SPECIAL MEETING OF THE BOARD OF DIRECTORS OF THE TUSCAN WATER DISTRICT

AGENDA

Thursday, May 14, 2026 @ 9:00 a.m.
Butte County Association of Governments (BCAG) Board Room
326 Huss Drive, Chico, California 95928

TUSCAN WATER DISTRICT (TWD) REGULAR BOARD MEETING

1. Call to Order & Pledge of Allegiance

2. Public Comment. Members of the public may address the Board on any matter not already listed below. The Board cannot act at this meeting on requests made under this section of the agenda.

REGULAR AGENDA

3. Board Meeting Minutes for April 15, 2026
   Recommendation: Review and Take Appropriate Action

4. Finances & Payment of the Bills
   Recommendation: Review and Take Appropriate Action

5. South Vina Extension Water Supply – Phase 1 Scoping & Feasibility
   Recommendation: Review and Take Appropriate Action

6. SWEEP Grant Application
   Recommendation: Discuss and Take Appropriate Action

7. 2026-27 County Assessment Process Update
   Recommendation: Review and Take Appropriate Action

8. 2026 County Elections Process Update
   Recommendation: Review and Take Appropriate Action

9. Vina GSA Periodic Evaluation Update
   a. GSP Plan Evaluation Process & Timeline
   b. Domestic Well Mitigation Program
   c. Land Subsidence Strawman Proposal
   d. GDE Technical Memo
   e. Approach to Interconnected Surface Water Technical Memo
   f. Monitoring Network, MT/MOs, Storage, & GDEs
   g. Water Quality, Interbasin Coordination & Project & Management Actions

   Recommendation: Review and Take Appropriate Action

COMMUNICATIONS AND REPORTS

10. General Manager Updates
    a. Legal Implications for Recharge Projects
        i. GSA Full Detail: https://www.vinagsa.org/legal-implications-of-recharge-in-the-vina-subbasin
        ii. AGUBC Summary: https://cosmo1007.github.io/vina-recharge-brief/
    b. Well Permit Ordinance Update Process
        i. https://www.buttecounty.net/774/Water-Well-Advisory-Group
    c. Interactive Maps:
        i. GSA: https://www.vinagsa.org/interactive-groundwater-map
        ii. AGUBC: https://cosmo1007.github.io/2022-rms-network/

11. Topics for upcoming meetings:
    a. Vina GSA Plan Evaluation & Amendment Process & Issues
    b. South Vina Extension Water Supply – Phase 1 Scoping & Feasibility (if funded)
    c. Groundwater Recharge Evaluation Project, including Durham Mutual Water Company Irrigation Main Conditions and Upgrade Recommendations
    d. Caltrans / Highway 99 Drainage Project
    e. Water Transfer Policy
    f. Demand Reduction Strategies Project

12. Board Member Announcements, Reports and/or Requests for Future Agenda Topics

CLOSED SESSION

PUBLIC EMPLOYMENT (Govt. Code Section 54957.)
Title: General Counsel
Title: General Manager

ADJOURNMENT

NOTES

In compliance with the American with Disabilities Act, if you need disability-related modifications or accommodations, including auxiliary aids or services, to participate in this meeting, please email info@tuscanwaterdistrict.org by Noon the day prior to this meeting.

Written material distributed during a public meeting will be available for public inspection at the meeting, if prepared by the district or a member of its legislative body, or after the meeting if prepared by some other person. Any materials related to an item on this Agenda are available for public inspection online at https://www.tuscanwaterdistrict.org/.

TUSCAN WATER DISTRICT

Board Meeting Minutes – April 15, 2026

DATE: April 15, 2026

TIME: 9:00 a.m.

LOCATION: Butte County Association of Governments (BCAG) Board Room, 326 Huss Drive, Chico, California 95928

Directors Present: Rich McGowan (President), Brian Mori, Bill Chance, Andrew Mendonca, Todd Turley, Steve Koehnen

Directors Absent: Rayme Antonowich, Director Knight, Director Paiva

Staff Present: Tovey Giezentanner, General Manager

Others Present: Joe Hughes, Legal Counsel (via Zoom); Jim Graydon; Joanne Kidd; Dillon McGregor; Anne Dawson

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1. Call to Order & Pledge of Allegiance

President McGowan called the meeting to order at 9:00 a.m.

2. Public Comment

No public comment was received.

3. Approval of March 18, 2026 Board Meeting Minutes

Action: Motion by Director Mori, seconded by Director Chance, to approve the March 18, 2026 board meeting minutes. Motion carried unanimously.

4. General Manager Employment Agreement

President McGowan opened discussion of the General Manager's employment agreement, which the Board had reviewed at the prior meeting. No public comment was received. For the record, President McGowan noted two provisions: (1) expenses must be pre-approved in writing by the District; and (2) the agreement carries a 24-month initial term with automatic annual renewal unless either party provides notice of non-renewal. The agreement also recognizes that GM Giezentanner operates under contract and may pursue other professional opportunities, which he is expected to disclose to the Board. GM Giezentanner confirmed his understanding of the terms. Director Mendonca noted a minor drafting issue—a reference to a "Section 9A" with no corresponding subsection—but indicated it was not a material concern; no correction was requested. Director Turley emphasized clear communication on reimbursable expenses, and GM Giezentanner agreed to seek advance written approval for anticipated expenses.

Action: Motion by Director Turley, seconded by Director Koehnen, to approve the General Manager employment agreement. Motion carried unanimously.

5. Payment of Bills

5A. Giezentanner & Associates — $14,583. Invoice presented for Board consideration.

Action: Motion by Director Chance, seconded by Director Turley, to approve payment. Motion carried unanimously.

5B. InterWest — Liability and D&O Insurance Premium. GM Giezentanner explained the District's plan runs on an April-to-April cycle. The prior premium had been prorated (approximately $7,300–$7,400) because coverage began in August; the current invoice reflects the first full-year premium. Coverage is unchanged from the prior year, though costs for certain individual coverages increased modestly. A side-by-side quote comparison is on page 30 of the packet.

Action: Motion by Director Mendonca, seconded by Director Koehnen, to approve payment. Motion carried unanimously.

5C. Provost & Pritchard — February Invoice (Rock Creek/Kiefer Slough Study). GM Giezentanner presented the February invoice reflecting the firm's initial work on the Rock Creek/Kiefer Slough concept the Board had previously directed staff to explore. Approximately $4,000 was billed in February, with $1,200 billed in January; an additional $4,000–$4,500 of March work is pending invoicing.

