

State Water Board staff are also in the process of developing draft possible changes to the Sacramento/Delta components of the Bay-Delta Plan, including specific draft regulatory text for the program of implementation for public review and comment, including a public workshop following release of the draft possible changes. The input received on the draft Sacramento/Delta Bay-Delta Plan amendments will inform the final proposed amendments, which will be brought before the State Water Board for consideration at a future Board meeting.

DOCUMENT AVAILABILITY

The MOU, term sheet, and other supporting documents describing the proposed VAs, as developed by the VA parties, can be found in Appendix G1 of the draft Staff Report. VA parties are currently in the process of developing additional draft components of the VA proposal. These documents are anticipated to be made publicly available on the State Water Board's File Transfer Protocol (FTP) site on, or shortly after, March 29, 2024. Notification of receipt of the additional VA documents and instructions for accessing these documents will be provided on the State Water Board's Proposed VAs webpage and by email to subscribers of the Board's Bay-Delta Notices email list (listed under Water Rights).

AGENDA

The three-day workshop will include introductory presentations each day; six detailed sessions over the three days on specific key components of the VA proposal; and opportunities for general public comments at the end of the second and third workshop days (April 25 and 26). Each of the six detailed sessions will include: (1) a detailed overview presentation from VA parties on the specific identified components of the VAs, (2) public panel presentations on the topics covered in that session, and (3) an opportunity for Board member questions and discussion.

April 24, 2024

- **Day 1 Introduction**
    - Board member opening remarks and staff introduction to the workshop
    - Overview of VA proposal from VA parties

- **Session 1: Integration of VA Flow and Non-flow Measures** – discussion of how VA flow and non-flow assets were developed and are intended to be integrated to benefit native fish
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

- **Session 2: Flow Measure Accounting** – discussion of proposed adaptive measures for implementing VA flows and proposed accounting for flow assets
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

April 25, 2024

- **Day 2 Introduction**
    - Brief Board member opening remarks and staff presentation

- **Session 3: Non-flow Measure Accounting** – discussion of the proposed VA accounting protocols for non-flow measures, including for spawning, rearing, floodplain, bypass, and tidal wetland non-flow measures
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

- **Session 4: Science Plan** – discussion of the proposed VA Science Plan, including the proposed approaches for evaluating outcomes of the flow and non-flow measures
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

- **Individual Public Comments** (anticipated to begin after 2 pm)

April 26, 2024

- **Day 3 Introduction**
    - Brief Board member opening remarks and staff presentation

- **Session 5: Governance and Participation** – discussion of the proposed VA governance structure for decision making, coordination of VA efforts, engagement with other interested participants, and State Water Board regulatory oversight
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

- **Session 6: Enforcement, Accountability, Transparency, and Implementation** – discussion of the proposed VA legal instruments for enforcement, accountability, and transparency and next steps for implementing the VAs
    - Overview presentation from VA parties
    - Panel presentations
    - Board discussion

- **Individual Public Comments** (anticipated to begin after 2 pm)

PARTICIPATION

This workshop is being organized to allow for a detailed discussion of VA components. The VA parties will be providing detailed presentations and the public will also have the opportunity to provide more detailed presentations on the session topics during the panel presentation portions of each session.

If you would like to provide a panel presentation, please email SacDeltaComments@waterboards.ca.gov with the subject line "VA Workshop Panel Request" no later than **April 5, 2024**, with the following information: (1) the names, affiliations, and email addresses of each member of the panel; (2) whether each panel member will present in person or remotely; and (3) the session the panel is requesting to present at. The panel presentations should be limited to the topics covered in that session as described in the agenda. Panel presentations will be limited to **10-20 minutes** (depending on the number of panel requests) unless otherwise directed. Participants that would like to make a PowerPoint presentation during their panel presentation must submit their PowerPoint presentation to SacDeltaComments@waterboards.ca.gov no later than **noon on April 22, 2024**.

For those who wish to provide an individual comment, those comments will be heard at the end of the second and third workshop days on April 25 and 26, 2024. Individual comments will not be heard the first day of the workshop on April 24, 2024. Individual public comments will be limited to 3 minutes unless additional time is otherwise provided. If you wish to make an individual comment, please fill out a virtual speaker card. For those that plan to participate virtually, the Clerk to the Board will respond to your form one day before the workshop with the information needed to join the meeting.

For those who only wish to watch the meeting, a webcast will be available at youtube.com/user/BoardWebSupport/ and video.calepa.ca.gov/ (closed captioning available) and should be used unless you intend to comment.

If you have questions about how to participate in the workshop, please email staff at SacDeltaComments@waterboards.ca.gov.

WRITTEN PUBLIC COMMENTS

The State Water Board will not be accepting written comments related to this workshop, however, an opportunity to provide written comments will be provided when the State Water Board releases draft regulatory text for the program of implementation later this year.

FUTURE NOTIFICATIONS

To receive future email notifications about the Bay-Delta Plan processes, subscribe to the "Bay Delta Notices" topic (listed under Water Rights). Any change in the date, time, and place of the public meetings described above will be noticed via the email subscription list.

AVAILABILITY OF LANGUAGE SERVICES

To request oral interpretation or sign language services, please submit your request at least 10 business days before the meeting by contacting the Office of Public Participation at (916) 341-5254 or OPP-LanguageServices@waterboards.ca.gov.

Telecommunications device for the deaf (TDD) users may contact the California Relay Service at: TTY (800) 735-2929 or voice line at (800) 735-2922.

VISITING THE CALEPA BUILDING
All visitors to the CalEPA Building are required to sign in at the security guard station located just inside the main entrance. Visit the CalEPA website for additional information on traveling to the CalEPA Building.

CONTACT INFORMATION
For questions regarding this notice, email SacDeltaComments@waterboards.ca.gov.

March 8, 2024
Date

Courtney Tyler
Courtney Tyler
Clerk to the Board

Impact of the State's Proposed Unimpaired Flow Mandate to Solano County Vs. Alternative Progam

BAY-DELTA PLAN UPDATE BY THE STATE WATER BOARD (known as Unimpaired Flows)

The proposed Bay-Delta Plan Update would:

- **Require 55% of Unimpaired Flows (winter runoff to the ocean).**
- **Would decrease Solano County's water supply by 75%**
- **Would cause building moratoriums in Vacaville, Fairfield, Suisun City, Benicia, and Vallejo.**
- **Would significantly impact/eliminate Solano County's agricultural diversity.**
- **Would impact Bay Area housing affordability (Solano is the most affordable County).**
- **Reduce Solano County's most reliable water supply.**

ALTERNATIVE- THE HEALTHY RIVERS AND LANDSCAPES (HRL) PROGRAM (known as Voluntary Agreements or VA)

The HRL, also known as Voluntary Agreements (VA) would be an alternative to the Bay-Delta plan.

The HRL would:

- **Provide additional flow to Lower Putah Creek**
- **Create new salmonid spawning habitat**
- **Fund scientic monitoring**
- **Continue to allow clean, safe, and reliable drinking water to Solano County residents, agriculture, and businesses.**
- **Build upon 24-years of success with the Putah Creek Accord**

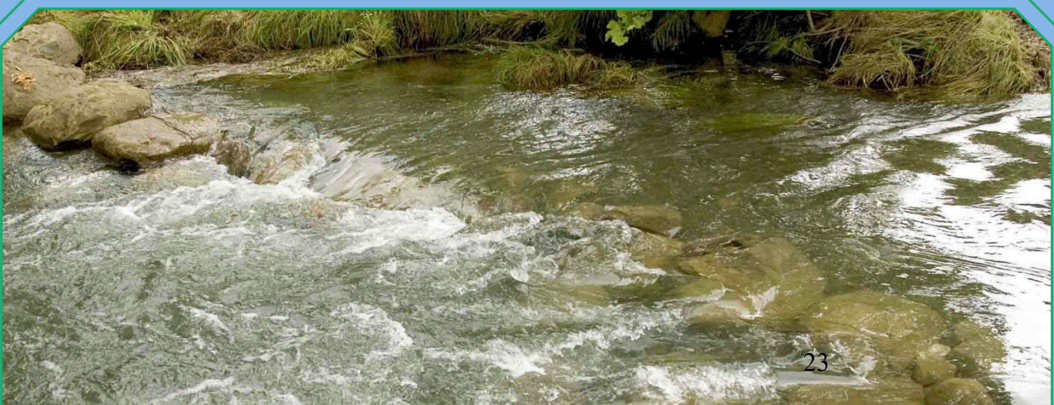
To provide comments on the HRL Agreements, please scan the QR code!

Solano County Water Agency

Solano County Water Agency

	Bay-Delta Plan	HRL Program
SALMONID HABITAT	NEUTRAL	BENEFICIAL
AFFORDABLE HOUSING	ADVERSE	BENEFICIAL
WATER SUPPLY-CITIES	ADVERSE	BENEFICIAL
WATER SUPPLY-AGRICULTURE	ADVERSE	BENEFICIAL
SUSTAINABILITY OF TRAVIS AIR FORCE BASE	ADVERSE	BENEFICIAL
SOLANO COUNTY ECOMONY	ADVERSE	BENEFICIAL
GROUNDWATER	ADVERSE	BENEFICIAL
DELTA RESILIENCY	ADVERSE	BENEFICIAL

To learn more about the HRL (VA), scan the QR code!



KEY FACTS:

- Putah Creek represents 1% of the Sacramento River Watershed.
- Over $15 million has been spent on creek restoration in Lower Putah Creek.
- Putah Creek historically was never well connected to the Delta, with only large overland flood flows reaching the Delta.

Solano Subbasin Groundwater Sustainability Workshop

April 24, 2024 | 5:00-6:30 pm PST
Location: 810 Vaca Valley Parkway, Vacaville, CA 95688
Hosted by: Solano Groundwater Sustainability Agency and Solano Irrigation District

Purpose

An Informational mixer to help GSA representatives understand Groundwater Sustainability Plan implementation in the Solano Subbasin. Objectives include:

- Discuss the Sustainable Groundwater Management Act (SGMA) with fellow Groundwater Sustainability Agency representatives
- Share groundwater updates on the State of the Solano Subbasin
- Provide a chance to ask hydrologists about the Solano Groundwater Sustainability Annual Report - Water Year 2023.

Draft Agenda

5:00 Welcome, informal introductions, SGMA context
5:20 Annual Report update and question/answer
5:40 Discussion about the State of the Solano Subbasin
6:20 Ways to stay involved

We welcome your input on the agenda. Contact Guadalupe Garcia (guadalupe@aginnovations.org) with questions and ideas.

ACTION OF
SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY AGENCY

DATE: **April 11, 2024**

SUBJECT: **2023 Groundwater Sustainability Plan Annual Report**

RECOMMENDATION:

1. Receive overview of 2023 Groundwater Sustainability Plan Annual Report.

2. Approve 2023 Groundwater Sustainability Plan Annual Report.

FINANCIAL IMPACT:

None.

BACKGROUND:

Pursuant to the Sustainable Groundwater Management Act (SGMA) of 2014, Groundwater Sustainability Plan (GSP) Annual Reports must be submitted to the California Department of Water Resources (DWR) on April 1 of every year. The 2023 GSP Annual Report was submitted to DWR on March 29, 2024.

The Annual Report provides an update on groundwater conditions in Solano County and the Solano Subbasin, focused on water year 2023 (October 1, 2022-September 30, 2023) with a summary of the estimated water use and groundwater extractions in the Solano Subbasin in accordance with the SGMA requirements for GSP annual reporting. Key topics addressed in the report include:

- Current and historical groundwater related monitoring.
- Characterizing groundwater conditions.
- Reporting on water use, groundwater extraction, and key water budget component through the current water year.

Recommended: ______________________________
Chris Lee, Secretary

☐ Approved as recommended	☐ Other (see below)	☒ Continued on next page

---

Modification to Recommendation and/or other actions:

I, Chris Lee, Secretary to the Solano Groundwater Sustainability Agency, do hereby certify that the foregoing action was regularly introduced, passed, and adopted by said Board of Directors at a regular meeting thereof held on April 11, 2024, by the following vote.

Ayes:

Noes:

Abstain:

Absent:

____
Chris Lee, Secretary to the
Solano Groundwater Sustainability Agency

- Estimates of annual change in storage by principal aquifer.
- Assessment of sustainable management criteria monitoring networks for tracking groundwater sustainability (avoiding undesirable results) related to the five sustainability indicators applicable to the Solano Subbasin (seawater intrusion is not applicable):
    - Chronic lowering of groundwater levels.
    - Reduction in groundwater storage.
    - Water quality degradation.
    - Land subsidence.
    - Depletion of interconnected surface water.
- Progress on GSP implementation

The Annual Report is included as an attachment to this item.

SOLANO COUNTY AND SOLANO SUBBASIN GROUNDWATER SUSTAINABILITY

ANNUAL REPORT – WATER YEAR 2023

Prepared for

Solano Collaborative and the Solano County Water Agency

Prepared by

Luhdorff & Scalmanini
Consulting Engineers

This report was prepared by the staff of Luhdorff & Scalmanini Consulting Engineers under the supervision of the Hydrogeologist whose seals and signatures appear hereon.

March XX, 2024

Nicholas A. Watterson, PG #9076, CHg #1088
Principal Hydrogeologist
Luhdorff & Scalmanini Consulting Engineers, Inc.

CONTENTS

ANNUAL REPORT – WATER YEAR 2023 I

EXECUTIVE SUMMARY I

ES 1 OVERVIEW OF SGMA AND THE GSP I

ES 2 GROUNDWATER RELATED MONITORING I

ES 3 GROUNDWATER CONDITIONS II

ES 4 WATER BUDGET III

ES 5 CHANGE IN GROUNDWATER STORAGE III

ES 6 ASSESSMENT OF SUSTAINABILITY CRITERIA AND MONITORING IV

ES 7 GSP IMPLEMENTATION VI

1 INTRODUCTION 1

1.1 Background 1
1.2 Study Area and Groundwater Basin Descriptions 2
1.2.1 Geography and Hydrogeology of the Solano Subbasin (Basin Number: 5-21.66) 2
1.2.2 Geography and Hydrogeology of the Suisun-Fairfield Valley Basin (Basin Number: 2-3) 4
1.2.3 Areas Outside of Solano Subbasin and Suisun-Fairfield Valley Basin 4
1.3 Solano Subbasin Groundwater Sustainability Planning 4

2 GROUNDWATER-RELATED MONITORING 6

2.1.1 Groundwater Levels and Change in Storage 6
2.1.2 Groundwater Quality 9
2.1.3 Land Subsidence 11
2.1.4 Interconnected Surface Water 11
2.1.5 Data Gaps 11

3 GROUNDWATER CONDITIONS 13

3.1 Historical and Recent Hydrology and Climate 13
3.2 Groundwater Levels 14
3.2.1 Groundwater Elevation Contour Maps 14
3.2.2 Groundwater Levels Trends 14
3.3 Groundwater Quality 21
3.3.1 Arsenic 21
3.3.2 Boron 22
3.3.3 Chloride 22
3.3.4 Chromium-6 22
3.3.5 Nitrate 23
3.3.6 TDS 23

3.4 Land Subsidence 24
3.4.1 CGPS Stations 25
3.4.2 InSAR Data 27
3.4.1 Comparisons of Vertical Displacement and Groundwater Level Data 28
3.4.2 Summary of Land Subsidence Conditions 30
3.5 Interconnected Surface Water 24

4 WATER BUDGET APPROACH FOR QUANTIFYING GROUNDWATER EXTRACTION, SURFACE WATER SUPPLIES, AND TOTAL WATER USE 32

4.1 Analysis Background and Approach 32
4.2 Groundwater Extraction - §356.2(b)(2) 33
4.2.1 Agricultural Groundwater Extraction 35
4.2.2 Urban Groundwater Extraction 35
4.2.3 Native Vegetation and Managed Wetlands Groundwater Extraction 37
4.3 Surface Water Supply - §356.2(b)(3) 38
4.3.1 Agricultural Surface Water Supply 38
4.3.2 Urban Surface Water Supply 39
4.3.3 Native Vegetation Surface Water Supply 40
4.3.4 Managed Wetlands Surface Water Supply 40
4.4 Total Water Use by Sector - §356.2(b)(4) 41

5 CHANGE IN GROUNDWATER STORAGE (§356.2.B.5) 42

5.1 Change in Groundwater Storage Maps 42
5.2 Groundwater Use and Change in Groundwater Storage 44

6 ASSESSMENT OF RMS MONITORING NETWORK STATUS 45

6.1 Groundwater Levels 48
6.2 Groundwater Quality 52
6.3 Land Subsidence 56
6.4 Interconnected Surface Water .... **Error! Bookmark not defined.**

7 GSP IMPLEMENTATION PROGRESS - §356.2(B) .... ERROR! BOOKMARK NOT DEFINED.

7.1 RMS Monitoring and Addressing Data Gaps .... **Error! Bookmark not defined.**
7.2 PMA Implementation 59

8 REFERENCES 68

LIST OF TABLES

Table 2-1	Summary of Historical Water Level Monitoring
Table 2-2	Summary of Historical Water Quality Monitoring
Table 3-1	Summary of Land Subsidence Monitoring
Table 4-1	Groundwater Extraction in Each Water Year by Water Use Sector
Table 4-2	Groundwater Extraction in Each Water Year by Method of Measurement (Water Year 2023)
Table 4-3	Urban Groundwater Extraction Data Sources (Water Year 2023)
Table 4-4	Surface Water Use in Each Water Year by Water Use Sector
Table 4-5	Surface Water Use in Each Water Year by Water Source Type
Table 4-6	Surface Water Diversions and Deliveries Data Sources in the Solano Subbasin (Water Year 2023)
Table 4-7	Total Water Use in the 2023 Water Year by Water Use Sector
Table 5-1	Calculated Change in Groundwater Storage in the Alluvial/Upper Tehama Zone
Table 5-2	Calculated Change in Groundwater Storage in the Basal Tehama
Table 6-1	Summary of MTs, MOs, URs, and Selection Rationale
Table 6-2	Summary of Water Level RMS Monitoring Status
Table 6-3	Summary of Water Quality RMS Monitoring Status
Table 6-4	Summary of Land Subsidence RMS Monitoring Status
Table 6-5	Summary of Interconnected Surface RMS Monitoring Status
Table 6-6	Summary of Putah Creek Flows and Required Flows
Table 7-1	Ongoing, Planned and Potential Projects and Management Actions in the Solano Subbasin

LIST OF FIGURES

Figure ES-1	Annual Groundwater Storage Changes and Extractions
Figure 1-1	Location Map and Groundwater Basins and Subbasins
Figure 1-2	Major Water Purveyors
Figure 1-3	Groundwater Sustainability Agencies in Solano
Figure 1-4a	Surficial Geology
Figure 1-4b	Surficial Geology Explanation
Figure 1-5	Sacramento Valley Schematic Cross Section X-X'
Figure 2-1	Wells with Water Level Information since 2015 -Alluvial Aquifer and Upper Zone
Figure 2-2	Wells with Water Level Information since 2015 - Confined Basal Tehama Zone
Figure 2-3	Wells with Water Level Information since 2015 - Unknown
Figure 2-4	Groundwater Level RMS Location Map-Alluvial Aquifer and Upper Zone
Figure 2-5	Groundwater Level RMS Location Map-Basal Tehama
Figure 2-6	Groundwater Quality Data since 2015 and RMS Location Map
Figure 2-7	Subsidence Monitoring Sites
Figure 2-8	Interconnected Surface Water Monitoring Sites

Figure 2-9	Data Gaps in Solano County
Figure 3-1	Cumulative Departure from Mean Annual Precipitation
Figure 3-2	Groundwater Surface Elevation Map: Spring 2023 - Alluvial Aquifer and Upper Zone
Figure 3-3	Groundwater Surface Elevation Map: Fall 2023 - Alluvial Aquifer and Upper Zone
Figure 3-4	Groundwater Surface Elevation Map: Spring 2023 - Confined Basal Tehama Zone
Figure 3-5	Groundwater Surface Elevation Map: Fall 2023 - Confined Basal Tehama Zone
Figure 3-6a	Select Groundwater Level Hydrographs: Northern Alluvial Aquifer
Figure 3-6b	Select Groundwater Level Hydrographs: Central Alluvial Aquifer
Figure 3-6c	Select Groundwater Level Hydrographs: Southern Alluvial Aquifer
Figure 3-7a	Select Groundwater Level Hydrographs: Northern Upper and Middle Tehama
Figure 3-7b	Select Groundwater Level Hydrographs: Central Upper and Middle Tehama
Figure 3-8a	Select Groundwater Level Hydrographs: Northern Basal Tehama
Figure 3-8b	Select Groundwater Level Hydrographs: Central Basal Tehama
Figure 3-9a	Groundwater Level Hydrographs: SCWA Nested Wells
Figure 3-9b	Groundwater Level Hydrographs: SSGSA Nested Wells
Figure 3-10a	Max Arsenic Concentration Since 2015
Figure 3-10b	Average Arsenic Concentration Since 2015
Figure 3-11a	Max Boron Concentration Since 2015
Figure 3-11b	Average Boron Concentration Since 2015
Figure 3-12a	Max Chloride Concentration Since 2015
Figure 3-12b	Average Chloride Concentration Since 2015
Figure 3-13a	Max Chromium (VI) Concentration Since 2015
Figure 3-13b	Average Chromium (VI) Concentration Since 2015
Figure 3-14a	Max Nitrate Concentration Since 2015
Figure 3-14b	Average Nitrate Concentration Since 2015
Figure 3-15a	Max Total Dissolved Solids Since 2015
Figure 3-15b	Average Total Dissolved Solids Since 2015
Figure 3-16a	Continuous GPS (CGPS) Stations and Elevation Data
Figure 3-16b	Continuous GPS (CGPS) Stations and Elevation Data
Figure 3-17	Total Surface Displacement: 2015 to 2022
Figure 3-18	Land Surface Vertical Displacement: 2021 To 2022
Figure 3-19	Dixon CPGS and Water Levels
Figure 3-20	Vacaville CPGS and Water Levels
Figure 3-21	Discharge and Relative Stage Height Along Putah Creek
Figure 3-22	SCWA Stream Stage Monitoring
Figure 4-1	Total Volume of Groundwater Extraction
Figure 5-1	Groundwater Level Change Map: Winter/Spring 2022 To 2023 - Alluvial Aquifer and Upper Zone
Figure 5-2	Groundwater Level Change Map: Winter/Spring 2022 To 2023 - Confined Basal Tehama Zone

Figure 5-3	Groundwater Storage Change Map: Winter/Spring 2022 To 2023 - Alluvial Aquifer and Upper Zone
Figure 5-4	Groundwater Storage Change Map: Winter/Spring 2022 To 2023 - Confined Basal Tehama Zone
Figure 5-5	Annual Groundwater Storage Changes and Extractions
Figure 6-1	Arsenic Concentration Evaluation for RMS
Figure 6-2	Chloride Concentration Evaluation for RMS
Figure 6-3	Chromium (VI) Concentration Evaluation for RMS
Figure 6-4	Nitrate Concentration Evaluation for RMS
Figure 6-5	Total Dissolved Solids Concentration Evaluation for RMS

LIST OF APPENDICES

Appendix A	Putah Creek Accord
Appendix B	Historical Groundwater Contour Maps
Appendix C	Groundwater Hydrographs
Appendix D	Additional Groundwater Quality Data
Appendix E	SWS Water Budget Components Summaries
Appendix F	Change in Storage Maps
Appendix G	Historical Summary of Water Level RMS Monitoring Status
Appendix H1	Historical Summary of Water Quality RMS Monitoring Status
Appendix H2	Water Quality Plots
Appendix I	Historical Summary of Interconnected Surface Water RMS Monitoring Status
Appendix J1	Historical Summary of Land Subsidence RMS Monitoring Status
Appendix J2	Land Subsidence Plots

LIST OF ABBREVIATIONS & ACRONYMS

AF	Acre Feet
AFY	Acre Feet per Year
As	Arsenic
bgs	below ground surface
B	Boron
Cal Water	California Water Service Company
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CAWC	California Water Code
CGPS	Continuous Global Positioning System
cm	centimeters
Cr6	Hexavalent Chromium
DDW	California State Water Resources Control Board - Division of Drinking Water
DIXN	Dixon
DMS	Data Management System
DWR	California Department of Water Resources
ET	Evapotranspiration
ft	Feet or foot
ft/year	Feet per year
GAMA	Groundwater Ambient Monitoring and Assessment Program
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IHM	Integrated Hydrologic Model
in/year	Inches per year
InSAR	Interferometric Synthetic Aperture Radar
JPA	Joint Powers Authority
LSCE	Luhdorff & Scalmanini, Consulting Engineers, Inc.
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MPWD	Maine Prairie Water District
msl	mean sea level
MT	Minimum Threshold
MO	Measurable Objective
mybp	Million years before present
NASA JPL	National Aeronautics and Space Administration Jet Propulsion Laboratory

N03-N	Nitrate as Nitrogen
PBO	Plate Boundary Observatory
RCD	Solano Resource Conservation District
RD2068	Reclamation District 2068
RNVWD	Rural North Vacaville Water District
RMS	Representative Monitoring Site
SCADA	Supervisory Control and Data Acquisition System
SCWA	Solano County Water Agency
SGMA	Sustainable Groundwater Management Act
SID	Solano Irrigation District
SVSim	Sacramento Valley Groundwater-Surface Water Simulation Model
SWS	Surface Water System
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
µg/L	Micrograms per liter
UR	Undesirable Results
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
VCVL	City of Vacaville
WY	Water Year

EXECUTIVE SUMMARY

ES 1 OVERVIEW OF SGMA AND THE GSP

The Sustainable Groundwater Management Act (SGMA) encourages groundwater management at the local level. Local entities are responsible for forming Groundwater Sustainability Agencies (GSAs) to develop and implement Groundwater Sustainability Plans (GSPs) to guide sustainable management of groundwater basins or subbasins identified as high or medium priority by the State. Five GSAs in the Solano Subbasin organized to form the Solano Collaborative to develop a single GSP for the Subbasin: Solano Subbasin GSA, Solano Irrigation District GSA, City of Vacaville GSA, Northern Delta GSA, and Sacramento County GSA. The Solano Collaborative together with five other GSAs have adopted the Solano Subbasin Groundwater Sustainability Plan and submitted the GSP to the Department of Water Resources (DWR) in January 2022. In January 2024 DWR informed the Subbasin that the GSP was approved.

In accordance with SGMA, the Solano Subbasin must also submit annual reports by April 1 of each year. No other areas of the County are within medium or high priority basins or subbasins and therefore are not currently subject to the requirements of SGMA; however, this report provides information on the current groundwater conditions in the Solano Subbasin in accordance with SGMA requirements with additional information on conditions in the Suisun-Fairfield Valley Basin to assist in monitoring of groundwater in other parts of the County where groundwater represents an important source of supply.

The Annual Report provides an update on groundwater conditions in Solano County and the Solano Subbasin, focused on water year 2023 (October 1, 2022-September 30, 2023) with a summary of estimated water use and groundwater extractions in the Solano Subbasin in accordance with the SGMA requirements for GSP annual reporting. Key topics addressed in the report are noted below.

- Current and historical groundwater related monitoring
- Characterizing groundwater conditions
- Reporting on water use, groundwater extraction, and other key water budget components through the current water year (2023)
- Estimates of annual change in storage by principal aquifer
- Assessment of sustainable management criteria monitoring networks for tracking groundwater sustainability (avoiding undesirable results) related to the five sustainability indicators applicable to the Solano Subbasin (seawater intrusion is not applicable):
    - chronic lowering of groundwater levels
    - reduction in groundwater storage
    - water quality degradation
    - land subsidence
    - depletion of interconnected surface water
- Progress on GSP implementation

ES 2 GROUNDWATER RELATED MONITORING

The Solano County and Solano Subbasin Data Management System (DMS) was updated in preparation of the Annual Report. The DMS was updated through water year 2023, with information related to the five sustainability indicators relevant to the sustainability of the Solano Subbasin. Monitoring data were assembled from public sources and local entities, including the GSAs in the Solano Subbasin.

ES 3 GROUNDWATER CONDITIONS

There are two primary aquifer zones defined in the Solano Subbasin GSP, the Alluvial Aquifer/Upper Tehama Zone and the Basal Tehama Zone. Most of the groundwater pumping in the Subbasin occurs in the shallower Alluvial Aquifer/Upper Tehama Zone. The Basal Tehama Zone is utilized locally, primarily by the City of Vacaville, and is generally found at great depths.

Hydrology and climate in the area during water year 2023 included above-average precipitation in the Solano Subbasin area of about 28 inches (based on the Davis meteorologic station), approximately 150 percent of average, and DWR has preliminarily classified 2023 as a wet year for the Sacramento Valley based on Sacramento River watershed runoff characteristics. Water year 2023 was preceded by three consecutive dry years from 2020 through 2022. Water year 2020 was classified as a dry year with measured precipitation (12.4 inches) in the Solano Subbasin area of less than 70 percent of the long-term annual average; 2021 was classified as a critical year, with only 6.5 inches of precipitation, less than 50 percent of average; and water year 2022 was classified as critical with 19 inches of precipitation, which although about average in the Solano Subbasin occurred mostly (75 percent) during the months of October through December.

Groundwater levels reflecting the amount (storage) of water in the groundwater system exhibit stable long-term trends, although groundwater levels remain depressed in a localized area in the northwestern portion of the Solano Subbasin (Northwest Focus Area) identified in the GSP as having lowered groundwater levels. Consistent with historical conditions, prevailing groundwater flow directions in Solano County and Solano Subbasin within the Alluvial Aquifer and Upper Tehama Zone in 2023 tend to be towards the Sacramento River and Delta from the north and west as indicated on contour maps. In the deeper confined Basal Tehama zone, groundwater gradients indicate flow is generally to the south and with a localized cone of depression in the vicinity of the City of Vacaville, mostly due to the pumping that occurs in the area.

Groundwater quality in Solano County and Subbasin is generally suitable for all beneficial uses, most notably for drinking water uses that typically have the most restrictive standards for water quality. Key groundwater quality constituents of interest identified in the Subbasin include total dissolved solids (TDS), nitrate (NO3-N), arsenic (As), boron (B), hexavalent chromium (Cr6), and chloride (Cl). Some localized areas with elevated concentrations of these key constituents exist in Solano County and Subbasin. Some of the elevated concentrations for select constituents are a result of naturally-occurring conditions, although some areas exhibit degraded groundwater quality as a result of groundwater contamination (e.g., plumes) from historical activities on the land surface. Such impacted areas, and actions to address these conditions, are overseen by other regulatory programs and entities.

Land subsidence data continue to indicate only very minor amounts of subsidence in Solano County and Subbasin with no documentation of inelastic (irreversible) land subsidence related to groundwater pumping. Historical land subsidence related to oxidation of peat deposits has occurred in the Delta area of the Subbasin. No significant impacts to surface infrastructure in Solano County and Subbasin have been noted as a result of land subsidence, and the magnitude of seasonal (elastic) fluctuations in the ground surface elevation occurring in association with seasonal changes in groundwater conditions is greater than the rate of long-term subsidence.

Interconnected surface waters in Solano County and Subbasin are most common in the Delta area of the Solano Subbasin where groundwater is very shallow. Fewer interconnected surface water features exist in the northern parts of the Subbasin where water levels are somewhat deeper. Streamflows in Putah Creek are maintained by the Solano County Water Agency in a manner designed to support beneficial users along the Creek following the flow schedule outlined in the Putah Creek Accord. Dedicated nested monitoring wells at five sites in the Subbasin have been used to monitor interconnected surface water conditions since 2022 and several additional monitoring sites adjacent to surface water features have been added to the GSP monitoring program in 2023 and are planned to be instrumented in 2024. The Subbasin also continues to track surface water and groundwater interaction with shallow seepage monitoring wells of varying depth installed along Putah Creek at four sites.

Seawater intrusion potential does not exist in the area because the Solano County and Subbasin do not have a coastline, although Delta areas of the Subbasin are tidally influenced. Monitoring of any potential influence from higher salinity water intrusion from the Delta is addressed through monitoring of conditions related to the groundwater quality sustainability indicator.

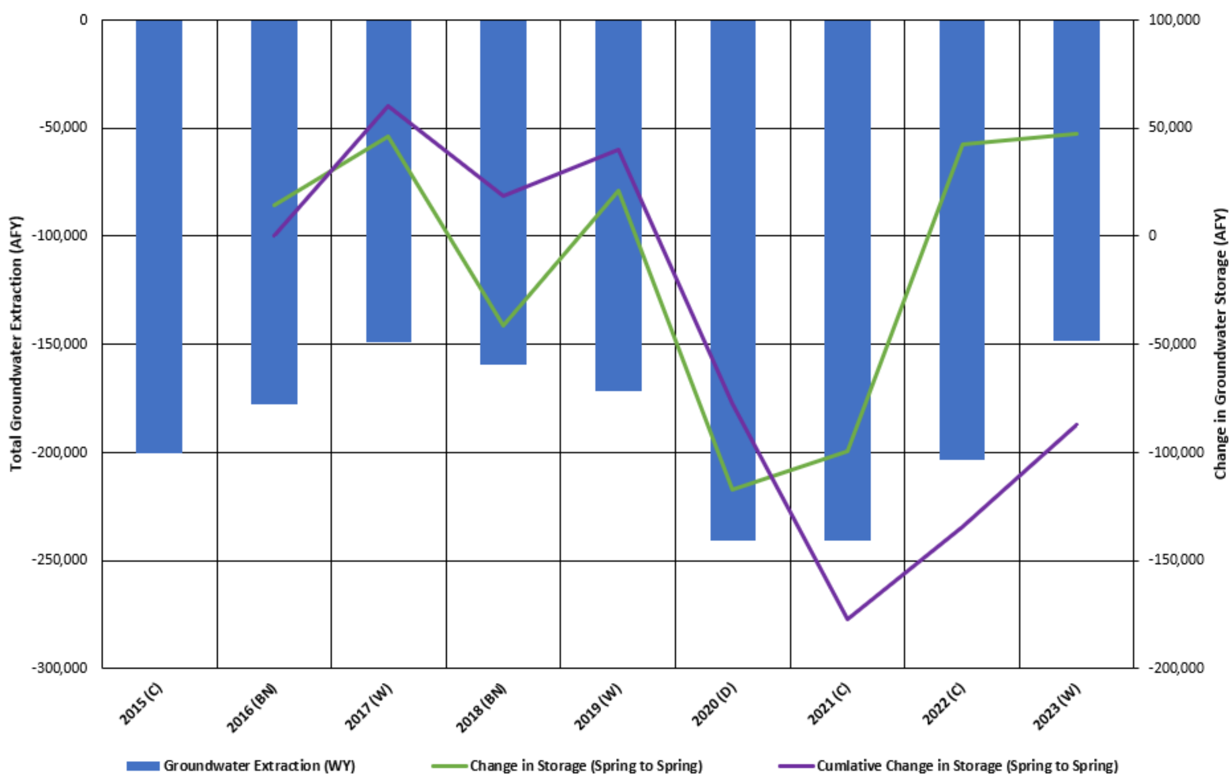
ES 4 WATER BUDGET

Historical and recent water use and water supplies in the Solano Subbasin were estimated through water year 2023 using the Solano Integrated Hydrologic Model (Solano IHM), a numerical groundwater flow model developed during the GSP preparation for application in the Solano Subbasin. Key inputs to the Solano IHM historical scenario used in GSP development were updated and expanded through water year 2023 for this Annual Report using available data and information about land use, water supplies, and water uses. The complete surface water system water budget for the Solano Subbasin was computed using the Solano IHM to estimate water use and groundwater extraction by water use sector. Estimated total water use during water year 2023 was 640,000 AF and estimated total groundwater extraction was 150,000 AF. Metered groundwater pumping accounted for about 12,000 AF of the total groundwater pumping in 2023.

ES 5 CHANGE IN GROUNDWATER STORAGE

Annual changes in groundwater storage for the Solano Subbasin were calculated for 2022 to 2023 for each principal aquifer in the Subbasin by comparing spring (seasonal high) groundwater elevation contour maps for each of the years and multiplying the change in groundwater elevation by estimated aquifer properties. Groundwater storage changed by approximately 47,000 AF in the Alluvial Aquifer/Upper Tehama Zone from Spring 2021 to Spring 2022 while only a minor amount of change in storage of 53 AF was estimated for the Basal Tehama Zone. Historically, groundwater storage changes have been positive (increasing storage) in wet periods and negative (decreasing) in dry periods (**Figure ES-1**). Water years 2020 and 2021 were remarkably dry years in the Subbasin and the negative changes in groundwater storage during these two years are consistent with these dry conditions. Water year 2022 was slightly wetter compared to previous years and a corresponding increase in storage was noted. Water year 2023 was a wet year correlating with the increase in storage evident between Spring 2022 and Spring 2023. Because the change in storage presented in this report is estimated based on comparisons of groundwater levels in Spring 2022 and Spring 2023 (in accordance with GSP Regulations), some of the effects from the wet conditions that occurred in water year 2023, including the reduced groundwater demands during Summer 2023, are not yet reflected in the most recent estimates of annual change in storage presented in this report.

Figure ES-1. Annual Groundwater Storage Changes and Extractions



ES 6 ASSESSMENT OF SUSTAINABILITY CRITERIA AND MONITORING

Each sustainability indicator was evaluated for the Subbasin and assigned minimum thresholds (MTs) and measurable objectives (MOs) to avoid undesirable results and ensure continued sustainable groundwater management. MOs and MTs are metrics assigned for sustainability indicators at selected representative monitoring sites (RMS) across the Solano Subbasin. MTs represent values at which undesirable results may be occurring in the Subbasin; MTs were set to avoid significant and unreasonable adverse impacts on beneficial users throughout the Subbasin, including drinking water users, agricultural users, and environmental users. MOs represent the long-term target for conditions in the Solano Subbasin. The RMS network in the Solano Subbasin consists of wells, streamflow gages, and land subsidence monitoring stations that are spatially distributed across the Solano Subbasin. Included in this Annual Report are updates on the five sustainability indicators relevant to the Subbasin, with current conditions presented in relation to MTs and any triggers identified in the GSP for implementing management actions. **Table ES-1** summarizes current Subbasin conditions with respect to MT exceedances (conditions that are above, or below in the case of groundwater elevation, the threshold value) and triggers. In 2023, MT exceedances occurred in the water level sustainability indicator although no undesirable result occurred. One RMS well exceeded the MT for interconnected surface water, although the measurement resulting in the exceedance is questionable and under review; nevertheless, the one MT exceedance does not constitute an undesirable result for depletion of interconnected surface water.

Table ES-1. Summary of Sustainable Management Criteria Status and Responses

<table>
<tr><th>Sustainability Indicator</th><th>Minimum Threshold Exceedances</th><th>Trigger Occurrences</th><th>Undesirable Result Occurrence</th><th>Response Summary</th></tr>
<tr><td>Chronic Groundwater Level Decline</td><td rowspan="2">Yes, 5 of 41 RMS wells recorded groundwater elevations below the MT.</td><td rowspan="2">Yes, a trigger is any MT exceedance.</td><td rowspan="2">No</td><td rowspan="2">Management actions underway include:
• Outreach to all water users
• Work to resume monitoring of wells previously monitored but dropped from other entity monitoring programs; identify replacement wells (as needed) and additional monitoring wells in data gap areas or areas of interest
• Further evaluation of surface water available for recharge or management actions for enhancing recharge
• Evaluation of factors related to MT exceedances</td></tr>
<tr><td>Reduction in Groundwater Storage</td></tr>
<tr><td>Degraded of Water Quality</td><td>No</td><td>Yes, a trigger is a concentration of 75% of MT.</td><td>No</td><td>Management actions underway include:
• Work to recruit and continue groundwater water quality sampling of wells that were previously monitored or have incomplete monitoring for GSP Constituents
• Evaluation of factors related to increasing constituent concentrations</td></tr>
<tr><td>Land Subsidence</td><td>No</td><td>No</td><td>No</td><td>--</td></tr>
<tr><td>Depletions of Interconnected Surface Water</td><td>Yes, one of six RMS wells exceeded the MT.</td><td>No</td><td>No</td><td>Management actions underway include:
• Evaluate measurement resulting in MT exceedance and potential factors related to MT exceedance
• Consideration of site-specific efforts to address MT exceedance</td></tr>
<tr><td>Seawater Intrusion</td><td colspan="4">Not Applicable to the Solano Subbasin</td></tr>
</table>

ES 7 GSP IMPLEMENTATION

DWR completed its review of the GSP and approved the GSP on January 18, 2024. DWR's GSP approval letter includes three recommended corrective actions to address in future GSP updates, primarily relating to clarifying and providing additional supporting rationale for SMC included in the GSP. Updates on the status of progress made in addressing these corrective actions will be included in future annual reports.

The GSAs are in the early stages of GSP implementation and key activities associated with implementing the GSP continue to focus on conducting regular monitoring and reporting on conditions in the Subbasin and performing management actions outlined in the GSP. Prior to 2023, the GSAs had already initiated efforts to fill key monitoring data gaps by installing new dedicated shallow monitoring wells in areas of interest. In 2023 the Subbasin continued work coordinating with local water agencies for the collection of data for the GSP water quality monitoring program. The Subbasin, in partnership with local entities, conducted targeted outreach for recruitment of wells for the GSP monitoring program. Wells target for recruiting into the monitoring program were identified because of their previous monitoring history (in some cases they were included as RMS, but recent monitoring had been discontinued) and to address monitoring data gaps. The GSAs were successful in reinstating two RMS wells in the water level monitoring network through the targeted outreach. Several additional wells were added to the monitoring program in key areas of interest and are planned for future inclusion as RMS wells, once sufficient data are available to assign appropriate SMC.

Additional GSP implementation activities conducted by the GSAs in 2023 include the following.

- stakeholder engagement and outreach efforts through public meetings, workshops, newsletters, websites, and an interactive web map
- interbasin coordination efforts, especially coordination with Yolo Subbasin on groundwater and interconnected surface water conditions in the northern parts of the Solano Subbasin
- well and surface water diversion inventory
- developing strategy for promoting projects and management actions to enhance recharge; identification of areas with interest and characteristics suitable for surficial recharge
- planning related to multi-benefit solutions to address excess stormwater drainage issues in areas of the Subbasin
- initiation of pilot project to assess benefits and challenges associated with winter cover cropping

Based on analyses conducted during GSP development, the Solano Subbasin anticipates sustainable groundwater conditions can be maintained without substantial intervention by the GSAs although the GSP identifies projects and management actions that may be implemented to maintain sustainability throughout the Subbasin should they be needed or desired.

In December 2022, the GSAs applied for and were ultimately awarded funding through a DWR SGMA Implementation Grant to support select GSP implementation activities through June 2026. The grant agreement with DWR was finalized in February 2024 and includes approximately $4.4 million for GSP monitoring and data management enhancements, development of management actions to maintain groundwater sustainability, planning of water supply replenishment and reliability projects, and GSP compliance and outreach activities.

1 INTRODUCTION

Regular reporting on groundwater conditions is valuable for tracking changes in the groundwater system and is also a requirement for some areas of the state under the 2014 Sustainable Groundwater Management Act (SGMA). SGMA requires that all groundwater basins and subbasins ranked as medium or high priority by the California Department of Water Resources (DWR) in the state develop and submit a Groundwater Sustainability Plan (GSP) describing how the basin or subbasin will achieve or maintain sustainable conditions. SGMA also requires that all medium and high priority subbasins submit annual reports describing groundwater monitoring activities and conditions and groundwater management efforts taken to maintain or achieve sustainability. The Solano Subbasin, primarily located within Solano County, is a medium priority subbasin and in January 2022 Groundwater Sustainability Agencies (GSAs) within the Solano Subbasin submitted a GSP (LSCE, 2021) covering the entire Subbasin, including parts of Sacramento and Yolo Counties. DWR completed its review of the GSP and approved the GSP on January 18, 2024. In accordance with SGMA, the Solano Subbasin must submit a GSP annual report by April 1 of each year. No other areas of Solano County are within medium or high priority basins or subbasins and therefore are not currently subject to the requirements of SGMA; however, this report provides information on the current groundwater conditions in the Solano Subbasin in accordance with SGMA requirements with additional information on conditions in the Suisun-Fairfield Valley Basin to assist in monitoring of groundwater in other parts of Solano County where groundwater represents an important source of supply.

This groundwater conditions report presents groundwater conditions spanning the period through the end of water year 2023 with select groundwater budget information presented for the Solano Subbasin for water years 2015 through the most recent water year (2023), as required by and in fulfillment of GSP Regulations. This report serves to fulfill SGMA and GSP annual reporting requirements for the Solano Subbasin.

1.1 Background

Groundwater supplies meet the needs of many beneficial users in Solano County and the Solano Subbasin, including urban and domestic uses, agricultural uses, and environmental uses. Water managers in Solano County and the Solano Subbasin have recognized the value of this resource and have commissioned various studies prepared on behalf of the Solano County Water Agency (SCWA) and other water entities as part of their efforts to characterize and manage Solano County's groundwater resources and groundwater resources within the Solano Subbasin. Key recent reports on groundwater conditions in Solano County include:

- Westside Sacramento Integrated Regional Water Management Plan (Kennedy Jenks, 2013)
- Updated Hydrostratigraphic Interpretation of the Northern Solano County Deep Aquifer System (LSCE, 2014)
- 2018 Groundwater Conditions Report, Solano Subbasin and Suisun-Fairfield Valley Basin (LSCE, 2020)
- Solano Subbasin Groundwater Sustainability Plan (LSCE, 2021)

1.2 Study Area and Groundwater Basin Descriptions

This report includes discussion of conditions in the Solano Subbasin and the Suisun-Fairfield Valley Groundwater Basin (**Figure 1-1**), with additional focus on groundwater conditions and management activities as they relate to the implementation of the Solano Subbasin GSP. The majority of these two basins are within Solano County, although there are areas within the Solano Subbasin that are located within Sacramento and Yolo Counties and some areas of the Suisun-Fairfield Valley Groundwater Basin that are within Napa County.[1] Major purveyors in the basins are illustrated in **Figure 1-2** and include SCWA, Solano Irrigation District (SID), City of Vallejo, City of Fairfield, City of Vacaville, City of Dixon, City of Rio Vista, City of Benicia, Rural North Vacaville Water District (RNVWD), Maine Prairie Water District (MPWD), North Delta Water Agency and Reclamation District 2068 (RD 2068). Descriptions of the Solano Subbasin and the Suisun-Fairfield Valley Basin are provided below. These descriptions are partly based on the information contained in *California's Groundwater, Bulletin 118 Interim Update 2016* (DWR, 2016).

A portion of the Napa-Sonoma Lowlands Subbasin also occurs within Solano County, in the vicinity of Vallejo (**Figure 1-1**). Groundwater use in the Solano County portions of the Napa-Sonoma Lowlands Subbasin is very limited due to the availability of surface water supplied by the City of Vallejo. As such, the Napa-Sonoma Lowlands Subbasin is not a focus of this report.

1.2.1 Geography and Hydrogeology of the Solano Subbasin (Basin Number: 5-21.66)

The Solano Subbasin, located in the southernmost portion of the Sacramento Valley Groundwater Basin and extending into the northern portion of the Sacramento-San Joaquin Delta (Delta), is designated as a medium-priority subbasin by DWR. Subbasin boundaries are defined by Putah Creek on the north, the Yolo County line on the east, the North Mokelumne River on the southeast (from Walnut Grove to the San Joaquin River), and the San Joaquin River on the south (from the North Mokelumne River to the Sacramento River). The western Subbasin boundary is defined by consolidated rocks of the Coast Range and a groundwater divide present between the Sacramento Valley Groundwater Basin within the Sacramento River Hydrologic Region and the Suisun-Fairfield Valley Groundwater Basin within the San Francisco Bay Hydrologic Region. The largest municipalities located in the Subbasin include the cities of Vacaville, Dixon, and Rio Vista with an overall population density across the Subbasin of approximately 191 people per square mile.

For purposes of understanding and managing groundwater conditions in the Subbasin, there are two primary aquifer zones defined: 1) the Alluvial Aquifer and Upper Tehama zone, and 2) the Basal Tehama zone. The Quaternary alluvium, Montezuma Formation, and Upper Tehama have similar hydrogeologic characteristics and behave as a hydraulically connected aquifer zone and represent a single primary aquifer referred to as the Alluvial Aquifer and Upper Tehama zone (Alluvial/Upper Tehama zone). The

[1] 20% of the Solano Subbasin is located within Sacramento County. 1% of the Solano Subbasin is located within Yolo County. Less than 1% of the Suisun-Fairfield Valley Basin is located within Napa County.