Action: Motion by Director Turley, seconded by Director Mori, to approve payment. Motion carried unanimously.

5D. Joe Hughes, Legal Counsel — $1,657.50. Invoice presented for Board consideration.

Action: Motion by Director Turley, seconded by Director Koehnen, to approve payment. Motion carried unanimously.

6. Approval of Fiscal Year 2026–27 Budget

President McGowan presented the proposed FY 2026–27 budget, developed by the ad hoc budget committee (President McGowan, Director Antonowich, Director Turley). The prior-year assessment of $6.45 per acre generated an authorized budget of $619,400; projected actual expenditures through June 2026 are approximately $196,000, with unspent balances carried forward as reserves. The committee recommended reducing the per-acre assessment for FY 2026–27 to **$4.91 per acre**, with a total approved budget of approximately **$471,000** (board packet pages 40–41).

GM Giezentanner summarized the budget structure (personnel, office, external support, litigation, outside counsel, technical support, lobbying and advocacy, and reserves), referencing packet pages 39 and 41. Personnel reflects an anticipated spend of approximately $215,000 with a $150,000 reserve; litigation and outside counsel received no new funding but retain approximately $75,000 in reserves; and a $50,000 contingency line under reserves may be reallocated as needed. Director Turley noted the technical support line was increased modestly in anticipation of district growth, while litigation was held level given no draws in the prior year. President McGowan added that pressures on the agricultural economy were a significant factor in the assessment reduction. The Board briefly discussed litigation reserve adequacy, noting significant legal expenditures typically arise later in the litigation lifecycle.

Action: Motion by Director Mendonca, seconded by Director Mori, to approve the FY 2026–27 budget as presented, including a per-acre assessment of $4.91 and a total budget of approximately $472,069. Motion carried unanimously.

Action Item: GM Giezentanner to initiate the annual assessment process with Butte County and return to the Board with a full outline of process and timeline.

7. May Meeting Date Change

BCAG advised that the May 20, 2026 regular meeting date was unavailable. After consulting with BCAG and board members, GM Giezentanner identified **Thursday, May 14, 2026, at 9:00 a.m.** as the alternative. Counsel Hughes advised that the cleanest path is to call a special meeting on May 14 rather than amend the adopted calendar, and that the Brown Act's traditional teleconference provisions (which predate COVID-era amendments and remain in effect) permit Director Turley to participate remotely if the agenda is posted at his office location at least 72 hours in advance (adjourned regular meeting) or 24 hours in advance (special meeting), with his office designated as a remote location. **No formal action was taken;** the May 2026 board meeting is rescheduled to a **special meeting on May 14, 2026, at 9:00 a.m.** at the BCAG Board Room.

Action Item: GM Giezentanner to update the TWD website and follow proper Brown Act noticing procedures, including posting the agenda at Director Turley's office location.

8. General Manager Report and Updates

8A. Vina GSA Update. The Vina GSA Board met March 8, 2026; primary discussion focused on the process by which the GSA receives and documents stakeholder input in anticipation of the Plan Evaluation report due to DWR in early 2027. The stakeholder input process has been posted to the GSA website. All board members have submitted Form 700s.

8B. Rock Creek Reclamation District Update. On March 12, 2026, GM Giezentanner presented to the Rock Creek Reclamation District on AGUBC work, the TWD assessment, and interbasin coordination. The presentation is posted to the TWD website.

8C. AGUBC Recharge and Demand Reduction Work

Recharge Studies. AGUBC is conducting field investigations across multiple sub-basin properties (TTEM surveys, CPT investigations, sonic borings, permeability testing, monitoring well installations, pilot ponding tests, and a tile drain pilot), including east of Durham and along Dry Creek. Geosyntec, with Joe Turner as lead technical analyst, will compile findings into a comprehensive technical memorandum to support project concepts for Vina GSA consistency determination and potential Proposition 4 construction funding.

Action Item: GM Giezentanner to circulate the draft recharge analysis to the Board prior to the May 14, 2026 special meeting, if available.

Demand Reduction — Extend Orchard and Precision Irrigation. Land IQ (prime) and ERA Economics (economic analysis) led this AGUBC workstream, one of three GSP pillars alongside surface water importation and recharge. Land IQ's eleven-site orchard study estimated that fallowing reduces water consumption by approximately **0.9 to 2.6 acre-feet per acre per year** (net of residual consumption on fallowed ground). ERA Economics developed an incentive-payment framework for voluntary fallowing; long-term funding remains an open policy question. Precision irrigation analysis of 21 walnut and almond orchards found that larger operations already employ pressure bomb and soil moisture monitoring; the principal opportunity is with smaller farms, and time-of-use scheduling is a low-cost behavioral intervention. GM Giezentanner intends to invite the Land IQ lead analyst to present findings at the June or July 2026 meeting.

Action Item: GM Giezentanner to post the Land IQ and ERA Economics technical memoranda to the TWD website.

Action Item: GM Giezentanner to coordinate with the Land IQ analyst to schedule a Board presentation on demand reduction findings.

8D. Interbasin Coordination — Sacramento Valley

GM Giezentanner described an emerging multi-agency work plan (coordinated potentially through NAWQA and EWR) with three components: (1) collecting interconnected surface water data across the Sacramento Valley; (2) refining a regional surface water–groundwater model; and (3) developing a non-binding best practices framework for GSAs. He expressed concern that a coarser regional model could become DWR's default lens for GSP review, potentially designing solutions for problems the Vina Sub-basin does not have, and noted that Butte County's Butte Basin Groundwater Model offers superior local granularity. Activity is expected to intensify between April and August 2026.

Director Turley, who participates in the meetings, noted the goal is a comprehensive framework by 2032 informed by five years of data, not a January 2027 policy response, and that he has not observed intent to disadvantage Vina. Director Mori cautioned that interpretation drives policy. Dillon McGregor (Vina GSA Program Manager) emphasized the effort is in its earliest stages, with substantive policy direction three to four years away.

Action Item: GM Giezentanner to post the interbasin coordination one-pager to the TWD website.

8E. SWEEP Block Grant — Potential Application. CDFA has opened the application process for the SGMA-related SWEEP block grant. Proposition 4 restricts recipients to 501(c)(3) organizations, excluding 501(c)(6) entities such as farm bureaus. Discussions are underway with the County Farm Bureau regarding the possibility of TWD applying as the block grant recipient; the matter remains in flux. No formal action was requested.