Basal Tehama zone, which coincides with the Basal Tehama formation is generally found at great depth and under confined (i.e., under pressure) conditions within the Subbasin, except for along parts of the western Subbasin boundary where it is steeply dipping and crops out at the surface. The Basal Tehama zone is not utilized for water supply throughout the entire subbasin, but primarily only used in the vicinity of Vacaville. The Middle Zone of the Tehama Formation, or Middle Tehama, is generally fine-grained with only relatively thin sandy intervals of limited lateral extent. As a result, the Middle Tehama does not serve as a major water-yielding unit in the Subbasin. Because of its fine-grained nature, the Middle Tehama functions as an aquitard in much of the Subbasin, confining the underlying Basal Tehama zone and limiting vertical movement of water between the shallower Alluvial Aquifer and Upper Tehama zone and the deeper Basal Tehama zone.

The hydrogeologic conceptualization of the Solano Subbasin is described in detail in the GSP (LSCE, 2021). This conceptualization includes fundamental descriptions of the groundwater system and hydrogeologic setting including topography, surface water bodies, soils, regional and structural geologic setting and features, extent of the groundwater subbasin (laterally and vertically), identification and discussion of configuration and characterization of major aquifers and aquitards, presentation of groundwater recharge and discharge areas, and identification of surface water and imported water supply sources.

The eastern part of Solano County and Solano Subbasin overlies the southern Sacramento Valley portion of the larger Great Valley geologic province of California. The sedimentary deposits in the Sacramento Valley contain fresh groundwater extending to an elevation of approximately -3,000 ft mean sea level (msl) along the axis of the basin. The mountainous Coast Range geologic province provides the western boundary for the Sacramento Valley and is composed largely of Mesozoic rocks (before 66.5 million years before present (mybp)). The uppermost Mesozoic marine sedimentary rocks (the Great Valley Sequence) extend beneath the Sacramento Valley eastward to pinch out and overlap the older Mesozoic metamorphic and granitic rocks of the Sierra Nevada geologic province from the east. The Mesozoic marine rocks have been explored and tapped into for natural gas resources and do not contain freshwater and are well-consolidated.

Above the Mesozoic marine sedimentary rocks in the southern Sacramento Valley is a sequence of Cenozoic marine deposits of Tertiary age (66.5 to 5.3 mybp). Local surface exposure of these units occurs along the edge of the Sacramento Valley near the City of Vacaville, where they are deformed by faulting. Relatively younger Cenozoic non-marine sedimentary units include deposits sourced from basin margin alluvial fans from the Coast Range to the west and the Sierra Nevada to the east. These alluvial fan deposits transition basin-ward to broad, low-gradient alluvial plains crossed by distributary stream channels and an axial basin of a fluvial system of wide floodplain and flood basin areas with south-draining river channels. These nonmarine sedimentary deposits are poorly stratified and typically thin, discontinuous, laterally limited sand to gravel beds interstratified with thicker fine-grained clays and silt beds.

Most of the Cenozoic nonmarine sedimentary deposits in Solano County and the Solano Subbasin are attributed to the Tehama Formation. The Tehama Formation extends to the base of freshwater on the eastern side of the Coast Range. Overlying the Tehama Formation in Solano County and Solano Subbasin is a sequence of younger Quaternary alluvial deposits. **Figure 1-4** illustrates the surficial geology of northern Solano County and Solano Subbasin. A schematic hydrostratigraphic interpretation of the subsurface crossing Solano County from the Coast Ranges going eastward across the Central Valley to the Sierra Nevada foothills is provided in **Figure 1-5**. This cross section illustrates the relative thicknesses of the various geologic units described above that occur below Solano County, and the order of their appearance and deposition. More details on the hydrogeology of Solano County and the Solano Subbasin are described in the GSP.

1.2.2 Geography and Hydrogeology of the Suisun-Fairfield Valley Basin (Basin Number: 2-3)

The Suisun-Fairfield Valley Groundwater Basin is located in an area of low alluvial plains to the west of the Solano Subbasin and directly north of Suisun Bay. Geologic formations of the Coast Range bound the Subbasin on the west. The southern extent of the Vaca Mountains forms the northern boundary of the Subbasin. The eastern margin of the Basin is delineated by the groundwater divide following low ridges of consolidated rock that outcrop near Vacaville and extend southeast to the Montezuma Hills (Thomasson et al, 1960). The Suisun-Fairfield Valley Basin is adjacent to the Suisun Bay in the south and surface water features in the Basin, including Suisun Creek and Laurel Creek, drain into the Suisun Bay. The main groundwater-bearing geologic units in the Basin include the Tertiary Sonoma Volcanics, Pleistocene alluvium, and Recent (Quaternary) alluvium. Although there is relatively little reliance on groundwater as a source of water supply in the Basin, the Pleistocene alluvium is the main water-yielding unit in the Basin, although the Recent (Quaternary) alluvium provides some water to wells in the north, and many of the deeper wells in the western portion of the Basin are constructed in the Sonoma Volcanics. The Basin encompasses part of the City of Vacaville and also includes Fairfield and Suisun City, although these cities do not rely to a great degree on groundwater pumped from within the Basin.

1.2.3 Areas Outside of Solano Subbasin and Suisun-Fairfield Valley Basin

There is an area within Solano County west of the Solano Subbasin between the Subbasin boundary and the Lagoon Valley/Vaca Valley fault in which some groundwater development has occurred, but which does not lie within a designated basin or subbasin area. This area is generally underlain by more consolidated rocks of the Great Valley Sequence, which have limited water-yielding characteristics.

1.3 Solano Subbasin Groundwater Sustainability Planning

Five GSAs in the Solano Subbasin organized to form the Solano Collaborative to sustainably manage groundwater in the Subbasin: Solano Subbasin GSA, City of Vacaville GSA, Northern Delta GSA, Sacramento County GSA, and Solano Irrigation District GSA. The Solano Collaborative, together with five other GSAs in the Subbasin, submitted a GSP for the Solano Subbasin in January 2022 and the GSP was approved by DWR in January 2024. The GSP describes historical and recent groundwater conditions based on available data at the time of the GSP development and outlines the approach to ensuring sustainable management of groundwater in the Subbasin. This annual report provides an update of information on groundwater conditions and status of GSP implementation efforts in the Subbasin through the most recent water year.

2 GROUNDWATER-RELATED MONITORING

Groundwater-related monitoring data were assembled for this report from various entities and used to update the existing Data Management System (DMS). Groundwater-related monitoring data documented in this report include information related to the five sustainability indicators relevant to the sustainability of the Solano Subbasin, as described in the GSP. These indicators include groundwater levels (including groundwater storage), groundwater quality, land subsidence, and interconnected surface water. Seawater Intrusion is not directly applicable to the Solano Subbasin although potential impacts that could conceivably occur as a result of intrusion of higher-salinity surface water from Delta surface water features is addressed through groundwater quality monitoring.

Monitoring data were assembled from the following entities (**Tables 2-1 and 2-2**):

- Groundwater Levels/Groundwater Storage
  - DWR
  - SCWA
  - City of Vacaville
  - Sacramento County
  - Solano Irrigation District (SID)
  - State Water Resources Control Board (SWRCB) GeoTracker
  - Rural North Vacaville Water District (RNVWD)
  - United States Bureau of Reclamation (USBR)
- Groundwater Quality (selected constituents)
  - DWR
  - U.S. Geological Survey (USGS)
  - SID
  - SWRCB Division of Drinking Water (DDW)
  - SWRCB GeoTracker
- Land Subsidence
  - SCWA
  - UNAVCO[2] Plate Boundary Observatory (PBO) stations
  - DWR
- Interconnected Surface Water
  - SCWA

2.1.1 Groundwater Levels and Change in Storage

Solano Subbasin has a long history of monitoring groundwater with groundwater level data going back to 1918. Early monitoring was limited mostly to the northern portion of the Subbasin where more agricultural and urban areas exist. **Table 2-1** summarizes recent groundwater level monitoring since 2015. As highlighted in **Table 2-1**, most of the recent groundwater level monitoring in the area are

[2] UNAVCO is "a non-profit university-governed consortium, facilitate(ing) geoscience research and education using geodesy." (http://www.unavco.org/about/about.html)

within the Alluvial Aquifer and Upper Tehama aquifer zone where most of the groundwater production occurs in Solano County and the Solano Subbasin. **Figure 2- 1 to 2-3** shows the spatial distribution of recent groundwater level monitoring across the County and Subbasin. Monitored wells screened in the Alluvial/Upper Tehama Zone are located throughout the Subbasin but are predominately located in the northern parts of the Solano Subbasin. Wells monitoring groundwater level conditions in the Basal Tehama zone are more limited to areas where greater groundwater production occurs from this deeper zone, especially in the Vacaville area.

The Solano Subbasin GSP identified select wells for use as representative monitoring sites (RMS) and assigned sustainable management criteria (SMC) to these RMS to track groundwater sustainability in the Subbasin. A total of 41 wells were selected as RMS wells with an additional 161 wells identified as part of the supplemental monitoring network to track groundwater levels and change in storage in the Subbasin. The selection of the RMS wells and supplemental monitoring network wells in the GSP was based on considerations related to spatial distribution (both laterally and vertically), availability of well construction details, historical data record, and proximity to key beneficial users (**Figure 2-4 to 2-5**). These well networks form the backbone of the GSP monitoring for groundwater levels and change in storage although all available groundwater level monitoring data are incorporated in ongoing evaluations of groundwater conditions in the Solano Subbasin. Several water level RMS wells were recently dropped from DWR and USBR monitoring programs, which provided monitoring of these wells. Efforts to re-recruit these wells for the GSP monitoring program have been occurring; however, four of these wells have been determined to be destroyed or inaccessible and the Subbasin is considering removing these wells from the network and replacing them with nearby wells. Identification and vetting of potential replacement wells is in progress. Through coordination with other agencies and landowners four additional wells have been added to the supplemental network to address data gaps. As part of GSP implementation, GSAs in the Subbasin are actively working to ensure that monitoring at RMS wells is continued with additional emphasis on maintaining monitoring at all supplemental sites.

Table 2-1 Summary of Recent Water Level Monitoring (Since 2015)

Monitoring Entity	Monitoring Start Date	RMS (# of wells)		Supplemental Monitoring (# of wells)					Other Monitoring Network (# of wells)		
		Quaternary Alluvium/ Upper Tehama	Basal Tehama	Quaternary Alluvium/ Upper Tehama	Middle Tehama	Basal Tehama	Markley	Unknown	Quaternary Alluvium/ Upper Tehama	Basal Tehama	Unknown
Cal Water	5/3/1976	1	0	7	0	0	0	0	2	0	1
City of Vacaville	1/29/1973	1	4	4	0	13	1	0	0	1	0
DWR	6/9/1918	13	0	59	0	1	0	14	16	0	29
Dixon	7/1/2018	0	0	1	0	0	0	2	0	0	3
GeoTracker	6/22/1994	0	0	0	0	0	0	0	646	0	18
Rio Vista	7/1/2014	2	0	0	0	0	0	0	4	0	0
Sacramento County	1/1/1993	2	0	6	0	0	0	0	0	0	2
SCWA	9/17/2001	1	4	13	2	6	0	0	2	2	24
SID	11/3/1937	3	0	16	0	0	0	2	5	0	14
United States Bureau of Reclamation	7/23/1931	10	0	0	0	0	0	0	0	0	0
Total		**33**	**8**	**106**	**2**	**20**	**1**	**18**	**675**	**3**	**91**

2.1.2 Groundwater Quality

Across Solano County, there are over 500 wells where recent groundwater quality conditions have been monitored since 2015 (**Table 2-2**). The majority of recent groundwater quality data were obtained from the SWRCB (DDW and GeoTracker) for characterizing recent groundwater quality conditions. The data on GeoTracker include monitoring conducted for various regulatory programs; data from DDW include monitoring of public water system wells. Much of the available water quality information is located near areas of groundwater production for municipal and public supply and at sites where data are maintained on GeoTracker (**Figure 2-6**). Data provided by DDW for public supply wells generally do not include well construction information that is needed to classify the primary aquifer zone. An additional effort is required to locate any well construction information that may be available for wells with data available through DDW. As part of the GSP effort, 27 wells were selected to be part of the RMS network for groundwater quality and 225 wells were identified for inclusion in supplemental monitoring efforts related to water quality. The selection and identification of the RMS network and supplemental monitoring wells in the GSP were based on considerations related to spatial distribution (both laterally and vertically), availability of well construction details, historical data record, and proximity to key beneficial users (**Figure 2-6**). These well networks represent the foundation of the GSP monitoring for groundwater quality, although these networks will be evaluated as the GSP implementation progresses to ensure appropriate monitoring of groundwater quality is maintained and as specific locations of projects and management actions described in the GSP are identified. As part of GSP implementation, the Collaborative is actively working to ensure that monitoring at all RMS wells is continued with additional emphasis on maintaining monitoring at all supplemental sites.

Table 2-2 Summary of Recent Water Quality Monitoring (Since 2015)

Monitoring Entity	RMS (# of wells)			Supplemental Monitoring (# of wells)				Other Monitoring Network (# of wells)		
	Quaternary Alluvium/ Upper Tehama	Basal Tehama	Unknown	Quaternary Alluvium/ Upper Tehama	Basal Tehama	Markley	Unknown	Quaternary Alluvium/ Upper Tehama	Basal Tehama	Unknown
Ag Lands	2	0	0	0	0	0	0	0	0	2
Cal Water	1	0	0	3	0	0	0	6	0	0
City of Vacaville	1	2	0	0	6	1	0	0	2	0
DDW	2	0	0	5	0	0	0	3	0	0
Dixon	0	0	13	0	0	0	61	0	0	40
GeoTracker	1	0	0	0	0	0	4	0	0	0
RNVWD	0	0	0	108	0	0	34	424	0	7
SID	0	1	0	0	1	0	0	0	0	0
UCD	1	0	1	0	0	0	1	8	0	0
USGS	0	0	0	0	0	0	0	0	0	1
Total	8	3	14	116	7	1	100	441	2	61

2.1.3 Land Subsidence

The locations of historical land subsidence monitoring stations are illustrated in **Figure 2-7**, including SCWA's two stations (Dixon (DIXN) and Vacaville (VCVL)), and other nearby Continuous Global Positioning System (CGPS) stations. The two SCWA subsidence stations, VCVL and DIXN, started recording data in 2012, whereas the other CGPS stations began in 2004 or 2005. Four subsidence monitoring stations located in the Solano Subbasin are part of the GSP RMS network for land subsidence. Additional data on vertical displacement of the land surface are available from DWR surveys conducted using remote sensing InSAR (Interferometric Synthetic Aperture Radar) technology. These data are available at different time intervals to supplement and compare with the high-resolution land subsidence monitoring stations.

2.1.4 Interconnected Surface Water

SCWA has a network of stream stages and gages located along the numerous small creeks found in Solano County, particularly in the northern and western areas of Solano County (**Figure 2-8**). Additionally, an extensive monitoring network exists along Putah Creek. Flows in Putah Creek within the Solano Subbasin are regulated through releases from Lake Berryessa and Lake Solano with specific flow requirements throughout the year that vary by month and water year type, including specific flow requirements for drought years as outlined in the Putah Creek Accord (**Appendix A**). The GSP RMS network for monitoring interconnected surface water includes seven wells located near surface water features and key surface water gages along Putah Creek within the Subbasin (**Figure 2-8**). Five supplemental monitoring wells are also included in the monitoring network related to tracking groundwater and surface water relationships.

2.1.5 Data Gaps

A detailed description of data gaps is provided in **Sections 3 and 6 of the Solano GSP** (LSCE, 2022). As part of Technical Support Services (TSS) provided to the Solano Subbasin by DWR, a total of 10 new monitoring wells of varying depths at five different sites were installed in late 2021 and early 2022 to fill data gaps identified in the Solano Subbasin. The wells are supporting monitoring for groundwater level, groundwater water quality, and interconnected surface water conditions in key areas of the Subbasin. In 2023, the Subbasin continued outreach efforts to owners of wells in data gap areas. These outreach efforts involved coordination with GSAs and local entities and resulted in reinstating several wells in the GSP monitoring program and the addition of several new wells. **Figure 2-9** identifies the wells added to the monitoring network since the last annual report and data gaps identified in the Solano Subbasin. Many existing and additional monitoring facilities near to surface water features emphasize the collection of data necessary to evaluate relationships between groundwater and surface water resources consistent with SGMA including:

- Collecting groundwater and surface water data to detect changes in groundwater levels and groundwater quality and corresponding surface water stage, flow, and quality conditions.
- Collect groundwater and surface water data to establish baseline conditions that will facilitate assessments of the potential effects due to future climate change.

- Collect data to help identify mechanisms for and quantify exchanges of water between groundwater aquifers and surface waters, and responses of the hydrologic system to surface water and groundwater use.
- Provide surface water quality monitoring (including temperature and electrical conductivity) at existing monitoring sites along the Sacramento River and Delta Tributaries.
- Collect groundwater and surface water data that will enable water managers to avoid significant and unreasonable depletions of surface waters consistent with the requirements of SGMA.

3 GROUNDWATER CONDITIONS

3.1 Historical and Recent Hydrology and Climate

Figure 3-1 presents a graph of the historical annual precipitation and cumulative departure from the mean precipitation for the Davis meteorological station by water year (October 1-September 30). Unless otherwise noted, all years presented in this report refer to water years. The Davis station has a long and reliable historical record and exhibits trends similar to other meteorological stations in and around the Subbasin that have shorter periods of record. Rising segments of the cumulative departure curve indicate periods of wetter than average conditions while falling segments indicate dryer than average periods. Flatter slopes on the curve indicate periods of more average precipitation conditions. The DWR water year hydrologic classifications (water year type) for the Sacramento Valley based on Sacramento River watershed runoff characteristics are indicated on **Figure 3-1**. The water year types in order of wettest to driest include wet (W), above normal (AN), below normal (BN), dry (D), and critical (C). The Solano Subbasin and Solano County have historically experienced cycles of wet, dry, and average precipitation conditions. Notable dry periods since the 1960s include the late-1970s (1975-1977), late-1980s to early 1990s (1987-1992), and a longer-term drier than average trend from 1999 through 2023 with a few brief wet and average periods. Several wetter than average periods occurred in the late 1970s and early 1980s (1978-1983), much of the 1990s (1993-1998), with two very wet single years in 2017 and 2019. Water year 2020 was a dry year with only about 12.5 inches of precipitation in the Solano Subbasin area (as measured at the Davis meteorologic station) and 2021 was classified as a critical year with only 6.5 inches of precipitation, less than half of average precipitation measured at the Davis station (average at Davis is about 18.4 inches). Water year 2022 had an annual average precipitation recorded at the Davis Station of about 19.1 inches and was similar to the long-term average; however, approximately 75 percent of the precipitation in 2022 occurred during the months of October 2021-December 2021 and the water year was classified as a critical year. Water year 2023 has been preliminarily classified by DWR as a wet year for the Sacramento Valley region, with annual precipitation at the Davis station exceeding the long-term average by approximately 10 inches (about 150 percent of average).

Groundwater conditions presented below focus on conditions during recent years, especially the last water year (2023). The influence of the prolonged period of drier than average conditions since about 2000 and the very dry hydrology that has occurred in the Subbasin during water years 2020 and 2021 is still evident in groundwater conditions in some areas of the Solano Subbasin and County. The occurrence of such dry years is not unusual in the area, as seen in historical precipitation data presented in **Figure 3-1**. The response of conditions to the higher precipitation during water year 2023 are evident in many areas, although the effect of the increased recharge and reduced demand from the wetter conditions in 2023 is likely not yet fully reflected by conditions presented in this report. The historical hydrology and the variability in the hydrology are important considerations when evaluating groundwater conditions and trends. A representative base period from 1988 to 2018 was selected for evaluation of conditions in the Solano Subbasin GSP because it is approximately representative of average long-term hydrologic (e.g., precipitation) conditions in the area.

3.2 Groundwater Levels

This section presents recent groundwater level conditions in Solano County and the Solano Subbasin. Groundwater level monitoring includes data from RMS wells in addition to supplemental monitoring being conducted and data collected from publicly available data sources. These data were used to prepare groundwater elevation contour maps and time-series graphs of groundwater levels.

3.2.1 Groundwater Elevation Contour Maps

Groundwater elevation contours for spring and fall water level conditions in 2023 for each of the primary aquifer zones in the Solano Subbasin (and select areas of Suisun-Fairfield Valley Basin) are presented on **Figures 3-2 to 3-5**. Groundwater elevation contours for all other years from 2015 through present are included in **Appendix B**. For contouring seasonal high and low conditions, spring conditions are representative of seasonal high groundwater level conditions and include the maximum observed water level elevation during the period February 1 to May 1. Seasonal low groundwater level conditions are represented by fall conditions based on the minimum static water level observed during the period September 1 to December 1. Although the fall observation period spans two water years, fall conditions as defined by this time period are believed to be most representative of the seasonal low conditions related to the water year ending September 30 of each year. The groundwater elevation contour maps were developed using all available groundwater elevation data related to each time period and for each primary aquifer zone. Only wells with known construction information or sufficient information to assign them to a primary aquifer were included in the contouring.

Prevailing groundwater flow directions in the Solano Subbasin within the Alluvial Aquifer and Upper Tehama zone tend to be from west/northwest to east/southeast away from the English Hills and Montezuma Hills towards the Sacramento River and Delta as indicated on contour maps. In the deeper confined Basal Tehama zone, there are fewer groundwater level data, but groundwater gradients indicate flow is generally to the southwest towards the City of Vacaville, largely because this is the area where the most historical groundwater pumping in the Basal Tehama zone has occurred.

3.2.2 Groundwater Levels Trends

Overall long-term trends in groundwater levels are stable in the Subbasin with some declining levels evident in localized areas of the Subbasin, most notably in the northwestern part of the Subbasin. Groundwater levels exhibit declines during drought periods and recovery during and after wet periods with seasonal fluctuations observed throughout the Subbasin as a result of the cyclic annual trends in groundwater pumping for urban and agricultural uses during the irrigation season. The Subbasin has experienced a prolonged drier-than-average period since about 1999; this is evident in many hydrographs, although many wells exhibit recovery from recent wetter years in 2017, 2019, and 2023.

Selected groundwater level hydrographs for different parts of the groundwater system are presented in **Figures 3-6a** to **Figure 3-8b** to illustrate temporal trends in groundwater levels across the Subbasin. Select groundwater level hydrographs are grouped and presented on separate figures for wells in the Alluvial deposits, Upper Tehama formation, and the Basal Tehama formation. Although hydrographs for wells in the Alluvial and Upper Tehama geologic units are presented on separate figures, as noted above, these two units have similar characteristics and behave as one hydraulically continuous primary aquifer zone referred to as the Alluvial Aquifer and Upper Tehama zone.

Additional groundwater level hydrographs, including for all RMS, are presented in **Appendix C**.

3.2.2.1 Alluvial Aquifer and Upper Tehama Zone

Select hydrographs for the alluvial deposits and other shallow deposits comprising part of the Alluvial/Upper Tehama Zone are displayed in **Figures 3-6a** to **3-6c** organized by wells in the northern, central, and southern parts of the Subbasin. **Figures 3-7a** to **3-7b** present select hydrographs for wells screened in the Upper Tehama part of the Alluvial/Upper Tehama Zone. **Figures 3-6a** and **3-7a** present hydrographs for wells in the northern portion of the Solano Subbasin where there are more wells, including many of the wells with the longest historical periods of record. **Figures 3-6b** and **Figure 3-7b** present select water level hydrographs for the alluvial deposits in the central portion of the Subbasin and **Figures 3-6c** presents wells in the southern portion of the Subbasin.

The influence of the completed Solano Project in the late 1950s on historical groundwater levels is evident in many of the hydrographs for the Alluvial Aquifer and Upper Tehama zone. A remarkable rise in groundwater levels in the early 1960s is apparent in many wells resulting from the increased availability of surface water and decreased reliance on groundwater in large parts of the Subbasin. This rising groundwater level trend during the 1960s coincided with a period of generally average to below average precipitation in the Subbasin. After the dramatic rise in groundwater levels in the 1960s, most hydrographs in the Alluvial Aquifer and Upper Tehama zone mimic the precipitation trends with periodic rising and falling levels in response to wetter and drier periods. Groundwater levels appear stable in most of the Alluvial Aquifer and Upper Tehama zone with groundwater depths less than 100 feet bgs and considerably shallower in many areas. Periods of drought in the Solano Subbasin are evident in falling groundwater levels in the mid- to late-1970s, from 1987 to 1992, and more recently over the period 1999 to 2016, culminating with five below average precipitation years during 2012 through 2016, three of which were dry or critical years, and then additional dry and critical years from 2020 through 2022.

Groundwater levels in the Alluvial Aquifer and Upper Tehama zone in northern portion of the Subbasin (**Figures 3-6a and 3-7a**) exhibit greater fluctuations over time relative to groundwater levels in the central and southern parts of the Subbasin. In the northern portion of the Subbasin, groundwater levels are heavily influenced by droughts, seasonal fluctuations, and pumping**.** The long-term groundwater level trends in the Alluvial Aquifer and Upper Tehama zone do not indicate any widespread chronic groundwater level declines, although groundwater levels in a number of wells have been declining recently as a result of the relatively dry conditions experienced since 1999. Declining water levels in some parts of this area are evident in hydrographs for wells, including 08N01E33Q002M, 07N01E11M001M, 07N02E15E001M, 07N01W05R001M, and 07N01E04P003M, which show declining levels starting around 2000. Recent recovery of groundwater levels is evident in many of these declining wells in response to two wet years in 2017 and 2019, although additional dry years in 2020 and 2021 may counterbalance the longer-term influence of these wet years on groundwater levels. One notable outlier to the groundwater level trends exhibited by most other wells in the Alluvial Aquifer and Upper

Tehama zone occurs in well 07N01W06E001M (**Figure 3-7a**), which shows relatively stable groundwater levels from the early 1930s through the late 1970s, but it has been progressively declining since. This well is located near the western edge of the Subbasin and is likely constructed in an area where the primary water-yielding geologic units are thinner and more consolidated. The nature and cause of localized declining groundwater levels in this area are being further monitored and evaluated.

Although there are fewer wells in the Alluvial Aquifer and Upper Tehama zone with longer periods of water level records in the central and southern parts of the Subbasin, the select hydrographs for those wells with available data suggest stable groundwater levels with minimal seasonal or longer-term groundwater level fluctuations or changes, and shallow groundwater is typically less than 20 feet bgs (**Figures 3-6b and 3-6c; and Figure 3-7b**). As presented on **Figure 3-6c**, one well (4N02E22P001M) in the southern part of the Subbasin is exhibiting longer-term declines in groundwater levels since the mid-1970s. This well is located in the Montezuma Hills, which is a topographically high area formed by the Montezuma Formation. The geology in this area is somewhat more consolidated and finer-grained compared to the underlying Tehama Formation and Quaternary Alluvium. The declining groundwater levels evident in this well may be a result of the local hydrogeologic characteristics of the Montezuma Formation and its lower water-bearing capacity.

3.2.2.2 Basal Tehama Zone

Development of the Basal Tehama zone for groundwater supply occurred after development of the Alluvial Aquifer and Upper Tehama zone. As a result, historical groundwater level monitoring in the Basal Tehama zone does not extend back as far in time. **Figures 3-8a and 3-8b** present select hydrographs for wells screened in the Basal Tehama zone. All of the hydrographs presented on these figures are for wells with depths greater than 1,000 feet and sometimes greater than 2,000 feet. As noted in previous sections, the Basal Tehama zone is under confined conditions throughout most of the Subbasin and in all of the wells presented on **Figures 3-8a and 3-8b**. Therefore, the groundwater elevations presented on the hydrographs are potentiometric elevations reflecting the height to which water rises in the aquifer when penetrated by a well. Changes in the groundwater elevations shown on these hydrographs do not represent desaturation or re-saturation of the Basal Tehama, but they are a function of reduced pore pressure in the aquifer and the effects of the compression and expansion of the aquifer matrix and pore water. Large changes in groundwater elevation can result from relatively small changes in storage in a confined aquifer.

Groundwater elevations in most wells in the Basal Tehama zone exhibit considerable declines during the period from 2000 to 2010 (**Figure 3-8a and 3-8b**). This is largely because of the redistribution in the location of pumping from the Basal Tehama that occurred in the vicinity of the City of Vacaville during this period in an area where the Basal Tehama zone had previously been undeveloped. Most of the Basal Tehama wells presented on **Figures 3-8a and 3-8b** show stabilization and indication of reaching a new equilibrium in the groundwater levels over the last decade at least since 2010. This stabilization in groundwater levels is believed to be a result of the natural stabilization and equilibration of recharge flow paths over time since the initial development of the aquifer occurred.

One deep monitoring well in the Basal Tehama zone located north of Vacaville and west of Interstate 505 (SCWA Allendale MW-1235) (**Figure 3-8a**) shows declining levels (about 30 feet) since 2010. This trend is similar to what is exhibited by shallower wells in this general part of the Subbasin and is consistent with the generally drier conditions over the period. Although the trend in this well continues to be monitored and evaluated, it is possible the Basal Tehama in this area of the Subbasin may be more closely hydraulically connected to the shallower part of the groundwater system, have more limited water-yielding characteristics, and receive more limited recharge. As a result, groundwater levels in this well may reflect greater influences from climatic conditions and associated demands on groundwater. However, climatic influences on recharge to the Basal Tehama is likely to be strongly attenuated because of the longer travel times from the recharge source to reach the Basal Tehama zone in most areas of the Subbasin. As with the Alluvial Aquifer and Upper Tehama zone, long-term trends in groundwater levels in this area will continue to be monitored and evaluated.

3.2.2.3 Groundwater Level Trends by Depth

Figures 3-9a and **3-9b** present hydrographs for multiple-completion nested monitoring wells in the central and northern parts of the Subbasin. These hydrographs compare groundwater elevations between monitoring wells screened at different depths at the same location and illustrate some of the unique behavior of groundwater levels by depth zone. The numbers in the well names on **Figure 3-9a** refer to the total depth of each well. **Figure 3-9b** present data for shallower nested monitoring wells located adjacent to surface water features.

3.2.2.3.1 SCWA Nested Monitoring Wells

SCWA has dedicated nested monitoring wells at sites across the Subbasin for tracking groundwater conditions at different depths and locations within the Subbasin.

Allendale Monitoring Wells

The SCWA Allendale monitoring wells in the northwestern part of the Subbasin range in depth from 1,235 feet to 1,925 feet and all are screened in the Basal Tehama. The vertical gradient across these depth intervals is downward (elevations decrease with increasing depth) with potentiometric elevation differences between the shallowest and deepest wells ranging of from about 60 feet in 2008 to 27 feet in 2023. The shallowest well exhibits greater seasonal fluctuations in potentiometric elevation than the two deeper wells and also exhibits greater declines of about 46 feet between 2008 and 2023. The middle well (Allendale MW-1345) has little seasonal fluctuations in water levels, but water levels have also been declining in this well since 2008, although at a slightly slower rate than in the shallower well. Groundwater levels in the deepest well (Allendale MW-1925) also show seasonal fluctuations but have been largely stable over the period of record between 2008 and 2023. Water levels increased slightly in all wells at the site during 2023.

RNVWD Monitoring Wells

The RNVWD monitoring wells are somewhat shallower than those at the SCWA Allendale site and include a mixture of wells screened in the Middle Tehama (MW-446 and MW-594) and deeper wells in the confined Basal Tehama zone (MW-862 and MW-1389) with depths ranging from 446 feet to 1,389 feet. The vertical gradient between the three shallowest wells is downward (groundwater surface elevation decreases with increasing depth); however, the deepest well (MW-1389) has a groundwater elevation that is similar to the two shallowest wells at the site (MW-446 and MW-594) and higher than the other Basal Tehama well (MW-862) indicating an upward vertical gradient at great depth within the Basal Tehama. All of the wells exhibit similar trends in groundwater levels over the period of record; these include similar magnitude of seasonal fluctuations and longer-term trends, including declining levels from 2002 through about 2008 and stable levels from 2008 to 2023. Water levels increased slightly or were approximately stable in all wells at the site during 2023.

Dixon Monitoring Wells

The SCWA Dixon monitoring wells range from 1,200 feet deep to 2,370 feet deep with the shallowest of the wells (MW-1200) screened in the upper part of the Basal Tehama zone and the other two wells completed within the lower parts of the Basal Tehama. MW-1200 exhibits seasonal fluctuations of 50 to 60 feet, which are quite distinct from the trends in the deeper wells in which groundwater levels show little or no seasonal change. The greater seasonal fluctuations in MW-1200 likely reflect the influence of regional pumping. As a result of the seasonal fluctuations in groundwater levels in MW-1200, the vertical hydraulic gradient between these wells is downward during the winter and spring periods and shifts to an upward gradient between the MW-2212 and MW-1200 during the summer and fall months. A consistent difference in head of about 20 feet is evident between the MW-2212 and MW-2370 wells, although the difference in the depths of these wells is only about 150 feet. The long-term trends in groundwater elevations exhibited in all wells at this site are stable over the period of record from 2009 to 2022. Water level data are not currently available for 2023 because of difficulties accessing data from the monitoring instrumentation in the wells at the site. Data for 2023 will be included in future reporting if they are able to be retrieved.

Maine Prairie Monitoring Wells

The SCWA Maine Prairie monitoring wells range from 840 feet deep to 2,170 feet deep with the shallowest well (MW-840) screened in the undifferentiated Upper/Middle Tehama and the other two wells within the Basal Tehama zone. This site is approximately six miles south of the Dixon site and exhibits very similar trends in groundwater levels. MW-840 in the Upper/Middle Tehama formation has higher groundwater elevations than the deeper wells in the Basal Tehama and also shows considerable seasonal groundwater level fluctuations, typically between 60 to 70 feet. The greater seasonal fluctuations in MW-840 are likely a reflection of greater pumping occurring in the shallower part of the groundwater system in this part of the Subbasin. The two Basal Tehama wells at this site have nearly identical groundwater elevation trends. All of the wells at this site exhibit long-term stability in groundwater level trends over the period of record from 2008 to 2022. Water level data are not currently available for 2023 because of difficulties accessing data from the monitoring instrumentation in the wells at the site. Data for 2023 will be included in future reporting if they are able to be retrieved.

Meridian Monitoring Wells

The SCWA Meridian monitoring wells are located southeast of the City of Vacaville and include two wells in the shallower part of the Tehama Formation (Upper/Middle Tehama) and one well in the Basal Tehama zone with depths ranging from 400 to 1,680 feet. The two Upper/Middle Tehama wells (MW-400 and MW-825) exhibit nearly identical groundwater elevation trends that are relatively stable at about 60 feet msl with periodic influences from nearby pumping activity evident as relatively shorter-duration drawdown and recovery cycles. The deeper Basal Tehama well (MW-1680) has groundwater elevations and seasonal fluctuations that are very distinct from the shallower wells, with groundwater elevations approximately 100 feet below levels in the Upper/Middle Tehama wells. Seasonal groundwater level fluctuations in MW-1680 are typically about 20 feet and are greater than in the shallower wells, although some of the short-term pumping influences in the Upper/Middle Tehama wells exceed 20 feet. Like MW-400 and MW-825, the Basal Tehama also shows long-term stability in groundwater levels at this site during the 2008-2023 period. Water levels increased slightly in all wells at the site during 2023.

3.2.2.3.2 Solano Subbasin GSA Nested Monitoring Wells

The Solano Subbasin GSA (SSGSA) installed and monitors dedicated nested monitoring wells at five sites to track groundwater conditions in select areas of the Subbasin near surface water features. In 2021 and 2022 SSGA had ten wells installed by DWR at five sites with DWR Technical Support Services assistance. These monitoring wells have been equipped with automated water level monitoring instrumentation for continuous monitoring of groundwater levels. Four of the SSGSA monitoring sites are along Putah Creek and one site is along Lindsey Slough near the Delta. Each of the sites have two wells at different depths, a shallower well with depths ranging from 25 to 75 feet deep and a deeper well with depths ranging from 71 to 109 feet deep, with well designs based on site-specific conditions. Hydrographs of groundwater levels in SSGSA monitoring wells are presented in **Figure 3-9b** and observations of groundwater level trends are discussed in the sections below.

As additional data are acquired from monitoring at these sites, more thorough analyses of relationships between groundwater and surface water at each site will be conducted. The SSGSA wells are planned for inclusion as RMS in the GSP monitoring program once sufficient data are available to assign appropriate SMC. SCWA installed shallow seepage monitoring wells in 2020 at the same four sites along Putah Creek. An in-depth characterization of groundwater conditions and the relationships between surface water and ground at these sites, including incorporation of data from the seepage monitoring wells, is planned as part of addressing data gaps in the Subbasin.

<u>SSGSA-01</u>

Monitoring site SSGSA-01 is located adjacent to Putah Creek approximately one mile downstream of Lake Solano. The automated water level instrumentation in the shallow well at this site experienced technical issues during the initial months of monitoring and currently only has data since July 2023. From available groundwater level data in the wells at the site, levels in the shallower well (SSGSA-01a; 56 feet deep), suggest a strong hydraulic connection with the nearby stream, as evidenced by the sharp changes in water levels in response to storm events and streamflow conditions, with lesser seasonal variability in levels than in the deeper well. In contrast, the deeper well (SSGSA-01b; 90 feet deep) exhibits larger seasonal variability in water levels with a more muted response to streamflow conditions, suggesting a stronger influence from the regional changes in groundwater levels associated with seasonal conditions and groundwater pumping activities.

SSGSA-02

Monitoring site SSGSA-02 is located adjacent to Putah Creek directly south of downtown Winters and approximately 3/4 mile downstream from SSGSA-01. Groundwater level data in the wells at the site suggest a greater influence from the regional changes in groundwater levels associated with seasonal conditions and groundwater pumping activities in both the shallow well (SSGSA-02a; 60 feet deep) and the deeper well (SSGSA-02b; 109 feet deep) than from the nearby stream, although water levels in the shallower well do indicate a stronger response to high streamflow events than the deeper well. A seasonal change in groundwater levels of between 20 and 40 feet is apparent in the deeper well over the two years of monitoring with a smaller change in the shallower well. The influence from nearby well pumping activities is apparent in the deeper well as oscillations in water levels superimposed on the longer-term trends in water levels. Water levels in the shallow well fall below the water level sensor in summer and fall months; however, the seasonal low water level in 2023 is about 20 feet higher than in 2022 in the deeper well.

SSGSA-03

Monitoring site SSGSA-03 is located adjacent to Putah Creek in the vicinity of the Interstate 505 crossing near the town of Winters and approximately 3/4 mile downstream from SSGSA-03. Groundwater level data in the wells at the site suggest very similar conditions in the deeper well (SSGSA-03b; 95 feet deep) as observed upstream in SSGSA-02b). Water levels in the deeper well appear to reflect regional changes in groundwater levels associated with seasonal conditions and groundwater pumping activities. The influence from nearby well pumping activities is apparent in the deeper well as oscillations in water levels superimposed on the longer-term trends in water levels. The shallow well (SSGSA-03a; 36 feet deep) exhibits water levels dominated by influences from the nearby stream. This is evident in abrupt increases in water levels during early periods of storm events (and high streamflow) with a subsequent recession curve after each storm period. Summer and fall water levels in SSGSA-03a appear to be supported by streamflow in the nearby stream with relatively small amounts of long-term change in groundwater levels.

SSGSA-05

Monitoring site SSGSA-05 is located adjacent to Putah Creek approximately five miles downstream from SSGSA-03. The shallower well (SSGSA-05a; 75 feet deep) and deeper well (SSGSA-05b; 100 feet deep) at this site show very similar groundwater level trends with influences apparent from the nearby stream and also from more regional and longer-term groundwater conditions affected by dynamics of groundwater demand and replenishment. Both wells exhibit a very similar and rapid response to storm events and streamflow conditions with abrupt rises in water levels and slower declines during the dry season. Water levels in the two wells diverge more during the summer and fall, with the deeper well showing slightly more declines, likely because of a combination of greater reflection of seasonal demands from the primary groundwater production zones in the area coupled with lesser influence from recharge by the nearby stream. Groundwater levels in the wells at the site increased by 5 or 6 feet between Fall 2022 and Spring 2023 with only 2 or 3 feet of lowering during the 2023 irrigation season between Spring and Fall 2023.

SSGSA-06

Monitoring site SSGSA-06 is located adjacent to Lindsey Slough in the more southern part of the Subbasin nearer the Delta. The shallow well at the site (SSGSA-06a) is 25 feet deep and the deeper well (SSGSA-06b) is 71 feet deep. In contrast to the four monitoring well sites along Putah Creek, groundwater levels in the deep well at SSGSA-06 tend to be several feet higher than in the shallower well suggesting some level of confinement of groundwater and an upward gradient within some of the relatively shallow parts of the groundwater system. Only for short periods during the winter and in direct response to high levels in the nearby slough, water levels in the shallow well are higher than in the deeper well. Neither well exhibits great seasonal variability in water levels, although seasonal changes in levels are greater in the shallower well with a more rapid response to precipitation and nearby surface water conditions.

3.3 Groundwater Quality

Recent groundwater quality data for key constituents of interest in Solano County and Solano Subbasin are presented in maps on **Figures 3-10a** through **3-15b**. These map figures show the recent (since 2015) average levels for total dissolved solids (TDS), nitrate as nitrogen (NO3-N), arsenic (As), chromium-6 (Cr6), chloride (Cl), and boron (B) measured in wells in the area.

The water quality data presented in this report represent untreated groundwater samples and should not be interpreted as reflective of the quality of treated drinking water supplied by any public water system. Drinking water served by public water systems must meet regulatory drinking water standards, which may involve water treatment or blending processes. Drinking water standards such as maximum contaminant levels (MCLs) or other water quality goals (for unregulated constituents) are referenced in this report to provide a point of comparison for understanding groundwater quality conditions. Primary MCLs are health-based standards and secondary MCLs are aesthetic standards.

3.3.1 Arsenic

Because of the natural hydrogeologic conditions, some notable areas of high arsenic concentrations in groundwater exist in parts of the County and Subbasin (**Figures 3-10a and 3-10b**). Elevated arsenic concentrations are apparent in the more southern parts of the Subbasin where the occurrences of historical maximum arsenic concentrations above the primary MCL of 10 µg/L are more common. Although some local areas of elevated arsenic concentrations exist in the more northern parts of the Subbasin, the arsenic levels in groundwater in the northern Subbasin are commonly less than 5 µg/L with some localized areas or depth horizons of the aquifer system exhibiting higher concentrations, most notably in and around parts of Vacaville and Dixon. A groundwater quality study conducted by the

USGS as part of the GAMA for the Southern Sacramento Valley, including the Solano Subbasin, found arsenic concentrations above the MCL in eight percent of wells sampled (Bennett et al., 2011). These higher concentrations are believed to be from natural sources and tended to occur near major river channels and in the Delta where naturally low dissolved oxygen concentrations in groundwater produce reducing geochemical conditions that increase the solubility of arsenic (Bennett et al., 2011).

3.3.2 Boron

Boron commonly occurs in groundwater as a result of the natural leaching process from rocks and soils in which groundwater travels or occurs. Average and maximum boron concentrations in Solano County and the Solano Subbasin since 2015 are shown on **Figures 3-11a and 3-11b** and suggest that boron levels in groundwater are below the Notification Level for drinking water of 1.0 mg/L throughout most of Solano County and Subbasin, with some areas of elevated levels. Boron does not have an established drinking water MCL. Boron concentrations in the northwestern part of the Solano Subbasin tend to be the lowest with generally increasing concentrations to the south and east.

3.3.3 Chloride

Historical chloride concentrations in groundwater in the Subbasin are relatively low in most areas as displayed on **Figures 3-12a and 3-12b**. Chloride concentrations in the northern Subbasin are typically less than 50 mg/L with nearly all well results suggesting concentrations below 100 mg/L. An area of relatively higher chloride concentrations is evident in the central and western part of the Subbasin, likely related to the geologic materials of marine origin that occur at shallower depths or at the surface along and to the west of the Subbasin in this area. Except for a few notable regulated facility sites, chloride concentrations within the Subbasin are generally below the secondary MCL of 250 mg/L. The generally low chloride concentrations across the Subbasin suggest little historical influence from any higher chloride concentrations that may have periodically occurred in the surface waterways of the Delta. Although elevated salinity and chloride concentrations have been observed in the Delta surface water during periods of major drought when freshwater outflows in the Delta were very low, no evidence of chronic intrusion of higher salinity surface water into the groundwater is apparent.

3.3.4 Chromium-6

No current MCL exists in California specific to chromium-6. An MCL of 10 µg/L for chromium-6 was rescinded in August 2017 and only the total chromium MCL of 50 µg/L is currently in effect. A recent proposed regulation to again establish the MCL for chromium-6 at 10 µg/L is in the process of undergoing review and public comment. Average and maximum recent concentrations of chromium-6 in groundwater are presented in **Figures 3-13a and 3-13b** and highlight several areas where concentrations are above 10 µg/L, including in Vacaville, Dixon, Winters, and south of Davis.

Chromium occurs naturally in groundwater throughout California, including parts of Solano County and the Solano Subbasin. When dissolved in groundwater, chromium can occur in both trivalent (Cr-3) and hexavalent (Cr-6) forms. Naturally-occurring chromium-6 can occur in association with serpentinite-containing rock or chromium containing geologic formations (SWRCB, 2017) that can be found in various metamorphic and igneous rocks common in the Coast Ranges throughout northern California.

Chromium can also occur in groundwater as result of localized contamination from industrial processes; however, chromium-linked industrial processes are not associated with any regulated soil and groundwater remediation sites (i.e., GeoTracker sites) in the County or Subbasin, including in the vicinity of municipal production wells where chromium-6 concentrations have been detected at elevated levels. Instead, it is likely that detections of chromium-6 in the Solano County are the result of natural occurrence and geochemical processes.

3.3.5 Nitrate

Data on nitrate concentrations in groundwater indicate many wells with high nitrate concentrations above the primary MCL of 10 mg/L exist along Interstate 80 between and around the Cities of Dixon and Davis, near Vacaville and Winters, and also dispersed more broadly across the northern Subbasin (**Figure 3-14a to 3-14b)**. Nitrate concentrations in groundwater are generally lower in the Suisun-Fairfield Subbasin and southeastern portion of the Solano Subbasin. Nitrate can occur naturally in groundwater, although typically at relatively low concentrations below the MCL. Elevated concentrations of nitrate can be associated with impacts from chemical fertilizers or animal waste (i.e., septic or manure). Considerable additional data on nitrate concentrations are now available within the Solano Subbasin as a result of the recent requirement (starting in 2022 calendar year) for nitrate testing of all domestic wells on parcels enrolled in the Irrigated Lands Regulatory Program (ILRP) as part of the ILRP Drinking Water Well Monitoring program (DWWMP). These additional DWWMP data suggest a larger spatial extent of areas affected by elevated nitrate concentrations than had previously been documented. The areas with elevated nitrate levels tend to occur where depth to groundwater is very shallow, notably in areas south and east of Dixon. A historical nitrate contamination plume from a former meat processing facility is known to exist in the vicinity of Dixon, although the extent of any relationship of this point source to the broader elevated nitrate concentrations east and south of Dixon is not documented and may warrant future consideration. In reviewing nitrate concentration data within the Subbasin in 2023, a surprisingly high number of wells sampled as part of the ILRP DWWMP had very low nitrate concentrations in 2022 with large spikes in concentrations in 2023. Whether this spike in nitrate is real or a result of a systematic data reporting error will be further investigated, including through coordination with the SWRCB, who are responsible for receiving and hosting these data. If an actual spike in concentrations did occur in these wells in 2023, additional investigation of the potential causes will also be conducted.

3.3.6 TDS

TDS provides a measure of the overall salinity of groundwater. High concentrations of TDS in groundwater can be the result of naturally occurring salinity, especially within aquifers comprised of sediments sourced from marine deposits such as those formations occurring at great depth in the Solano Subbasin or in the Coast Range. TDS concentrations tend to be lower in the more northern parts of the Subbasin with an increasing number of wells with higher TDS concentrations occurring in more southern parts of the Solano Subbasin near Montezuma Hills (**Figure 3-15a to Figure 3-15b**). Most of the wells in the Subbasin have recent historical TDS concentrations below the secondary upper MCL of 1,000 mg/L and many of the wells in the northern and central Subbasin have TDS concentrations below the recommended MCL of 500 mg/L. Localized areas of higher TDS concentrations in groundwater correspond to environmental monitoring wells at regulated sites, likely reflecting point source impacts to TDS concentrations.