8F. Preview of Upcoming Agenda Topics. GM Giezentanner previewed anticipated topics, including: County assessment process update; elections process detail and next steps; mitigation plan process update; well ordinance update (with agricultural stakeholder representation on the County committee to be confirmed before May 14); South Line Extension Project briefing; Durham Mutual Water Company canal/siphon work along Butte Creek; Caltrans Highway 99 drainage (Rock Creek is aware); water transfer policy (final adoption anticipated June or July 2026); and a demand reduction briefing with the Land IQ analyst.

9. Board Member Announcements & Requests for Future Agenda Items

In response to Director Mendonca's question, GM Giezentanner confirmed the status of active ad hoc committees:

- **Surface Water Ad Hoc —** concluded.
- **Budget Ad Hoc —** concluded. Director Turley confirmed for the record that he participated in the ad hoc meetings despite an inadvertent omission from the Zoom invitation.
- **Recharge Ad Hoc —** active. One additional meeting may be convened if the Kiefer Slough/Rock Creek technical memorandum is received before the May 14, 2026 meeting.
- **Legal Ad Hoc —** active. Members: Rich McGowan, Andrew Mendonca, Brian Mori. Counsel Hughes provided four candidates and offered to meet with the ad hoc following the interviews; he confirmed he remains available through at least June 2026. GM Giezentanner intends to schedule back-to-back interviews to complete the process before the May 14, 2026 meeting.

10. Closed Session

The Board adjourned to closed session at 10:25 a.m. pursuant to Government Code Section 54957 (public employment — General Counsel recruitment).

Report Out of Closed Session. The Board reconvened to open session at 10:29 a.m. No formal report out of closed session.

11. Adjournment

President McGowan adjourned the meeting at 10:29 a.m.

Agenda Item 4

TWD Finances

FY 2025-26	2025-26 APPROVED BUDGET *(attached)*	JUL 2025 Approved	AUG 2025 Approved	SEPT 2025 Approved	OCT 2025 Approved	NOV 2025 Approved	DEC 2025 Approved	JAN 2026 Approved	FEB 2026 Approved	MAR 2026 Approved	APR 2026 For Approval	MAY 2026	JUN 2026	Billed to Date	Approved Budget Remaining
TWD BUDGET CATEGORY															
Personnel	**$ 266,400**	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 14,583.33	$14,583.33			$ 89,167	$ 177,233
Office	**$ 81,000**	$ 7,304	$ 1,005	$ 165	$ 1,320	$ -	$ -	$ -	$ -	$ 12,200.00	$ -			$ 21,994	$ 59,006
External Support	**$ 97,000**	$ 2,175	$ 635	$ 1,580	$ 953	$ -	$ 3,041	$ 158	$ 2,908	$ 1,657.50	$ 977.50			$ 14,084	$ 82,916
Litigation	**$ 75,000**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ -	$ 75,000
Technical Support	**$ 50,000**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,206	$ 3,998.10	$ 4,794.82			$ 9,999	$ 40,001
Lobbying & Funding	**$ -**	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ -	$ -
Reserves	**$ 50,000**	$ 17,399	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			$ 17,399	$ 32,601
TOTALS	**$ 619,400**	**$ 34,378**	**$ 9,140**	**$ 9,245**	**$ 9,773**	**$ 7,500**	**$ 10,541**	**$ 7,658**	**$ 11,614**	**$ 32,438.93**	**$ 20,356**	**$ -**	**$ -**	**$ 152,642**	**$ 466,758**

Itemized Bills

Category	**Description**	**Amount**
Personnel	Giezentanner & Associates - General Manager	$14,583.33
Office		$ -
External Support	Klein DeNatale Goldner - General Counsel	$ 977.50
Technical Support	Provost & Pritchard	$ 4,794.82
	Total	**$20,355.65**

INVOICE

Giezentanner & Associates
30 Independence Circle, Suite 300
Chico, California 95973
United States

BILL TO
Tuscan Water District
30 Independence Circle
Chico, California 95973
United States

Invoice Number:	20201298
Invoice Date:	April 30, 2026
Payment Due:	May 30, 2026
Amount Due (USD):	**$14,583.33**

Items	Amount
Service Tuscan Water District General Manager Services April 2026 See attached Statement of Services.	$14,583.33

Total:	$14,583.33
Amount Due (USD):	**$14,583.33**

Agenda Item 4

Areas of Activity for April 2026 – General Manager Services

Board Governance & Administrative Support (Financial, Budget, Operations)

- April 15, 2026 – Regular Board Meeting. Material prep, coordination, and follow-up
- Ad hoc committee meetings (Budget). Material prep, coordination, and follow-up
- Finalize 2026-27 Budget – Narrative & Planning Budgets
- Maintenance of official District records
- Miscellaneous District Responsibilities: Insurance, May Meeting Location
- Potential office space

SGMA Compliance, Regulatory Coordination & Stakeholder Engagement

- April 22, 2026 – Attend SHAC Meeting
    - Domestic Well Mitigation Program Review & Comments to SHAC
- Wyandotte Creek GSA – Review PE, RCAs, SMCs, approach to Domestic Wells
- Develop Internal Dashboards to Analyze SGMA Issues & Basin Conditions:
    - 2022 RMS Network
    - 2022 Storage
    - Vina Subbasin Precipitation
    - Vina Subbasin Stream Flow
- Continued Evaluation: GSP Plan Evaluation & WY 2025 Annual Report

Project Development & Implementation

- Ongoing: Rock Creek / Keefer Slough Flood-MAR Concept development
- Ongoing: Durham Mutual Water Company Main Canal Conditions Assessment
- Ongoing: GSA: Recharge field work (SGM Grant) – Review & Draft PPT
- Ongoing: Caltrans Hwy 99 Project
- Ongoing: Water Supply Feasibility Analysis (South Vina Extension)
- Ongoing: Demand Reduction Strategies (Physical Stations – Upkeep)

Grant Pursuit and External Funding

- SWEEP:
    - Developed Conceptual Approach
    - Discussion & Agreement with Potential Partners

Klein · DeNatale · Goldner
ATTORNEYS AT LAW

10000 STOCKDALE HWY, SUITE 200
BAKERSFIELD, CA 93311

(661) 395-1000
FAX (661) 326-0418
E-MAIL accounting@kleinlaw.com

April 30, 2026

TUSCAN WATER DISTRICT
*****E-MAIL INVOICES*****

Invoice No.	1265595
Client No.	24618
Matter No.	001
Billing Attorney:	JDH

INVOICE SUMMARY

For Professional Services Rendered for the Period Ending: April 19, 2026.