3.3.7 Other Groundwater Quality Constituents

Maps of a variety of other groundwater quality constituents are presented in **Appendix D.** Many of these maps highlight distinct areas of local groundwater contamination that should be considered when evaluating potential groundwater quality impacts from implementation of projects and management actions to achieve sustainability. Wells with detections and exceedances for a variety of constituents, including anthropogenic contaminants like pesticides, solvents, and petroleum-related chemicals, are displayed in maps in **Appendix D**. Most notably, maps of DBCP, EDB, 1,2,3-TCP, naphthalene, and BTEX concentrations all indicate areas or locations with wells exceeding the respective drinking water MCLs. Additional contaminants such as aldicarb sulfone, atrazine, diazinon, simazine, and perchlorate have also been detected in areas of the Subbasin, although at concentrations below drinking water MCLs. Naturally occurring constituents such as uranium and manganese are also elevated in some wells with high uranium concentrations more apparent in the northern and central parts of the Subbasin and high manganese concentrations more common in the southeastern parts of the Subbasin. Uranium levels are generally below the MCL, except for one exceedance in the Delta area, whereas a greater number of manganese exceedances exist in the Subbasin.

3.4 Land Subsidence

Land subsidence is the sinking or settling of the land surface. Historical land subsidence caused by decomposition of peat soils has been documented in the Delta islands, including in parts of the southern Solano Subbasin. There are two general types of land subsidence: elastic and inelastic. Elastic subsidence is a reversible condition that can occur as a result of short- or long-term groundwater level declines in alluvial aquifers and the associated compaction of the aquifer matrix material that occurs when water is removed from pore spaces in the aquifer. With elastic subsidence, as groundwater levels recover, the condition is reversed (i.e., there is a rebound of the land surface). Inelastic subsidence is permanent subsidence that is not reversible. Inelastic subsidence caused by groundwater level declines results from the compaction of fine-grained materials (e.g., clay layers) in the groundwater system as the water held in these materials is released. Once the water has been expelled from the fine-grained materials, the layers compact and the water is permanently lost from these materials even when groundwater conditions change and the groundwater levels rise. Inelastic subsidence caused by groundwater depletion typically occurs after a period of chronic groundwater level or pressure declines that last for a prolonged period. There has been no documented ***inelastic*** subsidence in the Solano Subbasin. Seasonal or shorter-term declines in groundwater levels do not typically cause inelastic subsidence.

Land subsidence activity in Solano County and Solano Subbasin is monitored with CGPS stations and using remote sensing techniques (Interferometric Synthetic Aperture Radar [InSAR]) comparing the elevation of the land surface over time and generating vertical displacement results. Negative vertical displacement measurements indicate land subsidence and positive vertical displacement measurements indicate uplift.

3.4.1 CGPS Stations

The locations of long-term CGPS stations in and around Solano County and the Solano Subbasin are presented on **Figures 3-16a and 3-16b**. The CGPS stations are long-term and semi-permanent monitoring sites and collect highly accurate data on lateral and vertical positioning on a daily basis with records starting as early as 2005. CGPS surveying has an accuracy of less than 0.5 centimeter (cm) or about 0.2 inches (UNAVCO, 2010). The historical monitoring of the CGPS stations in the area has been conducted by SCWA and University NAVSTAR Consortium (UNAVCO) Plate Boundary Observatory (PBO), including installation and monitoring of two CGPS stations in June 2012 by SCWA to track land surface elevation conditions in the County and Subbasin. All ongoing acquisition and processing of monitoring data for CGPS stations is managed through UNAVCO PBO. Data and trends in vertical displacement monitoring from CGPS stations in and around the Solano Subbasin are summarized in **Table 3-1**. Information on the four CGPS stations included as GSP RMS for monitoring subsidence in the Solano Subbasin (DIXN, VCVL, P267, P266) and one station (P265) located just north of the Subbasin boundary, are presented in **Table 3-1**. For GSP reporting, vertical displacement data for CGPS stations are periodically acquired from UNAVCO PBO and updated to incorporate any changes to historical data made by UNAVCO PBO resulting from improvements in their data processing. As a result, some of the CGPS vertical displacement data presented in this report may differ slightly from what was presented in previous reports.

Data from the CGPS station located at the SCWA nested monitoring well site in Dixon (DIXN) exhibit an annual vertical displacement (change in elevation) behavior marked by a generally sinusoidal pattern with lower land surface elevations in summer and fall compared to winter and spring. This seasonal fluctuation pattern is typical of alluvial groundwater basins under natural and developed conditions as result of the seasonal cycles of draining and replenishment of the groundwater system during different seasons. The land surface elevation at the DIXN site has historically been relatively stable although an increased amount of negative vertical displacement (subsidence) is apparent at this site during WY 2021. Over the period of record from 2012 through 2023 the vertical displacement has generally been slightly negative at an average rate of only -0.0117 feet per year (ft/yr) or -0.14 inch per year (in/yr)) with only minimal total subsidence (-0.1322 feet or -1.6 inches) over the period of record for WY 2013 to 2023 (**Table 3-1**). Data from the CGPS station at the City of Vacaville MW-16 site (VCVL) indicate stable conditions over its historical record since June 2012 with very small seasonal fluctuations in land surface elevations throughout the year. The VCVL station has exhibited only a very slight downward trend in vertical displacement (-0.0054 ft/yr or -0.06 in/yr) and minimal total subsidence (-0.0541 feet or -0.65 inches) from 2012 through 2023 (**Table 3-1**). Over water years 2015 through 2023, the vertical displacement at the VCVL site has continued at a very small rate of subsidence (-0.0036 ft/yr or -0.0437 in/yr).

Station P266 is in the western part of the Subbasin near the Montezuma Hills and has recorded only very little vertical displacement of -0.1065 feet (-0.0058 ft/yr) since 2005. In the more central part of the Subbasin station P267 exhibits somewhat higher historical vertical displacement of -0.2393 feet (or -0.013 ft/yr) since 2005.

The CGPS stations show that the land surface elevation fluctuates seasonally by between 0.0659 and 0.0979 feet in areas of the Subbasin, with the higher fluctuations occurring in the central areas around the Dixon. At the four CGPS stations within the Subbasin the average annual rate of displacement is considerably less than typical season fluctuations. There is currently insufficient information to indicate whether the vertical displacement observed at the stations is reflective of inelastic or elastic conditions. Additional data after recovery from the prolonged drier than average period since 1999 and more extreme drought periods ending in 2016 is necessary to determine the nature of any subsidence observed in the Subbasin. The seasonal fluctuations indicate the magnitude of elasticity that can occur as a function of seasonal variability in conditions.

Table 3-1 Summary of Land Subsidence Monitoring

Station ID	Years of Record	Date Range Evaluated	Total Vertical Displacement (ft)	Rate of Land Surface Elevation Change (ft/yr)	WY 2015-2023 Total Vertical Displacement (ft)	WY 2015-2023 Rate of Land Surface Elevation Change (ft/yr)	Average Annual Seasonal Elevation Fluctuation[1] (ft)
Stations Located Inside Solano Subbasin							
DIXN	11	6/8/2012 - 9/30/2023	-0.1322	-0.0117	-0.1042	-0.0116	0.0979
VCVL	11	10/1/2014 - 9/30/2023	-0.0612	-0.0054	-0.0327	-0.0036	0.0784
P266	18	6/8/2012 - 9/30/2023	-0.1065	-0.0058	-0.0496	-0.0055	0.0659
P267	18	6/8/2012 - 9/30/2023	-0.2393	-0.0130	-0.1593	-0.0177	0.0675
Stations Located Outside Solano Subbasin							
P248	16	9/21/2007 - 9/30/2023	-0.0092	-0.0006	-0.0074	0.0008	0.0734
P256	19	10/28/2005 - 9/30/2023	-0.0568	-0.0031	-0.0361	-0.0040	0.0579
P261	19	6/4/2004 - 9/30/2023	-0.1089	-0.0056	-0.0691	-0.0077	0.0656
P262	19	3/30/2005 - 9/30/2023	-0.0281	-0.0015	-0.0035	-0.0004	0.0689
P264	18	5/13/2005 - 9/30/2023	-0.0392	-0.0021	-0.0488	-0.0054	0.0812
P265	18	8/27/2005 - 9/30/2023	-0.2765	-0.0153	-0.1503	-0.0167	0.0655
P268	18	4/11/2005 - 9/30/2023	-0.1842	-0.0100	-0.0878	-0.0098	0.0634
P271	19	6/8/2004 - 9/30/2023	-0.9941	-0.0515	-0.5526	-0.0614	0.1719

Station ID	Years of Record	Date Range Evaluated	Total Vertical Displacement (ft)	Rate of Land Surface Elevation Change (ft/yr)	WY 2015-2023 Total Vertical Displacement (ft)	WY 2015-2023 Rate of Land Surface Elevation Change (ft/yr)	Average Annual Seasonal Elevation Fluctuation[1] (ft)
P273	16	10/27/2005 - 12/26/2022	-0.1985	-0.0133	-0.1242	-0.0207	0.0833
P274	18-	10/28/2005 - 9/30/2023	-0.2365	-0.0132	-0.2205	-0.0245	0.0916

1 Annual fluctuation is calculated as the seasonal elevation variation occurring over a year spanning March to March.

Additional CGPS stations monitored as part of the UNAVCO PBO network exist around the Subbasin and the historical vertical displacement data at some of these stations are presented in **Figures 3-16a** and **3-16b.** Station P265 is located outside the Subbasin near Winters, just across the northern Subbasin boundary, and the other nearby PBO stations are located in the adjacent hills to the west or south of the Delta. The stations located outside the Subbasin provide a useful comparison for relating to the vertical displacement occurring at points within the Subbasin.

Station P265, located just north of the Subbasin boundary, has exhibited an average subsidence (negative displacement) of approximately -0.2765 feet (about -3.32 inches) over the 18 years of record. This translates to an estimated rate of vertical displacement of -0.0153 ft/year (-0.183 in/yr). Since 2016 the rate of vertical displacement has stabilized compared to earlier records. Stations P264 and P248 are located outside of alluvial basins and provide an interesting comparison of vertical displacement trends that are occurring in these geologic environments in areas less impacted by groundwater development. Sites P264 and P248 exhibit vertical displacement trends that are opposite to what is occurring at the sites within the Subbasin. These sites record positive vertical displacement during the drier periods and negative displacement during wet periods. This is likely because these stations are in more consolidated materials that do not experience compaction in the same way that less consolidated alluvial basin sediments do. Instead, these sites may be exhibiting the influence of hydrologic loading during wet periods and unloading during dry periods that correspond with the negative displacement in winter and spring and positive vertical displacement in the summer and fall.

These sites outside the Subbasin are not an indication of subsidence occurring within the Solano Subbasin, but they do provide context for how conditions outside the Subbasin relate to those observed within the Subbasin.

3.4.2 InSAR Data

InSAR mapping of land subsidence is particularly useful for observing and tracking spatial patterns in vertical displacement over an area. The National Aeronautics and Space Administration Jet Propulsion Laboratory (NASA JPL) has historically provided spatial data of vertical displacement of the land surface across the Central Valley from InSAR surveys, which DWR has published.[3] Some of these datasets cover parts of the Sacramento Valley, including the Solano Subbasin. **Figure 3-17** shows the vertical displacement of the land surface between June 2015 and June 2023. Data spanning this period suggest that vertical displacement of the land surface across most of the Solano Subbasin and Solano County is slightly negative at amounts between -0.025 and -0.1 ft with some areas of slightly greater negative values. Areas exhibiting the most negative vertical displacement (land subsidence) occur as red spots, and are located south of the Solano Subbasin near Montezuma Hills, in the Delta regions and south of Dixon and Davis in the Northern parts of the Solano Subbasin. The negative vertical displacement measured in the area of the Montezuma Hills using InSAR does not agree with the observations from CGPS station P266, which suggest very minimal subsidence (negative displacement of about -0.05 ft) in this area since 2015.

DWR has also published InSAR results in partnership with the European Space Agency's Sentinel-1A satellite with the data processed by TRE ALTAMIRA[4]. **Figure 3-18** presents a map of InSAR data representing the vertical ground surface displacement during the period October 2022 to October 2023 spanning WY 2023. InSAR data indicate that vertical displacement in the Solano Subbasin was relatively minimal during WY 2023 ranging from positive displacement to -0.05 feet (0.6 inches) with the areas of highest vertical displacement occurring west of Dixon and in the Montezuma Hills. Rates of vertical land surface displacement during WY 2023 are less than those in water years 2021 and 2022. InSAR data for previous water years 2019 through 2022 also suggest only limited negative vertical land surface displacement within the Solano Subbasin, primarily in areas to the south of Davis and Dixon (**Appendix B**).

Although small amounts of land subsidence have been observed historically and recently in the Solano County and Solano Subbasin, it is not currently an issue of significant concern in the Solano Subbasin or the Suisun-Fairfield Valley Basin because of the very small amount of historical subsidence and limited potential for impacts from land subsidence on surface infrastructure.

3.4.3 Comparisons of Vertical Displacement and Groundwater Level Data

Regional groundwater levels generally exhibit annual variability in response to climatic influences including precipitation or water year type in addition to anthropogenic influences such as groundwater pumping. Groundwater levels measured in wells and changes in land surface elevation can sometimes be correlated, depending on the depth of the wells and the hydrogeologic setting, including the characteristics of the geologic materials and their response to changes in groundwater levels or potentiometric surfaces. **Figures 3-19** and **3-20** illustrate the historical and recent relationship between land surface vertical displacement at the DIXN and VCVL CGPS sites and groundwater levels measured in monitoring wells at these sites or wells nearby. The dedicated monitoring wells located at these CGPS sites are relatively deep and water levels in nearby shallower wells are also presented for comparison with conditions in the shallower parts of the groundwater system.

[3] https://data.cnra.ca.gov/dataset/nasa-jpl-insar-subsidence and also https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer
[4] https://gis.water.ca.gov/arcgisimg/rest/services/SAR

Figure 3-19 presents vertical displacement (change in elevation) at the DIXN site in relation to groundwater levels in wells ranging from depths of 150 feet to 2,370 feet. The SCWA Dixon MW-1200 monitoring well is 1,200 feet deep and monitors groundwater levels in the upper portion of the Basal Tehama zone, which is a confined aquifer in this area. As a result, groundwater levels in this well can respond to very small changes in groundwater storage. Seasonal lows in groundwater levels in Dixon MW-1200 recovered after 2014 and 2016 lows, and changes in land surface elevation also initially stabilized after 2016. Land surface elevations started to decline slightly in 2021 and groundwater levels for Dixon MW-1200 dropped to between the 2014 and 2016 lows, but have shown recovery during 2022 and 2023. The other two deep nested wells located at this site have groundwater levels that are stable with little or no obvious correlation evident between groundwater levels and land surface elevation change. Although there has been stability in the groundwater levels in all of the nested monitoring wells at the site and little correlation to the longer-term trend of slight downward land surface elevation change, MW-1200 does exhibit more notable seasonal fluctuations that are consistent with seasonal ground surface elevation changes at the site. Changes in land surface elevation at the site were minimal during 2023.

The DIXN site does not have a shallow nested groundwater well, but there is a 150 foot deep well (07N01E11M001M) in the vicinity that has water level monitoring data. This shallow well is in the Alluvial Aquifer and Upper Tehama zone and exhibits a slightly declining groundwater level trend from 2012 through 2022 with some recovery in 2023. This water level trend is generally consistent with the trend in land surface elevation change over the same period. Well 07N01E11M001M exhibits much less seasonal variation in water level relative to MW-1200, although this is likely because the well reflects unconfined groundwater conditions. It is notable however that the seasonal fluctuations in water levels in well 07N01E11M001M are opposite of the ground surface elevation changes, with higher water levels in fall than in spring, which may reflect influence from percolating irrigation water from nearby agricultural areas.

Figure 3-20 presents a comparison of ground surface elevation changes and groundwater levels for three nested wells at the Vacaville CGPS site. All of the monitoring wells at the site exhibit relatively stable groundwater level trends representative of depths ranging from 117 feet to 1430 feet. MW16-1430 and MW16-1166 are monitoring wells that are 1,430 and 1,166 feet deep, respectively, and both the land surface elevation data and the groundwater elevation data at the sites exhibit long-term stability. No strong correlation between groundwater levels in MW16-143 and MW16-1166 and ground surface elevation changes are apparent at the site although lower groundwater levels in these wells in 2022 and 2023 align with a period of negative displacement. The shallower MW16-117 is 117 feet deep and water levels have been stable to slightly increasing since 2012 and no correlation between land surface elevation data and water elevation data is observed.

Although there is apparent consistency in some of the groundwater level and land surface elevation trends at the DIXN and VCVL sites and likely others in Solano County and Subbasin, evaluating whether the changing conditions at the different depth zones being monitored are the cause of land surface elevation changes can be challenging. Monitoring land subsidence paired with groundwater level measurements leads to an improved understanding of the aquifer system and hydrogeology; however, a sufficient period of monitoring and combination of conditions (i.e., hydrology, pumping influences) are important to evaluate the relationship between groundwater levels and land surface elevation and characterization of elastic and inelastic changes. Further evaluation and additional data are also needed to differentiate elastic and inelastic subsidence in the Subbasin and identify which subsurface geologic materials (units) are responsible for compaction and expansion. Long-term monitoring of land surface elevation is key to detect delayed mechanisms causing inelastic subsidence such as dewatering of fine-grained materials like clays, that can take considerable time to occur. Additional efforts to evaluate the relationship between groundwater levels in different parts of the groundwater system, especially shallow and intermediate depths where most of the groundwater extraction occurs, and vertical displacement at the land surface will be considered as the GSP implementation progresses and additional groundwater level and subsidence monitoring information are available.

3.4.4 Summary of Land Subsidence Conditions

The InSAR and CGPS data indicate that very small rates of land subsidence have occurred within Solano County and the Solano Subbasin over the period of record, although this period has also been drier than average with multiple dry and critically dry years. The observed rates of historical subsidence are very small, and it has not been determined whether the subsidence is elastic or inelastic. However, the different datasets suggest that the geologic materials in the Solano Subbasin have elasticity with generally negative vertical displacement occurring during drier years and positive displacement occurring during wetter years. In parts of the Delta, the occurrence of land subsidence from oxidation of peat soils has long been recognized. Land subsidence in the Delta is not a result of chronic overdraft in the Subbasin. On the contrary, the very shallow groundwater levels in the area present a challenge to maintaining productivity on Delta lands. The small amounts of subsidence that have been recorded in other parts of the Subbasin have not resulted in any reported adverse impacts to infrastructure or conditions at the land surface. The magnitude of historical annual land subsidence rates is considerably less than the magnitude of annual seasonal elastic fluctuations that occur as a result of the seasonal draining and recharge of the groundwater system. The magnitude of the total cumulative historical subsidence is also similar to the magnitude of annual fluctuations.

3.5 Interconnected Surface Water

Streamflows in lower Putah Creek within the Solano Subbasin are relatively consistent during the dry months as a result of regulated flow releases, as required by the Putah Creek Accord (**Figure 3-21**). Even during wet water years runoff flows from precipitation events in the Putah Creek watershed are often muted in lower Putah Creek due to the large storage capacity of Lake Berryessa. Monitoring of Putah Creek at Interstate 505 indicates the stream water level (stage) typically fluctuates minimally (less than a foot) during dry-month periods over the monitoring record and flows are commonly between 15 and 30 cubic feet per second (cfs). During high flow events, such as when flows exceed 100 cfs, the stage can rise considerably by more than five feet. Many of the highest flow events during the period from 2006-2022 shown on **Figure 3-21** exceed the rating curve at the gage and associated flow rates are not reported. Additional downstream monitoring during the lower-flow periods also occurs at the Stevenson Bridge Crossing and Pedrick Road Bridge. Both gages indicate stage varies by only a small amount during the months outside of the winter wet period. Typical stream stage at these locations vary by only a foot while discharges range between 10 and 100 cfs. Monitoring of Putah Creek at Interstate 80 indicates some variability in stage during drier months with typical fluctuations in stage of about one foot. During occasional wet periods, stage can rise by more than 7 or 8 feet. As with some of the other upstream gages, the rating curve at the Interstate 80 (I-80) gage does not extend to flood stages so discharges at very high flows are not reported. Some of the stream gages experienced operational difficulties caused by high flows and other circumstances resulting in missing data for sites.

Figure 3-22 illustrates the stream stage conditions for the other smaller creeks in the Solano Subbasin. Flows in three waterways (Sweeny Creek at South Putah Creek and Midway Road and Ulatis Creek at Farrell Road) exhibit a pattern of higher flows (higher stage) in the drier months and lower flows in the wetter months. Overall, stages in these three channels are highly influenced by irrigation water conveyance and drainage with elevated stages during the summer irrigation season. The other small surface water features in the Subbasin display a more typical pattern of elevated stages in the rainy winter months and lower stages in the dry summer months. Flows in the smaller Subbasin creeks and streams are generally less than 5 cfs. The Subbasin intends to establish elevation datums at select stream gage locations for relating surface water stage and groundwater levels.

Many creeks in the Subbasin are engineered for flood control and are also used by irrigation districts (i.e., MPWD and SID). During the typically dry months in the Subbasin, water is transported via the creeks to agricultural users, and flows in these creeks are largely or entirely sustained by irrigation water deliveries. Because so many of the surface water features in the Subbasin are used for water conveyance during the irrigation season, the potential for groundwater pumping to deplete natural stream flows is believed to be very limited in many parts of the Subbasin, especially in the more northern areas of the Subbasin that are more reliant on groundwater.

Flow conditions in the Delta are very complex and are very large with flows in many Delta rivers being orders of magnitudes larger than flows in Putah Creek and other streams in the northern parts of Solano County and Solano Subbasin. The Delta is the confluence of two major California rivers and as a result large amounts of water are being transported through the Delta and along the southern boundary of the Subbasin. Flows observed in the Delta portion of the Subbasin are managed outside the control and authority of the GSAs in the Subbasin. Groundwater management activities within the Subbasin are unlikely to cause any adverse impacts on larger channels in the Delta surface water system because the flow and volume of surface water vastly exceeds the minimal flow and volume of any groundwater extraction in the Delta.

4 WATER BUDGET APPROACH FOR QUANTIFYING GROUNDWATER EXTRACTION, SURFACE WATER SUPPLIES, AND TOTAL WATER USE

In fulfillment of the Annual Report requirements for the Solano Subbasin GSP, a water budget approach has been used to quantify groundwater extraction, surface water supply availability, and total water use in the Subbasin. This section describes the structure and uncertainties of these water budgets. Most of the water budget results presented in this section are rounded to two significant digits consistent with the typical uncertainty associated with the methods and sources used in the analysis. Water budget component results may not sum to the totals presented because of rounding.

4.1 Analysis Background and Approach

Water supply and use in the Solano Subbasin were quantified from the Subbasin surface water system (SWS) water budget, accounting for the total balance of inflows, outflows, and change in storage in the subbasin's surface layer[5]. The primary inflows to the SWS water budget generally include surface water inflows (stream inflows, diversions, etc.), precipitation, groundwater extraction, and groundwater discharge. The primary outflows from each SWS water budget generally include evapotranspiration (ET), surface water outflows (stream outflows, spillage at the subbasin boundary, etc.), infiltration (deep percolation) of irrigation water and precipitation, and infiltration (seepage) of surface water. Additional information about the water budget structure, including all inflows, outflows, and calculations, are described in Chapter 5 and Appendix 5C of the GSP.

The complete SWS water budget for the Solano Subbasin was computed using the Solano Integrated Hydrologic Model (Solano IHM), a gridded numerical groundwater model that characterizes surface water and groundwater uses in elements representing land across the Solano Subbasin and surrounding areas in Solano, Sacramento, and Yolo Counties. The Solano IHM model was created to support GSP development through adaptation of the Sacramento Valley Groundwater-Surface Water Simulation Model (SVSim). Inputs to the Solano IHM were summarized from the best available data and science, including information from Water Management Plans, Groundwater Management Plans, Agricultural Water Management Plans, Urban Water Management Plans, and other publicly available or agency-supplied data sources. Data and information about specific water agencies were used to quantify water supply and water use within the agency's service area, to the extent permitted by the resolution of the Solano IHM element grid. Additional information about the Solano IHM development process is described in the GSP.