**RE: TUSCAN WATER DISTRICT
GENERAL BUSINESS**

Professional Services	$ 977.50
Costs Advanced	$ .00
TOTAL THIS INVOICE	**$ 977.50**

Invoice No. 1265595 April 30, 2026

PROFESSIONAL SERVICES

Date	Init	Description	Hours	Amount
4/10/26	JDH	REVIEWED AND REPLIED TO E-MAIL REGARDING BOARD MEETING; RESEARCHED POTENTIAL EXCHANGE POLICY; TELEPHONE CONFERENCE WITH T. GIEZENTANNER.	1.20	510.00
4/15/26	JDH	ATTENDED APRIL REGULAR BOARD MEETING.	1.10	467.50

TOTAL PROFESSIONAL SERVICES **$ 977.50**

SUMMARY OF PROFESSIONAL SERVICES

Name	Init	Rate	Hours	Total
HUGHES, JOSEPH	JDH	425.00	2.30	977.50
Total			**2.30**	**$ 977.50**

TOTAL THIS INVOICE **$ 977.50**

Klein · DeNatale · Goldner
ATTORNEYS AT LAW

10000 STOCKDALE HWY, SUITE 200
BAKERSFIELD, CA 93311

(661) 395-1000
FAX (661) 326-0418
E-MAIL accounting@kleinlaw.com

April 30, 2026

TUSCAN WATER DISTRICT
*****E-MAIL INVOICES*****

Invoice No.	1265595
Client No.	24618
Matter No.	001
Billing Attorney:	JDH

REMITTANCE

RE: TUSCAN WATER DISTRICT
GENERAL BUSINESS

BALANCE DUE THIS INVOICE	**$ 977.50**

All checks should be made payable to:
(Please return this advice with payment.)

Klein DeNatale Goldner
10000 Stockdale Hwy, Suite 200
Bakersfield, CA 93311

For payment by ACH in USD:
(Please reference:
Client-Matter No. 24618-001,
Invoice No. 1265595)

J.P. Morgan Chase
Account No. 825707620
ABA No. 322271627

To pay by credit card, click here --->: Pay Now or call Accounting at (661) 395-1000.

DUE UPON RECEIPT

FEDERAL I.D. No. 95-2298220

Thank you! Your business is greatly appreciated.

PROVOST&PRITCHARD
CONSULTING GROUP

455 W Fir Ave • Clovis, CA 93611 • (559) 449-2700
www.provostandpritchard.com

Tuscan Water District
30 Independence Circle, Suite 300
Chico, CA 95973

April 17, 2026
Project: No: 04380-26-001
Invoice No: 129714

Project Name: **Keefer Slough & Rock Creek Flood-MAR Concept**

Client Project #:

Phase T01: Develop storage basin concepts including preliminary means for diverting, storing and returning flood flows from Keefer Slough and Rock Creek at the four subject properties. Prepare a draft Memorandum summarizing the methodology and findings of the study.

Professional Services from March 01, 2026 to March 31, 2026

Phase: T01 Flood-Mar Design Concept

Labor

	Hours	Rate	Amount	
Associate Engineer	26.63	164.00	4,367.32	
Associate Specialist	2.00	155.00	310.00	
Principal Engineer	.50	235.00	117.50	
Totals	29.13		4,794.82	
Total Labor				**4,794.82**

Total this Phase: **$4,794.82**

Total this Invoice **$4,794.82**

*** Please make checks payable to Provost & Pritchard Consulting Group ***
For billing inquiries, please email Billing@ppeng.com.

Contract Summary

Provost & Pritchard Consulting Group

Keefer Slough Flood-MAR Concept Eval

Project No. 04380-26-001	Contract Amount	Previous Billing	Current Billing	Total Billed	% Billed	Remaining
Phase T01 - Flood-Mar Design Concept	$10,000.00	$5,204.20	$4,794.82	$9,999.02	99.99%	$0.98
Project No. 04380-26-001 Total:	**$10,000.00**	**$5,204.20**	**$4,794.82**	**$9,999.02**	**99.99%**	**$0.98**

TUSCAN WATER DISTRICT
Staff Memorandum

TO: Board of Directors
FROM: Tovey Giezentanner, General Manager
DATE: May 14, 2026
RE: Item 4: Approval of Office Supply and Printer Toner Expenses ($647.59)

Action Requested. Authorize payment of $647.59 in office supply and printer toner expenses, to be paid in May or June 2026, as itemized below.

Background. Section 4 of the General Manager Agreement directs the General Manager to ensure expenditure controls and contract approvals consistent with Board-adopted policies. As the District continues its transition from formation to full operations, the General Manager is bringing routine office and printing expenses to the Board for pre-approval to maintain a clear authorization record.

Summary / Analysis. The two expenses below (and attached) cover general office supplies and printer consumables needed for District operations.

Staples — Copy Paper ($87.38). Two cases of Hammermill 8.5" x 11", 20 lb., 92-brightness copy paper for standard District printing and Board meeting materials.

Amazon — Printer Toner ($560.21). HP 202X high-yield color toner set (cyan, magenta, yellow) at $382.89 and HP 206X high-yield black toner cartridge at $129.89, plus applicable tax. These are the consumables for the District's working color laser printer and replace cartridges nearing end of life.

Total Request. $647.59.

Subject: Ordered: "HP 202X Cyan, Magenta,..." and 1 more item
Date: Monday, May 11, 2026 at 6:59:11 PM Pacific Daylight Time
From: Amazon.com
To: Tovey Giezentanner

Your Orders   Your Account   Buy Again

Thanks for your order, Tovey!