The historical Solano IHM application and inputs used in GSP development were updated and expanded for this Annual Report using available data and information about water supplies and uses since the GSP water budget period. Available data for the current reporting water year were updated, reviewed, or adapted from the GSP inputs. During the preparation of the annual report and associated updates to

[5] The vertical boundaries of the subbasin surface water system are the land surface (upper boundary) and the bottom of plant root zone, within the lateral boundaries of the Subbasin. The plant root zone is defined as "the upper portion of the soil where water extraction by plant roots occurs." The depth to the bottom of the root zone varies by crop, but typically ranges from 2-7 feet (ASCE, 2016).

Solano IHM, additional historical surface water diversion records were incorporated that previously had not been available. Incorporation of these data may result in some differences in historical water budgets from those presented in previous reports. A major change to the Solano IHM application since GSP development was the addition of managed wetlands as a simulated land use for the period 2019-2023 within select areas of the Delta region. These areas were identified from spatial land use data developed by Land IQ (2016, 2018, and 2020-2022) in which indications of managed wetlands were provided and generally correspond to areas that were previously categorized as native vegetation, riparian vegetation, and water in previous years. Model inputs and parameters used to calculate water demand and water use were adapted from wetlands simulated in DWR's SVSim model or comparable models elsewhere in the Sacramento Valley.

Other information about specific updates related to groundwater extraction and surface water supplies and uses are described in the sections below. Any data sources and methods not described in this section were generally the same as those described in Chapter 5, Appendix 5B, and Appendix 5C of the GSP.

Following model development and simulation of the entire Solano IHM domain, zonal summaries of model results were calculated for all elements representing the Solano Subbasin. These summaries are the source of the Subbasin SWS water budget results reported in this section. The SWS water budget is summarized from the historical Solano IHM model results through water year 2023 utilizing the data sources and procedures outlined in the subsections below. Summaries of all SWS water budget components by key water use sector for the period 1991 to 2023 are included in **Appendix E**. Due to limitations within the Solano IHM model structure, some managed wetlands demand was simulated as being met by groundwater pumping although it is believed that this demand is actually met by surface water. As a result, some adjustments were made to the SWS water budget during post-processing of model results to more accurately reflect true conditions.

4.2 Groundwater Extraction - §356.2(b)(2)

Groundwater extraction is reported for all water years extending from the end of the historical water budget period through the current reporting period (water years 2019-2023). **Table 4-1** summarizes groundwater extraction by water use sector in water years 2019-2023, and **Table 4-2** summarizes groundwater extraction by method of measurement and water use sector during the current reporting year (water year 2023). Historical estimates of groundwater extraction for 1991 through 2023 are presented in **Appendix E.**

Figure 4-1 presents the groundwater pumping in the Solano Subbasin in water year 2023. The majority of groundwater extraction in the Solano Subbasin is used for agricultural purposes, totaling approximately 120,000 acre-feet (AF) in 2023, a notable decrease from agricultural pumping in 2020 through 2022 (180,000-210,000 AF). Groundwater extraction also occurs to supply urban water users in the Cities of Dixon, Rio Vista, and Vacaville, and rural domestic groundwater users in other areas of the Subbasin. As noted previously, because of the Solano IHM structure, the water demand in some areas identified as managed wetlands in the model were incorrectly simulated as receiving pumped groundwater. As a result, some adjustments were made to the SWS water budget during post-processing of model results to more accurately reflect true conditions, which is reflected in **Tables 4-1 and 4-2 and Figure 4-1**.

Of the total groundwater extraction in 2023, 1,700 AF is directly-measured groundwater extraction for agricultural use in Solano Irrigation District (SID), and 10,000 AF is directly-measured groundwater extraction for urban use in the Cities of Dixon, Rio Vista, and Vacaville. The remaining volume of groundwater extraction in all water use sectors is estimated from the Solano IHM groundwater model results. While some groundwater may be used by native vegetation and managed wetlands in the Solano Subbasin, streamflows and precipitation are understood to be the primary originating sources of water available within these water use sectors. Due to confounding factors regarding the origins of water that is used, especially within the Delta region, all water supplies used in these sectors outside of precipitation are reported as surface water supplies.

The data sources and methods used to quantify groundwater extraction in each water use sector are described below.

Table 4-1: Groundwater Extraction in Each Water Year by Water Use Sector

Sector	2019 (AF)	2020 (AF)	2021 (AF)	2022 (AF)	2023 (AF)
Agricultural	140,000	210,000	210,000	180,000	120,000
Urban	28,000	28,000	26,000	26,000	27,000
Native Vegetation	0	0	0	0	0
Managed Wetlands	0	0	0	0	0
Total	170,000	240,000	240,000	200,000	150,000

Note: all values reported to two significant figures. Groundwater extractions do not include direct uptake of groundwater by plants.

Table 4-2: Groundwater Extraction by Method of Measurement (Water Year 2023)

Sector	Direct	Estimated	Description
Agricultural	1,700	120,000	Direct: Solano Irrigation District deep well usage records Estimated: Solano IHM groundwater model results
Urban	10,170	16,000	Direct: Well production data reported by the Cities of Dixon, Rio Vista, and Vacaville (metered production from CalWater wells serving areas within the City of Dixon was not available) Estimated: Solano IHM groundwater model results
Native Vegetation	0	0	Direct: N/A Estimated: Solano IHM groundwater model results
Managed Wetlands	0	0	Direct: N/A Estimated: Solano IHM groundwater model results
Total	11,870	136,000	

Note: Groundwater extractions do not include direct uptake of groundwater by plants. Estimated values reported to two significant figures.

4.2.1 Agricultural Groundwater Extraction

Groundwater extraction in the agricultural water use sector is summarized from two primary data sources: direct measurements of deep well usage by SID and estimates of groundwater extraction quantified in Solano IHM.

Deep well usage data was reported by SID on a monthly timestep. These volumes represent groundwater that is pumped from deep wells into the SID distribution system, where that water is delivered to district customers. The total groundwater extraction in 2023 reported from SID deep well usage records is 1,700 AF (approximately 1 percent of the total agricultural groundwater extraction).

Estimates of groundwater extraction were quantified in Solano IHM by simulating the volume of groundwater pumping needed to fulfill agricultural water demand on a monthly timestep. The total agricultural water demand was quantified for various crop types simulated in the Solano IHM according to representative crop water use and root depth characteristics, soil characteristics, the reference ET demand for each month based on local weather and climate conditions, and other parameters established in the model. The estimated volume of groundwater pumping was then calculated within Solano IHM as the additional volume of water necessary to meet the total agricultural water demand for each crop type. This was done within each element after distributing any other specified surface water deliveries to agricultural land in that element. Additional information about the Solano IHM inputs and calculations is described in the GSP. The amount of additional groundwater extraction for agricultural use that was estimated using the Solano IHM is approximately 120,000 AF in water year 2023 (approximately 99 percent of the total agricultural groundwater extraction).

4.2.2 Urban Groundwater Extraction

Groundwater extraction in the urban water use sector is summarized from three primary data sources: direct measurements of well production reported by the Cities of Dixon, Rio Vista, and Vacaville; direct measurements of urban potable water production available from the State Water Resources Control Board (SWRCB) for urban suppliers and public water systems in the Solano Subbasin that are known to use groundwater exclusively; and estimates of groundwater extraction quantified in Solano IHM.

Urban well production data was reported by the Cities of Dixon, Rio Vista, and Vacaville on a monthly timestep. These volumes represent groundwater that is pumped from wells for delivery to customers within the urban suppliers' water service areas. The total groundwater extraction in water year 2023 reported by cities from their urban water production records is 10,170 AF (approximately 38 percent of the total urban groundwater extraction).

Urban potable water production data are also available from the SWRCB for urban suppliers and public water systems in the Solano Subbasin, including the Cities of Dixon, Rio Vista, and Vacaville. These data were compared to the urban well production data provided by the cities. For the Cities of Dixon and Rio Vista, volumes reported in both sources were found to be exactly or nearly identical; thus, only the city-supplied well production data are reported. The City of Vacaville delivers both surface water and groundwater supplies; thus, only the city-supplied well production data are reported there as well.

Within the Solano IHM, total urban groundwater extraction was also estimated on an element-basis for urban demand areas[6] by simulating groundwater pumping based on urban population, urban per capita water use, and other urban water use criteria specified in the model. The cities' urban groundwater water production data and SWRCB urban potable water production data were used to develop the Solano IHM model inputs. However, these direct measurements are subtracted from the Solano IHM estimates of groundwater extraction reported in **Table 4-2**. The additional estimated groundwater extraction for urban use simulated in Solano IHM, after accounting for direct measurements, is approximately 16,000 AF in water year 2023 (approximately 62 percent of the total urban groundwater extraction). Details about the Solano IHM model inputs used to simulate urban groundwater extraction are summarized below.

The annual population in each urban demand area was quantified based on population data available from the California Department of Finance. In the Solano Subbasin, annual population estimates were aggregated for the Cities of Dixon, Rio Vista, and Vacaville, and for Solano County from calendar year 1984 (the beginning of the Solano IHM historical simulation period) through 2023. Solano IHM population inputs for the Cities of Dixon and Rio Vista were specified directly from Department of Finance data, while population inputs for the City of Vacaville were adjusted downward to account for the urban population within the Subbasin. Population inputs for areas within the Solano Subbasin, but outside those urban centers, were estimated based on Department of Finance data for unincorporated areas in Solano County, adjusted by the average ratio of those data and historical Solano IHM population inputs in 2014-2018. Population inputs for areas outside the Solano Subbasin were extrapolated from historical Solano IHM population inputs according to the average year-over-year population change for that area in 2009-2018. Data sources used for each urban demand area in 2023 are summarized in **Table 4-3**.

Per capita water use inputs for urban demand areas were generally estimated on a monthly basis based on available urban population data, urban well production or water use data, and comparison of those data with historical Solano IHM inputs. For the City of Vacaville, per capita water use was first calculated from the City's well production data and SWRCB population estimates (accounting for the city-wide service area). These values were then adjusted for the modeled area according to a regression calculated with the historical Solano IHM inputs from 2014-2018. For the Cities of Dixon and Rio Vista, per capita water use values were first calculated from SWRCB data and were then similarly adjusted for the modeled area according to a regression calculated with the historical Solano IHM inputs from 2015-2018. Per capita water use inputs for areas within the Solano Subbasin, but outside those urban centers, and for areas outside the Solano Subbasin were estimated as equal to the water year 2018 inputs within the historical Solano IHM model used in GSP development.

[6] Urban demand areas are groups of element areas representing specific cities, communities, or unincorporated areas. Urban water use criteria were specified for each of these areas to account for available population data, water use data, or other representative information about that area.

Table 4-3: Urban Groundwater Extraction Data Sources (Water Year 2023)

Urban Demand Area	Groundwater Extraction Data Source	Population Data Source	Simulated Per Capita Water Use Data Source
Dixon	Direct (California Water Service Company – City of Dixon groundwater pumping data)	California Department of Finance records	Calculated from SWRCB urban water use and population data, adjusted by relationship with historical Solano IHM inputs
Rio Vista	Direct (City of Rio Vista groundwater pumping data)	California Department of Finance records	Calculated from SWRCB urban water use and population data, adjusted by relationship with historical Solano IHM inputs
Vacaville	Direct (City of Vacaville urban well production data)	Population in Solano Subbasin estimated as fraction of California Department of Finance records (0.89, determined from 2014-2018 data analyses)	Calculated from City of Vacaville urban well production data and SWRCB population data, adjusted by relationship with historical Solano IHM inputs
Solano Subbasin Outside Urban Centers	Estimated (Solano IHM; inputs based on population and per-capita water use data sources)	Estimated from 2014-2018 relationship between historical California Department of Finance records for unincorporated county areas (0.89, determined from 2014-2018 data analyses)	Estimated as equal to water year 2018 inputs from historical Solano IHM
Outside Subbasin	Estimated (Solano IHM; inputs based on population and per-capita water use data sources)	Extrapolated from historical Solano IHM inputs by average year-over-year change in 2009-2018	Estimated as equal to water year 2018 inputs from historical Solano IHM

4.2.3 Native Vegetation and Managed Wetlands Groundwater Extraction

In the Solano Subbasin, streamflows and precipitation are believed to be the primary originating sources of water available to native vegetation and managed wetlands because of the prevalence of surface water features and proximity of these ecosystems to surface water bodies. Groundwater uptake through the root zone of native vegetation was evaluated in the Solano IHM, but it was ultimately not included in the final model due to complicating factors relating to simulation of agricultural irrigation management practices in areas of the Subbasin with shallow groundwater conditions, especially within the Delta region. Model improvements to more accurately simulate direct uptake of groundwater by native vegetation continue to be evaluated.

4.3 Surface Water Supply - §356.2(b)(3)

Surface water supplies used during 2019 to 2023 water year are reported in **Table 4-4** by water use sector, and in **Table 4-5** by water source type. Historical estimates of surface water supplies for 1991 through 2023 are presented in **Appendix E.** The majority of surface water supplies diverted for use in the Solano Subbasin are used for agricultural purposes, totaling approximately 400,000 AF in 2023. The City of Vacaville also receives surface water supplies from the Putah South Canal and the North Bay Aqueduct for treatment and delivery to urban water users. Surface water is also used by native vegetation and managed wetlands along waterways during periods when surface water is available.

Of the total surface water use in 2023, approximately 480,000 AF are local supplies (98 percent of the total surface water use), including Solano Project Supplies and diversions from local streamflows. The remaining surface water use includes 5,800 AF of State Water Project supplies delivered for urban uses in the City of Vacaville and an estimated 6,300 AF of reuse on agricultural lands. The data sources and methods used to quantify surface water supply use for each water use sector and water source type are described below.

Table 4-4: Surface Water Use in Each Water Year by Water Use Sector

Sector	2019 (AF)	2020 (AF)	2021 (AF)	2022 (AF)	2023 (AF)
Agricultural	400,000	450,000	460,000	440,000	410,000
Urban	10,000	12,000	13,000	11,000	9,800
Managed Wetlands	24,000	47,000	48,000	43,000	64,000
Native Vegetation	7,300	9,100	10,000	8,100	8,400
Total	440,000	520,000	530,000	500,000	490,000

Note: all values reported to two significant figures.

Table 4-5: Surface Water Use in Each Water Year by Water Source Type

Water Source Type	2019 (AF)	2020 (AF)	2021 (AF)	2022 (AF)	2023 (AF)
Local Supplies	430,000	510,000	520,000	490,000	480,000
State Water Project Supplies	4,600	3,600	4,000	4,500	5,800
Reuse	6,600	8,000	8,100	7,500	6,300
Total	440,000	520,000	530,000	500,000	490,000

Note: all values reported to two significant figures.

4.3.1 Agricultural Surface Water Supply

Surface water supplies used for agriculture in the Solano Subbasin include: deliveries of local surface water from the Solano Project to agricultural contractors and water users along the Putah South Canal, diversions of other local supplies by water rights users from the various waterways that traverse or adjoin the Subbasin, and reuse of upstream return flows for irrigation. Surface water supplies of these source types are summarized or estimated from the data sources listed in **Table 4-6**.

Application of surface water supplies for agricultural uses was quantified by specifying monthly diversions in Solano IHM. Monthly diversion volumes were summarized or estimated from the sources listed in **Table 4-6**. These diversions were then applied to groups of model elements that approximately correspond to the district service area or application area where that water is used. Deliveries were generally calculated by Solano IHM as the water supply used to meet simulated crop water demands, after accounting for any applicable seepage and evaporation of the diverted supply. Measured deliveries reported by SID from their TruePoint database and from their annual Solano Project reports were directly specified in the model and applied to elements representing the SID service area or the area where that water is delivered. Where applicable, diversions were simulated to occur from a location on the simulated stream or creek corresponding nearest to where that water is actually diverted. Available streamflows along those waterways were generally quantified in Solano IHM based on nearby or representative stream gage data available from the United States Geological Survey (USGS). Stream inflows were either directly summarized from those data sources (for stream gages near the inflow point), or they were estimated from those data through regression relationships computed from historical data and historical stream inflows simulated in Solano IHM.

Reuse was simulated in Solano IHM as the estimated fraction of return flow (i.e., runoff of delivered water) that is captured and re-used for irrigation. Reuse fractions for all crops are estimated to be approximately 0.015 of the total applied water, based on analyses of reuse in SID.

The surface water supplies reported in **Table 4-4** and **Table 4-5** represent the volume of water delivered for agricultural water use in the subbasin, as simulated in Solano IHM. Surface water supplies used for agricultural use totaled approximately 410,000 AF in water year 2023 (approximately 83 percent of the total surface water supplies used).

4.3.2 Urban Surface Water Supply

Surface water supplies used for urban water uses in the Solano Subbasin include: deliveries of surface water from the Solano Project to the City of Vacaville along the Putah South Canal and deliveries of State Water Project supplies to the City of Vacaville along the North Bay Aqueduct (**Table 4-6**). Application of surface water supplies for urban use was quantified by specifying monthly diversions in Solano IHM. These diversions were then applied to groups of model elements that approximately correspond to the City of Vacaville service area. The City of Vacaville delivers water for urban uses through a piped distribution system with minimal losses. Although some losses may occur, deliveries were estimated to equal the total diversion volumes. Surface water supplies used for urban use totaled approximately 10,000 AF in water year 2023 (approximately 2 percent of the total surface water supplies used).

4.3.3 Native Vegetation Surface Water Supply

Surface water supplies used in the native vegetation water use sector are estimated in Solano IHM on an element basis by simulating root water extraction of surface water flows along simulated waterways based on water demand and other crop water use characteristics specified in the model. The surface water supplies used by native vegetation were calculated within Solano IHM as the volume of surface water available to meet native vegetation water demand within each element in each month. All surface water supplies used by native vegetation are assumed to be local supplies. Surface water supplies used for native vegetation use was approximately 8,400 AF in water year 2023 (approximately 1 percent of the total surface water supplies used).

4.3.4 Managed Wetlands Surface Water Supply

Surface water supplies used in the managed wetlands water use sector are estimated in Solano IHM on an element basis by simulating root water extraction of shallow groundwater that is assumed to be supplied from nearby surface water sources based on water demand and other crop water use characteristics specified in the model. All water supplies used by managed wetlands are assumed to be local surface water supplies. Surface water supplies used for managed wetlands totaled approximately 64,000 AF in water year 2023 (approximately 13 percent of the total surface water supplies used).

Table 4-6: Surface Water Diversions and Deliveries Data Sources in the Solano Subbasin (Water Year 2023)

Water Source Type	Water Use Sector	Water Use Area	Surface Water Data Source
Solano Project Supply	Agricultural	SID	Solano Project Diversions Reports (diversions into SID distribution system and direct deliveries from Putah South Canal); TruePoint delivery records (deliveries from SID distribution system)
Solano Project Supply	Agricultural	Maine Prairie Water District	Solano Project Diversions Reports
Solano Project Supply	Agricultural	City of Vacaville	SID Solano Project Supply data sources (Deliveries from SID to turnouts within the City of Vacaville GSA)
Solano Project Supply	Urban	City of Vacaville	City of Vacaville Water Production Data
State Water Project Supply	Urban	City of Vacaville	City of Vacaville Water Production Data
Local Supply	Agricultural	Maine Prairie Water District	Compiled eWRIMS data when available; estimated from historical data when data not yet available
Local Supply	Agricultural	Reclamation District 2068	Compiled agency data and eWRIMS data when available; estimated from historical data when data not yet available

Water Source Type	Water Use Sector	Water Use Area	Surface Water Data Source
Local Supply	Agricultural	Delta region	Delta region diversions estimated from GSP analyses though comparison with available compiled eWRIMS data
Local Supply	Agricultural	Various (miscellaneous water rights diversions)	Compiled eWRIMS data for water rights users where available; estimated from historical data when data not yet available

4.4 Total Water Use by Sector - §356.2(b)(4)

Total water use in the 2023 water year is reported in **Table 4-7** by water use sector. The volume of total water use is summarized from the results presented in **Section 4.2** and **4.3**. Historical estimates of total water use for 1991 through 2023 are presented in **Appendix E.**

Table 4-7: Total Water Use in the 2023 Water Year by Water Use Sector

Sector	Groundwater (AF)	Surface Water (AF)	Total (AF)
Agricultural	122,000	410,000	530,000
Urban	27,000	10,000	36,000
Managed Wetlands	0	64,000	64,000
Native Vegetation	0	8,400	8,400
Total	**150,000**	**490,000**	**640,000**

Note: all values reported to two significant figures.

5 CHANGE IN GROUNDWATER STORAGE (§356.2.B.5)

5.1 Change in Groundwater Storage Maps

Consistent with §354.18.b, based on a comparison of the annual spring groundwater elevation contour maps representing seasonal high groundwater conditions, changes in groundwater elevation were calculated for the Solano Subbasin for individual years starting in Spring 2015. To calculate annual change in groundwater storage from the groundwater level contour maps, the difference in groundwater elevation between annual spring contour maps was calculated for each of the principal aquifers (Alluvial/Upper Tehama zone and Basal Tehama zone). Changes in groundwater levels and the potentiometric surface for each year were than multiplied by a specific yield and storage coefficient, respectively. For the Alluvial/Upper Tehama zone, a spatially-varying dataset of specific yield values representing thickness-weighted average values for layers 1 through 3 in Solano IHM was used in the analysis and multiplied by spatially continuous data for the change in groundwater elevation to estimate change in storage. For the Basal Tehama zone, a single uniform storage coefficient used in the model to represent Basal Tehama aquifer properties and derived from available aquifer test data was used to multiple by change in groundwater elevations.

Figures 5-1 and 5-2 show the spatial distribution of calculated annual change in groundwater level for the most recent reporting year between Spring 2022 and Spring 2023 for the Alluvial/Upper Tehama zone and Basal Tehama zone. Maps of change in groundwater levels for each of the years between Spring 2016 and 2022, separated by principal aquifer, are presented in **Appendix F**. **Tables 5-1** and **5-2** summarize the calculated annual change in groundwater storage volumes for 2015 to 2023 for both the Alluvial/Upper Tehama zone and Basal Tehama aquifers based on comparison of spring groundwater elevation contours. There is incomplete spatial coverage of groundwater elevation data across parts of the Solano Subbasin during some years and groundwater elevation contours were limited to areas where sufficient groundwater elevation data were available. To estimate the change in groundwater storage within the Alluvial/Upper Tehama zone for the entire Subbasin, in areas with insufficient groundwater level data, the average change in groundwater elevation value calculated for the area with data was applied to areas without data to estimate change in storage amounts in these areas. Because very limited groundwater pumping occurs in the Delta region of the Solano Subbasin, areas with insufficient groundwater level data located in the Delta were assumed to have no change in storage. In the Basal Tehama zone where current groundwater pumping is believed to be primarily limited to utilization by the City of Vacaville, the analysis of change in storage was limited to areas with sufficient available data in the vicinity of the City of Vacaville. Maps of the spatial distribution of change in storage in the Alluvial/Upper Tehama Zone and Basal Tehama for the most recent period from Spring 2022 to Spring 2023 are presented in **Figures 5-3 and 5-4**.

Using representative specific yield (Alluvial/Upper Tehama zone) and storage coefficient (Basal Tehama zone) aquifer parameter values described above, the calculated changes in groundwater levels both the Alluvial/Upper Tehama zone and Basal Tehama aquifers annual change in groundwater storage are summarized in **Table 5-1** and **Table 5-2**. Negative change in storage values indicate depletion of groundwater storage, whereas positive change in storage values represent accretion of groundwater in storage. Groundwater in the Alluvial/Upper Tehama zone is considered to be unconfined and therefore changes in groundwater elevation translate to greater storage changes due to application of a specific yield value. Between Spring 2022 and Spring 2023 groundwater storage increased in the Alluvial/Upper Tehama zone by an estimated 47,000 AF (**Table 5-2**). The change in storage in the Alluvial/Upper Tehama zone in previous years since 2015 is also included in **Table 5-1** and ranges from increases in storage up to 46,000 between Spring 2016 and Spring 2017 to a decrease in storage of about 117,000 AF between Spring 2019 and 2020. In the Basal Tehama, where confined conditions exist, changes in groundwater levels translate to substantially smaller changes in groundwater storage due to the smaller overall area and application of a storage coefficient value in these areas. Annual estimates in change in groundwater storage in the Basal Tehama zone since 2015 generally fluctuate by less than 100 AF, with a very minor increase in storage of 53 AF estimated for 2023.