Ordered   Shipped   Out for delivery   Delivered

Arriving Thursday

Tovey - CHICO, CA
Order # 113-1121954-9812219

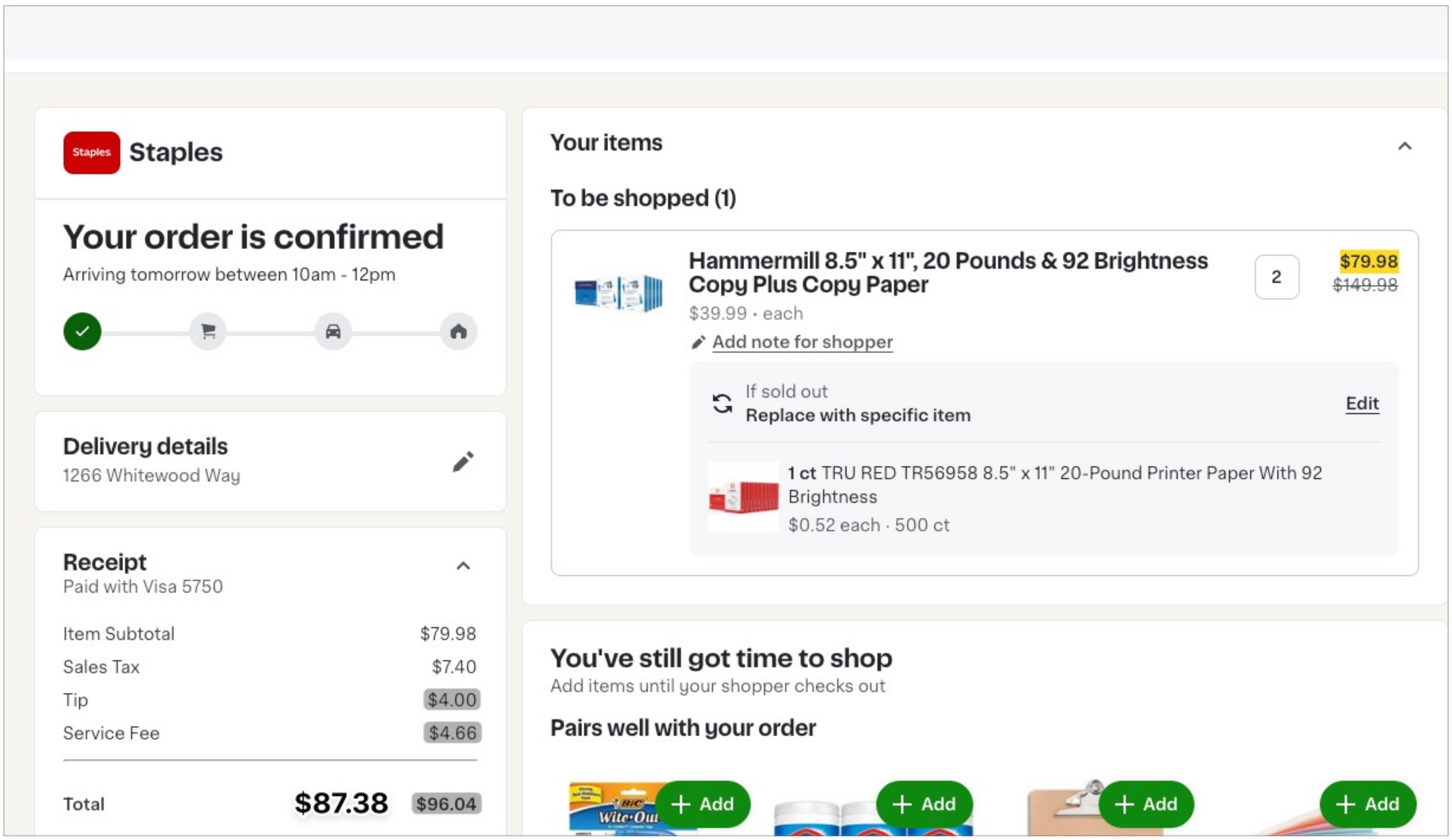
View or edit order

HP 202X Cyan, Magenta, Yellow Hig...
Quantity: 1
$382.89

HP 206X Black Toner Cartridge | W...
Quantity: 1
$129.89

Grand Total:	**$560.21**

Top picks for you



Staples

Your order is confirmed

Arriving tomorrow between 10am - 12pm

Delivery details

1266 Whitewood Way

Receipt

Paid with Visa 5750

Item Subtotal	$79.98	
Sales Tax	$7.40	
Tip		$4.00
Service Fee		$4.66
Total	**$87.38**	$96.04

Your items

To be shopped (1)

Hammermill 8.5" x 11", 20 Pounds & 92 Brightness Copy Plus Copy Paper — 2 — $79.98 ~~$149.98~~

$39.99 • each

Add note for shopper

If sold out

Replace with specific item — Edit

1 ct TRU RED TR56958 8.5" x 11" 20-Pound Printer Paper With 92 Brightness

$0.52 each · 500 ct

You've still got time to shop

Add items until your shopper checks out

Pairs well with your order

+ Add + Add + Add + Add

Agenda Item 5

TUSCAN WATER DISTRICT

Staff Memorandum

TO: Tuscan Water District Board of Directors

FROM: Tovey Giezentanner, General Manager

DATE: May 12, 2026

RE: South Vina Extension Water Supply Project — Phase 1 Scoping and Feasibility Engagement; Consultant Selection

Action Requested

Action Requested. Select the Water & Land Solutions / Provost & Pritchard joint proposal for the South Vina Extension Water Supply Project Phase 1 Scoping and Feasibility Engagement, and authorize the General Manager to execute a not-to-exceed contract in the amount of $19,950.

Background

The 2025 Vina Subbasin Surface Water Supply Feasibility Analysis confirmed that the South Vina Extension Water Supply Project is technically feasible but identified two implementation barriers.

- **First,** surface water delivery under the current configuration would cost landowners $189–$520 per acre-foot, considerably more per acre-foot than pumping groundwater.
- **Second,** the Cottonwood Creek crossing would, at a minimum, trigger an estimated 18-month USACE Section 408 review. Without a strategy that avoids or shortens that review, the District would likely not be in a position to apply for the first Proposition 4 implementation solicitation windows expected to begin opening in early 2027 ($386 million is anticipated to be available for groundwater management infrastructure).

In April 2026, the General Manager and the (then-active) Surface Water Ad Hoc Committee discussed the value of a short, focused engagement to address both barriers strategically before the Vina GSA consistency determination process opens this summer. On April 23, 2026, a Phase 1 Scoping and Feasibility Engagement memo ("Accelerate v3") was issued to a short list of qualified consulting firms with a proposal deadline of May 8, 2026 and an anticipated budget of $15,000–$20,000.

Three firms responded. Two submitted responsive proposals: Geosyntec Consultants, Inc. ($20,000 time-and-materials, not-to-exceed) and a joint proposal from Water & Land Solutions (WLS) and Provost & Pritchard Consulting Group (P&P) ($19,950 fixed budget by task). EKI Environment & Water declined to propose for the current scope, citing current workload, and requested to be notified if the Phase 2 work is competitively procured.

Summary / Analysis

Why accelerate now. The driver is Proposition 4 application timing. State agencies are currently drafting Prop 4 distribution guidelines, and that process is expected to conclude by the end of 2026, with the first application windows expected to begin opening in early 2027. Phase 2 work —

detailed engineering, hydraulic analysis, CEQA, Section 408 permitting as applicable, and grant proposal support — must be substantially in hand before the first windows open. That sequencing requires Phase 1 to complete this summer. A Vina GSA consistency determination on the project is also targeted in advance of the Prop 4 application. The Vina GSA accepts consistency determination requests at any time, but receiving the determination before the application is submitted materially strengthens the District's submission.

What Phase 1 will deliver, June–July 2026. A Strategic Scoping and Feasibility Memo addressing three issues.

- **Cost re-engineering** evaluates whether project capital costs can be funded through Prop 4 Chapter 8 and structured as a "Pilot Implementation Phase" with early-period operations and maintenance capitalized into the grant-funded scope, in order to reduce direct per-acre-foot costs to landowners in the near term.
- **Section 408 strategy** identifies pathways to avoid triggering the 408 review at the Cottonwood Creek crossing or to qualify under a maintenance-based exemption.
- **Proposition 4 positioning** recommends the most promising solicitation(s) to target with a competitive positioning strategy. Phase 1 will also produce a refined project description suitable for the Vina GSA consistency determination and a Phase 2 work plan (detailed engineering, hydraulic analysis, CEQA, Section 408 permitting as applicable, and grant proposal support) for subsequent procurement.

Proposal comparison. Both responsive proposals price at or just under the $20,000 budget ceiling and both target a late-July completion consistent with the Vina GSA consistency determination timeline. A neutral side-by-side comparison of the two proposals — covering scope response, team, schedule, budget, qualifications, and references — is attached as Attachment 1. The Board is encouraged to review the attachment as part of its deliberations.

Staff recommendation. Staff recommends selection of the Water & Land Solutions / Provost & Pritchard joint proposal for Phase 1. Three considerations support this recommendation.

Fit to scope. The substance of Phase 1 is primarily strategic and policy-driven — Prop 4 grant structuring, Section 408 regulatory strategy, and competitive grant positioning, with a project description prepared for the Vina GSA consistency determination. The joint proposal's team composition (WLS strategy and grants administration; P&P engineering and Section 408 permitting) maps directly to that scope. WLS authored the strategic and assessment portions of the 2025 Feasibility Analysis, providing direct continuity into Phase 1. P&P brings hands-on USACE Section 408 permitting experience referenced in two recharge projects (Friant-Kern at Big Dry Creek and Laton North).

Proposal completeness against the RFP. The joint proposal includes a task-level budget summing to $19,950, a weekly schedule from kick-off through a final TWD Board presentation in August, six named team members with roles and years of experience, six relevant project references, and a draft Phase 2 Scope of Work delivered as a Phase 1 deliverable. The Geosyntec proposal is a three-page fee letter at $20,000 time-and-materials; it identifies one team member and does not include a task-level budget, weekly milestones, references, or a Phase 2 scope.

Phase 2 considerations remain open. The RFP explicitly states that no Phase 2 commitment is required as part of Phase 1 selection. Phase 2 will require detailed engineering, hydraulic analysis, CEQA review, and — depending on Phase 1 findings — Section 408 permitting. Multiple qualified firms are likely Phase 2 candidates, including Geosyntec (engineer of record for the 2025 Feasibility Analysis); Provost & Pritchard (with significant USACE Section 408 experience on the Friant-Kern Canal at Big Dry Creek and other Central Valley recharge projects, plus added continuity if selected for Phase 1); and EKI Environment & Water (which has indicated interest in being notified of Phase 2 procurement). Selecting WLS/P&P for the strategic Phase 1 engagement does not preclude any of these firms from competing for the Phase 2 engineering work.

Additional Context

Geosyntec's ongoing work in the Vina Subbasin. Geosyntec is currently leading the Vina Subbasin Groundwater Recharge Feasibility Study for the Vina GSA, a separate SGM grant-funded engagement. Joe Turner of Geosyntec presented dry well concepts to the TWD Board in March 2026 and to the Butte County Water Commission on May 6, 2026 (with an update on the Vina GSA recharge feasibility study). Geosyntec retains a substantive and valued role on Vina-area work outside of this Phase 1 engagement and would be a strong candidate for Phase 2 engineering work.

Surface Water Ad Hoc Committee. The Surface Water Ad Hoc Committee that originally oversaw this work concluded earlier this year. Given the time-sensitive nature of the engagement and the modest budget level, staff has brought this item directly to the full Board rather than reconstituting the Ad Hoc Committee.

Western Canal Water District coordination. Cost re-engineering under Phase 1 will require engagement with Western Canal Water District. Jenny Scheer, who previously served as primary point of contact on the 2025 Feasibility Analysis for WLS, has since assumed the General Manager role at Western Canal. Staff and the WLS team will manage this transition on an arms-length basis consistent with the District's interest in a clear cost structure for landowners.

Phase 2 procurement. A separate Phase 2 procurement is anticipated following the Vina GSA consistency determination, with scope and pricing informed by Phase 1 findings.

Attachments

1. Phase 1 Proposal Comparison (May 11, 2026)
2. Phase 1 Scoping and Feasibility Engagement Memo, "Accelerate v3" (April 23, 2026)
3. Geosyntec Consultants Phase 1 Proposal (May 8, 2026)
4. Water & Land Solutions / Provost & Pritchard Joint Phase 1 Proposal (May 8, 2026)

Agenda Item 5
TUSCAN WATER DISTRICT
Phase 1 Scoping and Feasibility Engagement — Proposal Comparison
South Vina Extension Water Supply Project

Date: May 11, 2026
Prepared by: Tovey Giezentanner, General Manager
Purpose: Side-by-side comparison of the two responsive proposals for Board consideration at the May 14, 2026 special meeting.

Background

On April 23, 2026, the Tuscan Water District (TWD) distributed a Phase 1 Scoping and Feasibility Engagement memo ("Accelerate v3") to a short list of qualified firms inviting proposals for a focused strategic and engineering analysis to position the South Vina Extension Water Supply Project for a July 2026 Vina GSA consistency determination and a competitive Proposition 4 application. Anticipated Phase 1 budget: $15,000–$20,000. Three firms responded:

- Geosyntec Consultants, Inc. — sole proposal.
- Water & Land Solutions, LLC (WLS) and Provost & Pritchard Consulting Group (P&P) — joint proposal.
- EKI Environment & Water — declined for current capacity reasons; asked to be kept informed if the Phase 2 work goes back out to bid.