Table 5-1 Change in Groundwater Storage in the Alluvial/Upper Tehama Zone in the Solano Subbasin

Analysis Period (spring to spring)	Average Specific Yield	Average Groundwater Elevation Change (ft)	Average Groundwater Storage Change (AF/ac)	Analysis Area[1] (acres)	Delta Area Without Data[2] (acres)	Other Areas Without Data[3] (acres)	Annual Subbasin Groundwater Storage Change (AF)
2015-2016	0.0418	1.2008	0.0532	241,627	83,618	29,427	14,418
2016-2017	0.0418	3.3837	0.1695	214,269	83,618	56,786	45,936
2017-2018	0.0418	-2.8863	-0.1534	214,269	83,618	56,786	-41,586
2018-2019	0.0418	1.6367	0.0624	305,173	19,155	30,346	20,935
2019-2020	0.0418	-7.2153	-0.3496	305,173	19,155	30,346	-117,311
2020-2021	0.0418	-6.2233	-0.2802	354,673	--	--	-99,374
2021-2022	0.0418	-0.7498	0.0905	354,674	--	--	42,638
2022-2023	0.0418	2.7184	0.1335	354,673	--	--	47,358

1. Only areas within the Solano Subbasin with sufficient groundwater level data were contoured. Because Spring 2016, 2017 and Spring 2019 had limited data control, the analyses of change in elevation and change in storage did not cover the entire Subbasin and was limited to the "analysis area" where sufficient groundwater level data exist.
2. Very little groundwater pumping occurs in the Delta region of the Subbasin; therefore, for years and locations in the Delta region without groundwater elevation data, it is assumed that these areas have no change in groundwater storage.
3. Change in storage for areas outside of the Delta region with insufficient groundwater level data were estimated by applying the average change in storage per acre from areas with data (within the analysis area) to these areas without groundwater level data.

Table 5-2 Change in Groundwater Storage in the Basal Tehama Zone in the Solano Subbasin

Analysis Period (spring to spring)	Average Storativity	Average Groundwater Elevation Change (ft)	Average Groundwater Storage Change (AF/ac)	Analysis Area (acres)	Annual Groundwater Storage Change (AF)
2015-2016	2.2E-04	-4.5144	-9.71E-04	53,353	-52
2016-2017	2.2E-04	4.6855	1.01E-03	53,353	54
2017-2018	2.2E-04	-2.1996	-4.73E-04	53,353	-25
2018-2019	2.2E-04	1.3325	2.86E-04	53,353	15
2019-2020	2.2E-04	1.0013	2.15E-04	53,353	11
2020-2021	2.2E-04	-2.5957	-5.58E-04	53,353	-30
2021-2022	2.2E-04	-7.1300	-1.53E-03	53,353	-82
2022-2023	2.2E-04	4.6261	9.95E-04	53,353	53

5.2 Groundwater Use and Change in Groundwater Storage

Annual groundwater extractions and change in groundwater storage in the Solano Subbasin is shown in **Figure 5-5** for water years 2015 to 2023. Groundwater extractions are estimated or directly measured by water year following the procedures described in **Section 4**. Change in groundwater storage presented in **Figure 5-5** is estimated based on an annual comparison of spring groundwater elevations. Total annual groundwater extraction typically decreases in wet years and increases in dry years, while the annual change in groundwater storage has ranged between increases as high as about 47,000 AF to decreases of up to -117,000 AF (**Figure 5-5**). Historical groundwater extractions for the Subbasin for all water years since 1991, as estimated using the Solano IHM, are also included in **Appendix E**. Annual changes in groundwater storage in water years 1991 through 2018 are included in the GSP based on water balance results from the Solano IHM.

6 ASSESSMENT OF SMC AND RMS MONITORING NETWORK STATUS

Section 6 in the Solano Subbasin GSP provides a discussion of the Sustainable Management Criteria (SMC) developed for the Subbasin, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, interim milestones, and the monitoring networks for the five sustainability indicators relevant to groundwater management in the Subbasin. Undesirable results occur when significant and unreasonable effects for any sustainability indicator are caused by groundwater conditions occurring in the Subbasin. As described in the GSP, a network of RMS was identified for each of the sustainability indicators relevant to the Solano Subbasin to monitor sustainability and occurrence of any undesirable results. A summary of criteria used to define SMC in the Subbasin is provided in **Table 6-1**. This section provides an overview of the status of the RMS network in relation to the different SMCs in the GSP for tracking of conditions in the Subbasin. Consideration of any linkages between GSP implementation activities and groundwater conditions exceeding SMCs will be included in subsequent annual reports, as appropriate. The SMC developed in the GSP will be periodically reviewed to ensure they are appropriate for avoiding undesirable results from adverse impacts on beneficial users in the Subbasin, including no later than the first five-year GSP update.

Table 6-1 Summary of MTs, MOs, URs, and Selection Rationale

Sustainability Indicator	SMC Selection Considerations/Rationale	SMC Metric	Representative Monitoring Used	Minimum Threshold (MT)	Measurable Objective (MO)	Undesirable Result (URs)
Chronic Lowering of Groundwater Levels (GWL)	Locations based on groundwater use and historical groundwater conditions, density of domestic wells, disadvantaged communities reliant on GW, GDEs.	Fall (seasonal low) groundwater elevation	Separate RMS wells for Alluvial Aquifer/Upper Tehama and Basal Tehama zones	Alluvial Aquifer/Upper Tehama Zone: •Minimum static groundwater elevation in the base period (Water Year 1991 prior to January 2015), with consideration for operational flexibility. Basal Tehama Zone: •Fifty feet below the recent five year average static groundwater elevation (prior to January 2015)	Average static groundwater elevation in the base period (prior to January 2015)	30 percent of RMS wells below MTs for two consecutive years
Reduction of Groundwater Storage	Currently the Subbasin is pumping at or below the Sustainable Yield, GWL will be used as a proxy to determine overall changes	Fall (seasonal low) groundwater elevation	Groundwater elevation contours	Alluvial Aquifer/Upper Tehama Zone: •Minimum static groundwater elevation in the base period (prior to January 2015) Basal Tehama Zone: •Fifty feet below the recent five year average static groundwater elevation (prior to January 2015)	Average static groundwater elevation in the base period (prior to January 2015)	30 percent of wells below MTs for two consecutive years
Seawater Intrusion	Not Applicable – The Subbasin is not located along the Pacific Ocean, however potential for impacts from ancient conditions or future acute instances will be monitored via chloride concentrations, as part of the degraded water quality sustainability indicator	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Sustainability Indicator	SMC Selection Considerations/Rationale	SMC Metric	Representative Monitoring Used	Minimum Threshold (MT)	Measurable Objective (MO)	Undesirable Result (URs)
Land Subsidence	The Subbasin does not have documented inelastic subsidence or impacts to surface infrastructure. SMCs consider historical rates of displacement, seasonal fluctuations in displacement.	Annual rate of vertical displacement	Existing subsidence monitoring stations	Annual subsidence rate exceeding the historical average range of the yearly fluctuation in vertical displacement	Rate of vertical displacement equal to average historical rate of vertical displacement	A RMS location exceeding MT for three consecutive years
Degraded Water Quality	The MT accounts for applicable state and federal water quality standards. Constituents of Concerns were based on communication with water suppliers and historical elevated water quality results.	Concentrations for nitrate, TDS, arsenic, chloride, Cr6	RMS wells monitored by GSAs and for other programs	Drinking water MCLs or existing concentration plus 20%, whichever is greater.	Current concentrations of nitrate, arsenic, chloride, TDS, Cr6. For constituents with Primary MCL MT, Trigger Level set at 75% of MT. Trigger initiates evaluation of factors related to increasing constituent concentrations.	Greater than 25 percent of wells above the MT for the same constituent, based on average of most recent three-year period.
Depletion of Interconnected Surface Water	•Putah Creek has a long standing historical guidance for flows. •GDE distribution/viability and reduction in surface water availability were considered. Smaller streams are confounded by management and are not sufficient indicators of stream depletions WLs are used as a proxy •Flows in the Delta are so large, and GW is so shallow that depletions are not significant	Putah Creek streamflow; WLs as proxy elsewhere	Existing Putah Creek Accord compliance flow stations and select WL RMS wells	•Minimum Flows for Putah Creek outlined in the Putah Creek Accord. • Minimum static groundwater elevation in the base period (prior to 2015) for wells located in close proximity to groundwater connected waterways	•Compliance with the Putah Creek Accord for Putah Creek. •Average static groundwater elevation in the base period	•Non-compliance with the Putah Creek Accord flow requirements along Putah Creek. • 30 percent of wells below MTs for two consecutive years

6.1 Groundwater Levels

Figures 2-4 and **2-5** display the current groundwater level RMS wells for the Solano Subbasin. **Table 6-2** provides a summary of the current (2023) groundwater level measurements in all RMS wells and **Appendix G** provides a summary of historical water level data for these wells. In 2023, eight of the 41 RMS wells did not have water level measurements because they were recently removed from either the DWR or USBR water level monitoring program due to limitations on monitoring resources, access issues, or lack of well construction details. The Solano Subbasin continues efforts to re-recruit these wells and ensure they are monitored as part of the GSP monitoring program. In 2023 monitoring of two of the RMS wells dropped from DWR's monitoring program was re-initiated by the GSAs with the assistance of coordinated efforts by the Dixon Resource Conservation District. One RMS well recently dropped by USBR due to access issues was determined to be the same as a well monitored by SID with a different well ID (07N01E16B001M). The combining of historical monitoring data for this well provides a longer-term record of water levels, but also necessitates adjustments to the MT and MO to be consistent with the methodology applied in the GSP. Four wells were determined to have been destroyed or no longer accessible. In coordination with USBR, RMS well 08N01W33A001M was determined to have an obstruction that is not repairable. A nearby well is currently being considered as a potential replacement RMS well. Additional RMS well candidates are being considered for replacing three other RMS wells that were destroyed.

In 2023, a total of five RMS wells in the Alluvial/Upper Tehama Zone had groundwater elevations below the MTs (MT exceedances). Many of these wells had elevations below the MT in 2022 and exhibited recovering in 2023, although not enough to raise levels above the MTs. One of the MT exceedance wells (06N01E12M001M) was monitored for the first time in December 2023 since being dropped from DWR's monitoring program. Oil was observed in the well at the time of the December 2023 measurement and this measurement is being reviewed to determine if it accurately represents groundwater levels at the site. The Solano Subbasin GSP set triggers for groundwater levels as the occurrence of any MT exceedance. The occurrence of such conditions during the GSP implementation and sustainability period (after GSP adoption) triggers adaptive management actions, including evaluation of groundwater conditions contributing to any MT exceedances. The GSAs have been evaluating local conditions near MT exceedances, conducting outreach to water users, and considering potential projects and management actions in these areas. No wells in the Basal Tehama had groundwater elevations below the MT. Three (8 percent) of the RMS wells have had two consecutive years of MT exceedances; however, this does not constitute an undesirable result as outlined in **Table 6-1**, which occurs when more than 30 percent of wells exceed the MT for two consecutive years. Water years 2020 and 2021 were remarkably dry years in the Subbasin and dry conditions also existed during much of 2022; falling groundwater levels observed in these years reflect the natural variations in groundwater conditions as a result of the varying hydrology. Water levels measured in many wells have not recovered from the influences of these recent dry years in addition to the dry years occurring between 2012 and 2016.

Table 6-2 Summary of Groundwater Level RMS Monitoring Status (Water Year 2023)

RMS ID	Aquifer Designation	Spring 2023 Water Elevation (ft msl)	Fall 2023 Water Elevation (ft msl)	Minimum Threshold (MT)		2023 Lowest Observed Water Level		Comment
				Depth (ft)	Elev (ft msl)	Depth (ft)	Elev (ft msl)	
47	Alluvial/Upper Tehama	81.2	77.4	32.1	63.3	18.0	77.4	
5340	Alluvial/Upper Tehama	-3.5	-3.6	16.4	-4.4	15.6	-3.6	
03N03E07N001M	Alluvial/Upper Tehama	0.3	1.1	38.6	-14.1	23.4	1.1	
04N01E02E001M	Alluvial/Upper Tehama	59.8	56.2	17.7	44.8	6.3	56.2	
04N02E09A001M	Alluvial/Upper Tehama	--	--	27.1	14.6	--	--	Well destroyed or no longer accessible; well planned for network removal and/or replacement
05N02E25K001M	Alluvial/Upper Tehama	--	--	11.9	-8.4	--	--	Well destroyed or no longer accessible; well planned for network removal and/or replacement
06N01E12M001M	Alluvial/Upper Tehama	--	10.8	16.9	25.7	31.8	10.8	Successfully re-recruited, resumed monitoring in December 2023; representativeness of 2023 measurement being reviewed (oil in well)
06N01E17M001M	Alluvial/Upper Tehama	60.4	54.8	18.2	48.1	11.5	54.8	
06N01E33L001M	Alluvial/Upper Tehama	--	--	17.2	30.3	--	--	Well destroyed or no longer accessible; well planned for network removal and/or replacement
06N01W36C004M	Alluvial/Upper Tehama	--	--	21.7	61.2	--	--	Ongoing efforts to re-recruit
06N02E19J001M	Alluvial/Upper Tehama	23.4	16.4	15.2	10.8	9.6	16.4	

RMS ID	Aquifer Designation	Spring 2023 Water Elevation (ft msl)	Fall 2023 Water Elevation (ft msl)	Minimum Threshold (MT)		2023 Lowest Observed Water Level		Comment
				Depth (ft)	Elev (ft msl)	Depth (ft)	Elev (ft msl)	
07N01E04P003M	Alluvial/Upper Tehama	--	49.3	38.0	54.6	43.3	49.3	
07N01E11M001M	Alluvial/Upper Tehama	--	35.7	41.1	37.0	42.4	35.7	
07N01E14J001M	Alluvial/Upper Tehama	24.1	14.1	70.0	-6.9	49.0	14.1	
07N01E16B001M	Alluvial/Upper Tehama	48.1	6.7	99.1	-21.5	70.9	6.7	Additional historical water level data were identified for the well; SMC assigned to the well have been revised to reflect updated information in a manner consistent with the methodology used in the GSP
07N01E21H003M	Alluvial/Upper Tehama	--	-1.0	88.1	-14.5	74.6	-1.0	
07N01E25M001M	Alluvial/Upper Tehama	20.6	8.9	66.7	-15.7	42.1	8.9	
07N01E29P001M	Alluvial/Upper Tehama	67.8	64.6	15.0	61.6	12.0	64.6	
07N01W04C002M	Alluvial/Upper Tehama	65.9	50.9	100.5	47.9	97.5	50.9	
07N01W05R001M	Alluvial/Upper Tehama	--	--	119.8	53.3	--	--	Ongoing efforts to re-recruit
07N01W13H001M	Alluvial/Upper Tehama	--	--	20.6	88.0	--	--	Ongoing efforts to re-recruit
07N01W33J002M	Alluvial/Upper Tehama	64.7	59.8	107.5	25.6	73.3	59.8	
07N02E15E001M	Alluvial/Upper Tehama	--	-14.0	56.7	-12.2	58.5	-14.0	Successfully re-recruited, resumed monitoring in December 2023
07N02E33D002M	Alluvial/Upper Tehama	4.1	-3.9	43.3	-7.3	39.9	-3.9	

RMS ID	Aquifer Designation	Spring 2023 Water Elevation (ft msl)	Fall 2023 Water Elevation (ft msl)	Minimum Threshold (MT)		2023 Lowest Observed Water Level		Comment
				Depth (ft)	Elev (ft msl)	Depth (ft)	Elev (ft msl)	
07N02E35D002M	Alluvial/Upper Tehama	7.0	-0.2	63.3	-25.6	38.0	-0.2	
08N01E24Q001M	Alluvial/Upper Tehama	7.3	-23.4	131.1	-60.1	94.4	-23.4	
08N01E32E001M	Alluvial/Upper Tehama	--	46.5	98.7	4.2	56.4	46.5	
08N01E33H001M	Alluvial/Upper Tehama	--	41.0	47.0	37.6	43.6	41.0	
08N01W26A002M	Alluvial/Upper Tehama	60.6	53.9	64.2	60.4	70.7	53.9	
08N01W33A001M	Alluvial/Upper Tehama	--	--	70.8	67.0	--	--	Well destroyed or no longer accessible; well planned for network removal and/or replacement
08N01W35R001M	Alluvial/Upper Tehama	58.4	45.2	85.9	26.1	66.8	45.2	
08N02E27C002M	Alluvial/Upper Tehama	12.0	-10.2	69.9	-15.4	64.7	-10.2	
08N03E31N001M	Alluvial/Upper Tehama	0.1	-28.1	68.4	-34.9	61.6	-28.1	
41	Basal Tehama	6.0	5.0	138.6	-34.6	99.0	5.0	
43	Basal Tehama	-53.6	-57.4	179.0	-97.9	138.5	-57.4	
44	Basal Tehama	-72.4	-78.0	211.1	-116.2	173.0	-78.0	
45	Basal Tehama	-79.9	-83.5	218.8	-125.8	176.5	-83.5	
06N01E10J004M	Basal Tehama	-48.5	-52.6	147.5	-93.9	106.2	-52.6	
06N01E30N003M	Basal Tehama	-54.0	-61.7	179.2	-101.3	139.7	-61.7	
07N01E11G002M	Basal Tehama	-8.4	-9.5	131.2	-51.7	89.0	-9.5	
07N01W15A001M	Basal Tehama	43.2	38.0	110.9	21.9	94.8	38.0	

Notes:

Grey shading indicates MT exceedance.

6.2 Groundwater Storage

Groundwater levels are used as a proxy to detect any changes in groundwater storage that may be significant and unreasonable. Using groundwater levels as a proxy relies on field measurement of groundwater levels in the RMS monitoring well network (**Figures 2-4 and 2-5**). Groundwater levels have a direct relationship with groundwater storage based on aquifer properties. Aquifer properties in the Alluvial Aquifer/Upper Tehama Zone differ from the Basal Tehama zone. **Section 5.2** provides details on the methodology for change in storage calculations. In the Alluvial Aquifer/Upper Tehama Zone, which is unconfined, changes in groundwater levels are reflective of changes in saturated thickness of the aquifer and correspond with larger changes in groundwater storage than in the Basal Tehama zone based on the specific yield (or effective porosity) of the aquifer materials. In the Basal Tehama, where groundwater is confined and under pressure, changes in groundwater levels are not reflective of changes in saturated volumes. Rather they are indicative of the potentiometric surface (i.e., the elevation groundwater level will rise to under normal atmospheric pressure). As a result, changes in groundwater levels reflected in the Basal Tehama Zone are associated with very small changes in storage. In both unconfined and confined settings groundwater levels are a direct proxy to detect and evaluate changes in storage. In 2023 there are five MT exceedances in the water level RMS network and three of those exceedances (8 percent) are for the second consecutive year. An undesirable result for change in groundwater storage is 30 percent of wells below the MTs for two consecutive years. Accordingly, no undesirable result for change in storage occurred in 2023.

6.3 Groundwater Quality

Figure 2-6 displays the current water quality RMS wells for the Solano Subbasin GSP. **Table 6-3** provides a summary of the groundwater quality conditions for all RMS wells as represented by the average concentration over the most recent three years (2021-2023), in accordance with the SMC described in the GSP. **Figure 6-1 to 6-5** show the average concentration of As, Cl, Cr6, NO3-N, and TDS for the last three years at each RMS well. Several RMS wells did not have data collected during the most recent three years. The Solano Subbasin is working to coordinate with monitoring entries on the timing of sampling and the necessary water quality analyses for GSP monitoring. **Appendix H1 and H2** provides a summary of historical water quality data and plots for these wells. In 2023 no wells in the RMS network had MT exceedances. Recent review of SMC for water quality RMS included in the GSP highlighted several RMS wells with assigned MT values that were not consistent with the methodology intended in the GSP or which did not allow for sufficient variability in water quality concentrations associated with natural variability in water quality conditions and laboratory uncertainty. These MT were adjusted to reflect an increase of 20 percent from the MO which will allow for operation flexibility. The GSP outlined that RMS concentrations greater than 75 percent of the MT would trigger additional review of the circumstances relating to the triggering conditions, specifically review of GSP projects and management actions that may have exacerbated groundwater quality conditions. In 2023 several RMS wells had constituent concentrations above the trigger levels; a review will be conducted on trends that may be occurring at these locations. The groundwater quality conditions during 2020 and 2021 pre-dated the adoption of the Solano Subbasin GSP and are included in the recent 3-year average concentration for each RMS well. Consideration of any linkages between GSP implementation activities and groundwater quality conditions exceeding MTs will be included in annual reports once sufficient data are available representative of conditions since commencement of implementation of the GSP, as appropriate.

Well Number	Aquifer Designation	MT Arsenic (µg/L)	2023 Arsenic (µg/L)	3-Yr Avg Arsenic (µg/L)	MT Nitrate (mg/L)	2023 Nitrate (mg/L)	3-Yr Avg Nitrate (mg/L)	MT Chloride (mg/L)	2023 Chloride (mg/L)	3-Yr Avg Chloride (mg/L)	MT TDS (mg/L)	2023 TDS (mg/L)	3-Yr Avg TDS (mg/L)	MT Cr6 (µg/L)	2023 Cr6 (mg/L)	3-Yr Avg Cr6 (µg/L)
61493	Alluvial/Upper Tehama	--	--	--	10	--	--	250	--	--	1176	--	--	--	--	--
61494	Alluvial/Upper Tehama	--	--	--	13.2	--	--	250	--	--	810	--	--	--	--	--
07N01E08N002M	Alluvial/Upper Tehama	--	--	--	10	--	--	250	--	--	500	--	--	--	--	--
07N01E14J001M	Alluvial/Upper Tehama	10	--	ND	20	--	12.00	250	--	22.00	597.87	--	540	27.60	--	12.00
08N01E32N001M	Alluvial/Upper Tehama	10	--	--	10	--	--	250	--	--	500	--	--	--	--	--
08N01E35K001M	Alluvial/Upper Tehama	16.32	--	1.25	10	--	4.40	250	--	12.00	500	--	350.	10	--	4.40
4810008-025	Alluvial/Upper Tehama	10	--	ND	10	--	ND	250	--	6.90	500	--	280	10	--	ND
4810009-003	Alluvial/Upper Tehama	10	--	2.30	10	--	3.60	250	--	12.00	500	--	320	18.75	--	3.60
4810008-007	Basal Tehama	10	2.00	2.35	10	1.30	1.38	250	16.00	16.50	500	360	380	10	8.60	1.38
4810008-030	Basal Tehama	10	8.20	7.02	10	0.32	0.30	250	8.30	8.10	500	300	305	25.18	30.00	0.30
4810013-001	Basal Tehama	10	6.30	5.97	10	0.98	0.86	250	--	9.00	500	--	380	10	--	0.86
3400122-001	Unknown	10	--	5.30	10	--	0.87	250	--	--	500	--	--	10	--	0.87
3400192-001	Unknown	10	--	4.05	10	--	ND	250	--	11.00	500	--	170	10	--	ND
3400420-001	Unknown	94.57	--	64.42	10	--	0.43	--	--	--	--	--	--	--	--	0.43
3400444-001	Unknown	--	--	--	10	--	ND	--	--	--	--	--	--	--	--	ND

Well Number	Aquifer Designation	MT Arsenic (µg/L)	2023 Arsenic (µg/L)	3-Yr Avg Arsenic (µg/L)	MT Nitrate (mg/L)	2023 Nitrate (mg/L)	3-Yr Avg Nitrate (mg/L)	MT Chloride (mg/L)	2023 Chloride (mg/L)	3-Yr Avg Chloride (mg/L)	MT TDS (mg/L)	2023 TDS (mg/L)	3-Yr Avg TDS (mg/L)	MT Cr6 (µg/L)	2023 Cr6 (mg/L)	3-Yr Avg Cr6 (µg/L)
3400455-001	Unknown	--	--	--	10	--	ND	--	--	--	--	--	--	--	--	ND
3410047-001	Unknown	16	--	14.75	10	--	ND	250	--	5.80	500	--	130	10	--	ND
3410302-002	Unknown	21	--	--	10	--	ND	303	--	--	985	--	--	--	--	ND
4800612-001	Unknown	10	--	--	10	--	ND	--	--	--	--	--	--	--	--	ND
4800709-001	Unknown	10	--	--	10	0.30	0.30	250	--	--	552	--	--	--	--	0.30
4800786-001	Unknown	10	--	--	10	0.90	0.97	250	--	--	500	--	--	--	--	0.97
4810004-003	Unknown	10	--	8.03	10	--	1.37	250	--	112	500	--	470	10	--	1.37
4810004-004	Unknown	18	17.00	14.39	10	ND	ND	250	--	--	500	410	426.92	10	--	ND
4810011-001	Unknown	10	--	ND	10	3.90	2.33	250	--	18	534.75	--	380	10	--	2.33
4810020-001	Unknown	10	--	ND	10	6.20	7.44	250	--	--	500	--	--	14.40	--	7.44
4810023-001	Unknown	10	--	--	10	ND	ND	250	--	--	500	--	--	--	--	ND
4810801-002	Unknown	10	5.60	6.40	10	0.21	0.33	250	--	--	852	--	--	10	--	0.33

Notes

Wells without MTs do not have historical data; MTs will be set at 5-year update.