Comparison

	GEOSYNTEC	WLS / P&P (joint)
SUMMARY		
Proposal date	May 8, 2026	May 8, 2026
Proposal length	3 pages	14 pages
Total fee	$20,000	$19,950
Fee structure	Time and materials, not-to-exceed	Fixed budget by task
Phase 1 completion	July 30, 2026	July 31, 2026 (final Board presentation in August)
Primary point of contact	Amer A. Hussain, P.E., Principal Engineer (Fresno office)	Maddie Munson, Senior Water Specialist, WLS
Team members named	1	6
Project references	None	Six
Rate sheet	Referenced, not attached	Attached (both firms)
RESPONSE TO PHASE 1 SCOPE OF WORK		
Cost re-engineering (Prop 4 Chapter 8 Pilot Implementation Phase; capitalize early-period O&M)	Task 1 — Evaluate Proposition 4 Eligibility. Review whether capital costs can be funded through Prop 4 and structured as a Pilot Implementation Phase with early-period O&M capitalized into grant funds. Stated goal: reduce costs for landowners.	Task 2 — Strategic Scoping, Cost Re-engineering and Funding Strategy. Refine cost structure from the Vina Analysis (water rates, O&M, capital amortization) with engagement of Western Canal Water District, Butte County, Vina GSA, and landowners. Identify pathways to bridge the gap between surface water and groundwater costs, including partnerships with Vina GSA. Align designs with Prop 4 opportunities, including a Pilot Implementation Phase approach.
Section 408 strategy (avoid trigger at Cottonwood Creek crossing, or qualify	Task 2 — Evaluate strategy for 408 permit. Review alternative methods to avoid triggering a Section 408 review at Cottonwood Creek,	Task 2 — Strategic Scoping, Permitting Strategy. P&P will lead an evaluation of permitting strategy, including Section 408 permitting at Cottonwood Creek.

	GEOSYNTEC	WLS / P&P (joint)
for maintenance exemption)	including whether the project qualifies under a maintenance exemption. Each alternative evaluated for feasibility and risk profile.	Identify permitting alternatives, key risks, schedule implications, and a recommended path forward.
Prop 4 positioning (target solicitation; competitive considerations)	Task 3 — Proposition 4 Planning. Evaluate Prop 4 solicitations and identify the one with the most promising chance of success to target. High-level strategy to identify competitive considerations.	Task 2 — Strategic Scoping, Proposition 4 Positioning. Identify the most competitive funding pathways for the $386.25M in Prop 4 funding expected in 2026–2027, including Sustainable Groundwater Management Grants and Conveyance Assistance. Develop a positioning narrative aligned with program objectives (groundwater sustainability, regional conveyance, multi-benefit outcomes). Outline grant approach and key elements for competitiveness.
Project description for Vina GSA consistency determination (July 2026)	Task 5 — Prepare Project Description. Project description prepared for submission to Vina GSA in support of a consistency determination by July 2026.	Task 3 — Vina GSA Consistency Determination Support. Refined project description suitable for submission to the Vina GSA, leveraging and updating the existing Project narrative. Additional documentation and presentation materials as needed. Support TWD staff in the consistency determination process.
Phase 2 scope and ballpark pricing	Task 6 — Phase 2 Scope and Fee Estimate. Proposal text states only that "Geosyntec is prepared to support TWD as needed once Phase 2 is authorized." No Phase 2 scope or pricing provided.	Task 4 — Phase 2 Scope. Draft Phase 2 Scope of Work including engineering refinement, permitting pathway (CEQA/NEPA, Section 408), hydraulic and infrastructure analysis, and grant application support. Ballpark cost ranges not included.
TEAM AND KEY PERSONNEL		
Named personnel	Amer A. Hussain, P.E. — Principal Engineer (Fresno). Signatory and proposal contact. No additional team members, roles, or biographies identified in the proposal.	Maddie Munson, M.S. — Project Lead and Senior Water Specialist, WLS (12 yrs). Primary point of contact. Chase Hurley, B.S. — Managing Member, WLS (30 yrs). Brad Samuelson, M.S. — Managing Member, WLS (30 yrs). Yvonne Petroni — Grants Administration / Outreach Coordinator, WLS (13 yrs). Danny Kerns, P.E. — Engineering Lead, P&P (17 yrs). Amy Giacomini — Permitting Lead, P&P (4 yrs).
SCHEDULE		
Phase 1 milestones	Tasks 1–3 completed by July 30, 2026. Project description submitted to Vina GSA by July 30. Phase 2 timing: TBD upon authorization. Weekly milestones and interim deliverables not provided.	Kick-off: week of May 25. Strategic Scoping work: June 1 – July 17 (draft memo week of July 6). Final Feasibility Memo: week of July 27. Refined project description: week of July 20. Consistency determination support and final TWD Board presentation: August. Phase 2 SOW delivered: week of July 27. Weekly internal team calls; monthly TWD staff check-ins.

	GEOSYNTEC	WLS / P&P (joint)
BUDGET		
Total and breakdown	Total: $20,000. Structure: time and materials per the Geosyntec 2026 Rate Schedule; not-to-exceed without prior authorization. Budget may be shifted among tasks within the total. Task-level breakdown: not provided. Rate schedule: referenced but not attached.	Total: $19,950. Task 1 — Project Management and Collaboration: $3,000. Task 2 — Strategic Scoping: $10,425. Task 3 — Consistency Determination Support: $2,025. Task 4 — Phase 2 Scope: $4,500. Rate sheets attached for both firms. WLS Senior Water Specialist: $225/hr. P&P Principal Engineer: $235–$295/hr.
QUALIFICATIONS AND REFERENCES (RFP requested: SGMA, USACE Section 408, Prop 4 / state water grants)		
Qualifications statement and references provided	No separate qualifications statement or representative project references included in the proposal. Geosyntec's prior work on the 2025 Vina Subbasin Surface Water Supply Feasibility Analysis is referenced in the proposal opening.	Six representative project references with contacts and relevance to Phase 1 scope: • Vina Subbasin Surface Water Supply Feasibility Study — Butte County DWRC. • Orland-Artois Water District Annexation — USBR WaterSMART grant funding. • Yolo-Zamora Groundwater Recharge Pilot — Yolo Subbasin GSA. • Corning Subbasin Groundwater Recharge — $15M SGMA grant referenced. • Friant-Kern Canal at Big Dry Creek Recharge — P&P-led USACE Section 408 and 404 permitting. • Laton North Recharge — P&P-led USACE Section 408 and 404 permitting.