Table 6-3 Summary of Groundwater Quality RMS Monitoring Status (Water Year 2023)

6.4 Interconnected Surface Water

Figure 2-8 displays the current interconnected surface RMS network for the Solano Subbasin. Interconnected surface water conditions in the Subbasin are tracked using groundwater levels measured at select RMS wells and streamflow measured at gages specified in the Putah Creek Accord. **Table 6-5** provides a summary of the current (2023) groundwater levels at interconnected surface water RMS wells and **Appendix J1 and J2** provide a historical summary. In 2023, two RMS wells were not measured after being recently dropped from DWR's monitoring program. Efforts are being made to resume monitoring of these wells, as noted in Section 6.1. One of the six wells in the interconnected surface water RMS network was below the MT in 2023; this represents 17 percent of the RMS wells. The one well with the MT exceedance (06N01E12M001M) was monitored in December 2023 for the first time since being dropped from DWR's monitoring program. Oil was observed in the well at the time of the December 2023 measurement and this measurement is being reviewed to determine if it accurately represents groundwater levels at the site. **Table 6-6** provides a summary of measured flows in Putah Creek during 2023 relative to flow requirements within the Subbasin specified in the Putah Creek Accord. During 2023 all mean daily passing flows in Lower Putah Creek were above the required flow values with many months experiencing flow values in Lower Putah Creek that were two or three times those required by the Putah Creek Accord. An undesirable result for depletion of interconnected surface water is defined as greater than 30 percent of RMS wells exceeding the MT for two consecutive years or not meeting the flow requirements of the Putah Creek Accord. Therefore, no undesirable result for interconnected surface water occurred in the Subbasin in 2023.

Table 6-5 Summary of Interconnected Surface Water RMS Monitoring Status (Water Year 2023)

RMS ID	Aquifer Designation	Minimum Threshold (MT)		2023		Comment
		Depth (ft)	Elev (ft msl)	Depth (ft)	Elev (ft msl)	
47	Alluvial/Upper Tehama	32.1	63.3	18.0	77.4	
05N02E25K001M	Alluvial/Upper Tehama	11.9	-8.4	--	--	Well destroyed or no longer accessible; well planned for network removal and/or replacement
06N01E12M001M	Alluvial/Upper Tehama	16.9	25.7	31.8	10.8	Successfully re-recruited, resumed monitoring in December 2023; representativeness of 2023 measurement being reviewed (oil in well)
06N01E17M001M	Alluvial/Upper Tehama	18.2	48.1	11.5	54.8	
06N02E19J001M	Alluvial/Upper Tehama	15.2	10.8	9.6	16.4	
07N01W13H001M	Alluvial/Upper Tehama	20.6	88.0	--	--	Ongoing efforts to re-recruit

Notes:
Gray shading indicates MT exceedance.

Table 6-6 Summary of Measured Putah Creek Flows in Relation to Required Flows (Water Year 2023)

	October	November	December	January	February	March	April	May	June	July	August	September
Specified Flow Requirements – Non-Drought Year (cfs)												
Required Mean Daily Flow in Lower Putah Creek	5	10	10	15	15	25	30	20	15	15	10	5
2023 Measured Flows – Non-Drought Year (cfs)												
Actual Mean Daily Flow in Lower Putah Creek	23	44	41	23	22	36	51	33	24	20	12	12

6.5 Land Subsidence

Figures 2-7 display the current land subsidence RMS network for the Solano Subbasin. **Table 6-4** provides a summary of the current (2023) seasonal fluctuation and **Appendix I** provides a historical summary. In 2023 no subsidence RMS had annual vertical displacement exceeding an MT.

Table 6-4 Summary of Land Subsidence RMS Monitoring Status (Water Year 2023)

Station ID	MT Annual Vertical Displacement (ft/yr)	Annual Vertical Displacement (ft/yr) March to March	Annual Vertical Displacement (ft/yr) October to October
		2022-2023	2022-2023
DIXN	-0.0957	-0.0355	0.0216
VCVL	-0.0786	0.0105	-0.0278
P266	-0.0677	-0.0186	-0.0031
P267	-0.0651	-0.0070	-0.0025

6.6 Sea Water Intrusion

The Subbasin is not located adjacent to the Pacific Ocean and no monitoring network or SMC for sea water intrusion was developed in the GSP. However, chloride concentrations in groundwater are monitored as part of the groundwater quality monitoring network as a metric for tracking any potential migration of higher-salinity water from the Delta. No MT exceedances for chloride have occurred in the Subbasin to date.

7 GSP IMPLEMENTATION ACTIVITIES

The Solano Subbasin GSAs are committed to maintaining the sustainability of groundwater resources in the Subbasin. Many of the ongoing groundwater management activities in the Subbasin are summarized in the GSP. Additional projects and management actions (PMAs) have been developed to support the sustainability goal for the Subbasin, as described in the GSP. Based on historical, current, and projected water budgets, the Solano Subbasin is anticipated to remain sustainable with minimal to no additional intervention by the GSAs. The PMAs identified in the Solano GSP were determined not to be necessary to maintain sustainability throughout the Solano Subbasin, but they are available to the GSAs should conditions change. This section describes some of the GSP implementation activities occurring in the Subbasin. **Table 7-1** presents the potential PMAs in the Subbasin identified during GSP development and being pursued or considered during GSP implementation. The PMAs described in the GSP for ongoing completion or future planning include continued outreach and education efforts to implement practices that conserve water, enhance recharge, and reduce runoff and projects that will augment water supplies.

Additional GSP implementation activities are being undertaken and are planned as part of work funded through a DWR Proposition 68 GSP Implementation Grant awarded to the Subbasin in 2023. In The grant will support a variety of GSP implementation tasks being conducted by different GSAs and collaborating entities through April 2026. GSP implementation activities supported by the grant include the following:

- Enhancements to monitoring program and data management system
- Well and surface water diversion inventories
- ISW and GDE evaluation
- Refinement of subbasin ET and water use estimates
- Water conservation evaluations, education, and outreach
- Developing future groundwater management policies
- Recharge study and project design and planning
- Recycled water planning
- GSP reporting
- Stakeholder engagement and community outreach

7.1 Outreach and Education

The GSAs in the Subbasin have performed extensive outreach efforts focused on informing, educating, and engaging water users and other interested parties in the Subbasin. Particularly notable outreach efforts conducted recently include a public virtual town hall meeting, a grower workshop, distribution of newsletters and other content with information on groundwater management activities and public engagement opportunities, and development of an interactive web map application providing information on groundwater conditions in the Subbasin.

On June 1, 2023 the Solano Collaborative convened a virtual town hall event to provide interested participants an overview of GSP implementation activities, current and recent groundwater conditions in the Subbasin, and an opportunity to ask questions of GSA representatives and technical experts. Individuals representing a range of beneficial uses and users attended the virtual town hall. The Dixon and Solano RCDs, in coordination with the NRCS and the Solano GSA, held an annual Groundwater Workshop on January 24, 2024 focused on providing information to growers in the Subbasin and nearby areas on the status of GSP implementation, groundwater level and quality conditions in the Subbasin, and recharge opportunities, and nitrogen and irrigation management. The Solano Collaborative recently developed and launched an interactive web map presenting information on groundwater conditions in the Subbasin. The first phase of the web map development focusses on providing information on ground water level and quality conditions at RMS locations; future web map enhancements are planned to incorporate information on other sustainability indicators and additional monitoring sites. The web map application can be accessed at the following link: https://experience.arcgis.com/experience/bcf6baddd9014bf98b81917b5b2b2051/.

The Subbasin has and will continue in efforts to develop and distribute informational materials and conduct outreach to improve water use efficiency across all sectors. Many of these activities occur through efforts conducted by partnering entities in the Subbasin with missions involving improving water conservation and management.

The Solano County Water Agency (SCWA) has various ongoing programs targeting water conservation in the County, including in the Solano Subbasin. The SCWA website provides information to stakeholders on residential and commercial rebates, free assessments of residential water use through the Solano County Residential Survey Program, Solano County's School Water Education Program (SWEP) targeting K-12 schools in the County, and tips and resources for conserving water. The Solano Water Advisory Commission (SWAC) convened by SCWA and consisting of water managers in the County, developed a white paper in October 2022 (https://www.solanogsp.com/wp-content/uploads/2022/11/20221004_SWAC-White-Paper.pdf) summarizing findings from review of water conservation activities occurring in the County and evaluating compliance with statewide water conservation goals and regulations. The SWAC paper lists different actions implemented by urban water suppliers to improve water use efficiency. These include a variety of actions including:

- expanding outreach about rebate and incentive programs for increasing water conservation through turf removal and installation of water-efficient appliances and fixtures;
- expanding public education about water conservation;
- reinstating residential and commercial water use survey program;
- prohibiting, monitoring, and educating residents on preventing wasteful activities;
- making water use data more readily available to customers;
- restricting days and times for landscape irrigation; and
- leak detection and meter calibration/replacement programs to reduce water distribution system losses.

The Agricultural Water Conservation Committee comprised of representatives from SCWA, SID, MPWD, RD2068, Dixon RCD, Solano RCD, U.C. Cooperative Extension, and the Natural Resources Conservation

Service provides soil and weather monitoring, educational materials, training, workshops, and well and irrigation system testing to support improvements to irrigation water management for growers in Solano County. The process for accessing these resources is included on the SCWA websites.

The Dixon and Solano RCDs provide many services within the Solano Subbasin that support water management including conducting ongoing activities to educate and train stakeholders in water conservation and irrigation management practices. The Dixon RCD adopted a long-range plan in March 2022 that includes goals involving supporting improved water conservation, efficiency, and reuse by growers and landowners through continued support of the Solano County Agricultural Water Conservation Committee efforts to increase water efficiency and also partnering with various agencies (local, State, and Federal) to demonstrate and convey the benefits of water conservation. The Solano RCD goals also include educating children and adults about watershed science and stewardship. Partnering with the RCDs provides a valuable avenue for outreach on water management practices to a wide audience of stakeholders.

7.2 Projects

Projects identified for potential implementation as part of the GSP, if determined to be necessary or of interest in the Subbasin, include expanded use of recycled water from the City of Vacaville and enhancing groundwater recharge through stormwater capture and rainfall infiltration in parts of the Subbasin. Although these projects are not anticipated to be necessary to maintain sustainability in the Subbasin, the GSAs have continued exploration of potential opportunities for implementing projects aimed at enhancing groundwater recharge. In coordination with the GSAs, Dixon RCD has initiated outreach to landowners to solicit interest in implementing projects. The outreach conducted to date has included focused meetings and broader distribution of surveys to landowners in areas of the Solano Subbasin where there is greater need or benefit from projects aimed at enhancing recharge. Follow-up conversations with select survey respondents have also occurred and will continue in the future as further evaluation of potential recharge project opportunities occurs.

Building on work completed during the preparation of the GSP, the Subbasin GSAs have continued review of conditions and characteristics in the Subbasin for the purpose of evaluating the potential for implementing recharge projects in different areas of the Subbasin. The assessments have included review of data on land uses and cropping, parcel characteristics (e.g., size, shape), groundwater levels, soil characteristics, subsurface lithology, existing water infrastructure, historical flooding and drainage issues, and other considerations.

Because of the Subbasin's proximity to major surface water features in the Delta and westside tributary streams with periodic availability of stormflow water, including from surface water in Putah Creek and stored in Lake Berryessa, the Subbasin likely has access to considerable available surface water for use in enhancing recharge. Detailed assessment of surface water available for enhanced recharge projects in the Subbasin has not been conducted, although analyses of recharge projects conducted as part of the GSP development estimated available stormwater for the purpose of simulating the effects and benefits of implementing such activities. Further evaluation of surface water available for recharge will be conducted as part of studying and design of any specific recharge projects undertaken in the Subbasin.

Planning of multi-benefit projects to improve stormwater management and reduce local flooding while providing benefits to groundwater through enhanced recharge, especially in the Northwest Focus Area, is of strong interest in the Subbasin. Solano County has recently initiated a One Water Framework planning process intended to provide a coordinated approach to water management across the County and the objectives of the One Water Framework planning activities are closely aligned with GSP implementation objectives. A One Water Framework Steering Committee comprised of representatives from water management entities across the entire County was formed and six Steering Committee meetings were held in 2023 to provide input in the development of a One Water Master Plan.

In 2023 the GSAs, in partnership with Solano County Water Agency, Dixon RCD, and Solano RCD, began a pilot study on the use of cover crops as a potential agricultural management practice to improve stormwater management and reduce local flooding while providing benefits to groundwater through enhanced recharge. A local pilot study of select cover crop practices is underway to document potential benefits and management challenges associated with implementation of these practices. The results from the study will be shared with growers in the Subbasin.

SID has been continuing planning efforts related to a project to improve the reliability of water supply for drinking water and fire protection needs in the Quail Canyon Improvement District (QCID) community. SID recently secured $2.82 million in federal funding for design and construction of a new well and associated distribution system components for QCID. The existing QCID Public Water System Well is in the far northwestern part of the Solano Subbasin and is the sole source of supply for the community. Water levels in the well have been declining over recent years despite reductions in demand from water conservation efforts. The production capacity of the well has declined from 140 gallons per minute (gpm) to 40 gpm. The greatly reduced well production capacity cannot meet domestic or fire needs as was demonstrated in the 2020 LNU Complex fire when production from the well was insufficient to fill tanker trucks needed for firefighting. There are also properties nearby that have requested service because of declining production and water levels in private wells. QCID is located several miles from the nearest domestic water system; therefore, interconnection is not feasible. The project will include constructing a new well at a nearby site with more favorable aquifer characteristics to provide drought and fire resiliency for QCID. Approximately 3,500 linear feet of conveyance pipeline will be installed to deliver water from the new well to serve current and future customers.

Through funding provided by the SGMA implementation grant, the GSAs intend to evaluate the need and opportunity for developing greater resilience of drinking water supplies in the far northwest part of the Subbasin. This evaluation will include consideration of domestic well vulnerability and opportunities to bolster drought and climate change resilience involving water system consolidation, localized enhanced recharge, and other more. Initial stages of characterizing the locations of wells and water quality conditions in the vicinity of groundwater drinking water users is underway and involves a well inventory (described below).

Table 7-1. Ongoing, Planned and Potential Projects and Management Actions in the Solano Subbasin

Name	Brief Description	Status
Ongoing PMAs		
Municipal & Industrial Water Use Efficiency Outreach & Implementation	Develop Outreach materials and incentives for municipal and industrial water users to increase water use efficiency.	Occurring, additional efforts planned with funding through SGMA Implementation grant
PMAs Developed for Implementation		
City of Vacaville Recycled Water	Develop City's Recycled Water Program as recommended in the 2020 Recycled Water Master Plan Feasibility Study, including construction and installation of recycled water treatment, storage and conveyance facilities; development of a recycled water use ordinance; updating permits; and identifying customers and executing supply contracts.	Funding secured for advancing planning efforts beginning in 2024.
Westside Streams Stormwater Capture Project	Develop an implementation schedule for potential projects in the Northwest Focus Area to enhance groundwater recharge and support local groundwater sustainability.	Evaluating opportunities, coordinating planning with local property owners and entities, additional efforts planned with funding through SGMA Implementation grant
Rainfall Managed Aquifer Recharge Demonstration Project	Evaluate the use of specific managed aquifer recharge activities on local farms to generate multiple benefits for groundwater sustainability and stormwater management.	Efforts occurring and continuing, additional efforts planned with funding through SGMA Implementation grant
Potential PMAs		
Other Groundwater Recharge Opportunities	Several conceptual recharge projects have been identified along Ulatis Creek to support ongoing groundwater sustainability in the Solano Subbasin. The Nature Conservancy has provided GSAs with guidelines to implement on-farm, multi-benefit groundwater recharge efforts that would also be applicable in the Solano Subbasin.	Evaluating opportunities
Grower Education Related to On-Farm Practices for Sustainable	Use of Solano Agricultural Scenario Planning System (SASPS), a web-based application that GSAs and other local agencies can use to	Ongoing and for future consideration

Name	Brief Description	Status
Groundwater Management	design voluntary programs to engage agricultural producers in on-farm sustainable groundwater management projects.	
Demand Management	Develop a program that would incentivize voluntary participants to reduce water consumption.	Ongoing consideration, additional efforts planned with funding through SGMA Implementation grant
Groundwater Trading Institution	Monitor Solano Subbasin conditions and consider a groundwater trading market to increase flexibility (options) to respond to potential demand management programs.	For future consideration
Education and Collaboration	The Solano Resource Conservation District (SRCD), TFT, Local Government Commission (LGC), and RD 2068 all provide groundwater and water conservation education to classrooms and growers within the Solano Subbasin.	Occurring; grower Groundwater Workshops held in January 2022 and 2023 focusing on groundwater conditions and management practices to enhance recharge, additional efforts planned with funding through SGMA Implementation grant
Well Owner Outreach and Education	Develop and implement education and outreach about private domestic well monitoring.	Occurring to some degree through new interactive web map and other information presented on the GSP website and coordinated ILRP efforts, additional efforts planned with funding through SGMA Implementation grant
Participation in Other Water Resources Management Programs	Implement other groundwater management strategies including further use of recycled water, expanded conjunctive water management, changes to well regulations, inventory of active wells, and other actions.	Occurring and in planning

7.3 Monitoring Enhancements and Addressing Data Gaps

The GSAs in the Solano Subbasin have been conducting various efforts to enhance GSP monitoring and address data gaps. Important efforts conducted in 2023 related to monitoring enhancement and addressing data gaps, some of which have been described above, consisted of the following:

- Re-recruiting of GSP monitoring network wells dropped from other monitoring programs (e.g., DWR, USBR)
- Recruiting of wells for the GSP monitoring program to address monitoring data gaps

- Planning and implementation of automated water level monitoring in select wells
- Establishing reference elevations for stream gage sites

As part of an effort to ensure an accurate representation of groundwater uses and users is available for groundwater management planning efforts in the Subbasin, in 2023 the GSAs started an inventory of wells throughout the Subbasin. The well inventory relies heavily on coordination with Solano County (most wells in the Subbasin are in Solano County) and will also support broader Solano County efforts to develop and maintain a more accurate accounting of wells across the entire County. Implementation of the well inventory builds on planning efforts initiated by the GSAs and Solano County in 2022 and involves compiling a complete GIS dataset of groundwater wells in Solano Subbasin, aggregating all available well completion report data from DWR and well permit data from the County, attempting to differentiate between active and inactive wells, and identifying and characterizing the uncertainty associated with individual records or mapped well locations. Data processing includes digital verification of all well locations where possible, evaluation of parcels likely to have wells and needing further reconnaissance, and development of a data structure to tie in with the County's current Accela database. Well inventory efforts are ongoing. Information gathered from this effort will help inform the Subbasin on future water management strategies and strengthen understanding of the locations of current water users and estimates of water use.

Improving the representation of surface water diversions and deliveries in the Subbasin is important for estimating groundwater and surface water uses in the Subbasin. In coordination with completion of the well inventory described above, the GSAs also started an inventory of surface water diversions in the Subbasin in 2023. This work also built on planning efforts initiated in 2022 with work in 2023 involving coordination with Solano County and existing data available from the County's Habitat Conservation Plan, reviewing points of surface water diversions reflected in the SWRCB Electronic Water Rights Information System (eWRIMS) database system for the Subbasin, and compiling a processed GIS dataset that includes a refined inventory of surface water points of diversion, volumes of surface water diverted, and where possible the place of use for these diversions. Surface water diversion inventory efforts are ongoing. Information gathered from this effort will help inform the Subbasin on future water management strategies with improved estimates of locations and volumes of surface water use, which will also help support improvements to estimates of groundwater use.

7.4 Recommended GSP Corrective Actions in DWR Determination Letter

On January 18th, 2024 DWR issued an approval of the Solano Subbasin GSP. The GSP approval letter from DWR recommends three corrective actions to address in future GSP updates. The first required review and assessment (update) of the GSP is due in January 2027. The following section summarizes DWR's recommended GSP corrective actions and the status of GSA efforts undertaken to address each.

7.4.1 Recommended Corrective Action 1

Revise the definition of undesirable results for degraded groundwater quality so that exceedances of minimum thresholds caused by groundwater extraction, whether the

GSAs have implemented pumping regulations or not, are considered in the assessment of undesirable results in the Subbasin. Under SGMA, GSAs are responsible for monitoring and managing potential water quality degradation caused by groundwater extractions in the Basin.

The SMC for groundwater quality in the Subbasin are defined in **Section 6** of the GSP. The definition of an undesirable result for degraded groundwater quality will be reviewed and revised to address this recommendation at the time of the next GSP update. .

7.4.2 Recommended Corrective Action 2

Revise the proposed sustainable management criteria for land subsidence as follows:

a. Identify critical infrastructure susceptible to land subsidence and describe what constitutes significant and unreasonable effects. Define the rate (vertical displacement over time) and extent (lateral extent and total vertical displacement) of land subsidence considered to cause these significant and unreasonable impacts.

b. Describe how minimum thresholds and the quantitative identification of undesirable results defined for the land subsidence monitoring network are protective of the rate and extent of land subsidence considered significant and unreasonable.

c. Revise or expand the land subsidence monitoring network to be able to sufficiently detect land subsidence throughout the Subbasin. Department staff understand that portions of the Subbasin near the Delta may experience land subsidence due to the decomposition of peat, which is unrelated to groundwater extractions. The GSP may develop an evaluation process where groundwater level data is used in conjunction with land subsidence data to disregard this type of land subsidence, if detected.

Historical subsidence data indicate there is only very small amounts of subsidence that may be related to groundwater extraction. The subsidence SMCs in the GSP were developed with consideration for historical rates of displacement and seasonal fluctuations in displacement and their potential to impact critical infrastructure. Subsidence SMC are assigned at selected CGPS sites identified as RMS. InSAR data for the Subbasin are readily available and reviewed each year as part of the GSP annual reporting and this will continue. Prior to the submittal of the first periodic GSP review and update, SMC for land subsidence will be reviewed with consideration for the items described in Recommended Corrective Action 2. Additional characterization of critical infrastructure in the Subbasin and the tolerance of this infrastructure for land surface elevation changes will be a key part of addressing this item.

7.4.3 Recommended Corrective Action 3

Department staff understand that estimating the location, quantity, and timing of stream depletion due to ongoing, Subbasin-wide pumping is a complex task and that developing suitable tools may take additional time; however, it is critical for the Department's ongoing and future evaluations of whether GSP implementation is on track to achieve sustainable groundwater management. The Department plans to provide guidance on methods and approaches to evaluate the rate, timing, and *volume of depletions of interconnected surface water and support for establishing specific sustainable management criteria in the near future. This guidance is intended to assist GSAs to sustainably manage depletions of interconnected surface water.*

In addition, the GSA should work to address the following items by the first periodic update:

a. Continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.

b. Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSA's jurisdictional area.

c. Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.

Available guidance provided by DWR on management of depletions of interconnected surface water, which to date has not yet been released, will be considered as part of completing the next update of the GSP.

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