Prior Project Involvement and Relevant Context

The information in this section is drawn from project history rather than the proposals themselves and is included so the Board can consider it alongside the proposal record.

2025 Vina Subbasin Surface Water Supply Feasibility Analysis

Geosyntec and Water & Land Solutions jointly authored the 2025 Vina Subbasin Surface Water Supply Feasibility Analysis. Geosyntec led the engineering analysis; WLS led the strategy and assessment work and overall project coordination. The Feasibility Analysis is the technical and strategic baseline for the Phase 1 scope.

Within the WLS team, Maddie Munson was the primary author on Option A of the Feasibility Analysis (the Butte Creek diversion using the Parrott-Phelan Canal to deliver water to properties along Comanche Creek). Ms. Munson is identified in the joint WLS/P&P proposal as Project Lead and primary point of contact.

Jenny Scheer, who served as the primary WLS point of contact through much of the Feasibility Analysis work, has since assumed the General Manager role at Western Canal Water District. Western Canal is identified in the WLS/P&P proposal as a party with which cost-structure refinement will be coordinated.

Geosyntec — current Vina-area engagement

Geosyntec is currently leading the Vina Subbasin Groundwater Recharge Feasibility Study for the Vina GSA, a Sustainable Groundwater Management (SGM) grant-funded study. Joe Turner of Geosyntec presented on the use of dry wells as Groundwater Recharge Enhancement Features to the TWD Board at its March 2026 regular meeting, and presented the same dry-well material together with an update on the Vina Subbasin Groundwater Recharge Feasibility Study to the Butte County Water Commission at its May 6, 2026 regular meeting (Agenda Items 4.a and 4.b).

Provost & Pritchard prior TWD work

Provost & Pritchard was not involved in the 2025 Feasibility Analysis. P&P previously provided engineering services to TWD on the Keefer Slough / Rock Creek Flood-MAR recharge concept, documented in the April 2026 Engineering Memorandum prepared for the District.

TUSCAN WATER DISTRICT
Phase 1 Scoping and Feasibility Engagement
South Vina Extension Water Supply Project

Overview

The Tuscan Water District (TWD) is inviting a short list of qualified firms to submit proposals for a Phase 1 scoping and feasibility engagement on the South Vina Extension Water Supply Project. This memo summarizes the project context, scope of work, budget, and timeline so that firms have the information needed to prepare a responsive proposal.

Project Context

The 2025 Feasibility Analysis confirmed the South Vina Extension is technically viable but identified two barriers to implementation. First, surface water delivery under the current configuration would cost landowners $189–$520 per acre-foot, compared to roughly $40–$60 per acre-foot for groundwater pumping. Second, the Cottonwood Creek crossing triggers an 18-month USACE Section 408 review, which would push project readiness past the anticipated Q2 2026 Prop 4 solicitation window ($386 million available for groundwater management infrastructure).

Phase 1 is intended to address both barriers through a focused strategic and engineering analysis, positioning the project for a July 2026 Vina GSA consistency determination and a competitive Prop 4 application.

Phase 1 Scope of Work

TWD is seeking a concise strategic scoping and feasibility package, including:

- **Strategic Scoping and Feasibility Memo** (approximately 10–20 pages) addressing the three issues below.
    - **Cost re-engineering.** Evaluate whether project capital costs can be funded through Prop 4 Chapter 8 and structured as a "Pilot Implementation Phase," with early-period operations and maintenance capitalized into the grant-funded scope. The goal is to reduce the direct per-acre-foot cost to landowners in the near term while preserving long-term project viability.
    - **Section 408 strategy.** Identify pathways to avoid triggering Section 408 review at the Cottonwood Creek crossing, or to qualify under a maintenance-based exemption, and assess the feasibility and risk profile of each.
    - **Prop 4 positioning.** Recommend the most promising Prop 4 solicitation(s) to target, with a high-level positioning strategy and competitive considerations.
- **Project Description.** A project description suitable for submission to the Vina GSA in support of a consistency determination targeted for July 2026.
- **Phase 2 Scope and Ballpark Pricing.** A recommended Phase 2 work plan (detailed engineering, hydraulic analysis, CEQA, 408 permitting as applicable, and Prop 4 grant

proposal support) with rough ballpark cost ranges for each item. No commitment to perform Phase 2 work is required with the Phase 1 proposal.

Budget

TWD anticipates a Phase 1 budget of $15,000–$20,000.

Timeline

- **Proposals due:** May 8, 2026
- **Selection and award:** May 14, 2026 (TWD Board meeting)
- **Phase 1 execution:** June–July 2026
- **Vina GSA consistency determination:** July–August 2026
- **Phase 2:** Subject to a favorable GSA consistency determination; scope and schedule to be developed from the Phase 1 recommendations.

Governance

Final project roles between TWD and the Vina GSA—including lead agency, contracting entity, grant applicant, and implementation entity—are still being finalized. For Phase 1, TWD will serve as the contracting entity, with confirmation prior to award.

Qualifications Sought

TWD is seeking firms with directly relevant experience in:

- Sustainable Groundwater Management Act (SGMA) implementation
- USACE Section 408 review and permitting
- Prop 4 and related California state water grant programs

Next Steps

Interested firms should submit a proposal by May 8, 2026. For questions or to request additional background materials, please contact Tovey Giezentanner, General Manager, Tuscan Water District.

May 8, 2026

Tuscan Water District
Tovey Giezentanner
30 Independence Circle, No. 300
Chico, CA 95973

26-214-01

Dear Mr. Giezentanner,

Thank you for the opportunity for Water & Land Solutions, LLC (WLS) to respond to Tuscan Water District's (TWD) ***Phase 1 Scoping and Feasibility Engagement on the South Vina Extension Water Supply Project*** (Project). This Proposal discusses our understanding of the project, the scope of services and the associated budget, for Phase 1.

WLS brings a unique advantage as the author of the Vina Subbasin Surface Water Supply Feasibility Analysis, allowing our team to immediately build from prior work and deliver a highly focused, efficient Phase 1 effort aligned with TWD's timeline and budget.

WLS has thoughtfully assembled a team that integrates strategy and technical expertise, addressing all requirements described in the Request for Proposals (RFP). In addition to WLS, who specializes in Sustainable Groundwater Management Act (SGMA) implementation, land use consulting, permitting, and project financing, we have included Provost & Pritchard Engineering Group (P&P), who are highly recognized experts in engineering and permitting of irrigation and water infrastructure projects.

The WLS and P&P team is dedicated to working collaboratively with TWD, with an end goal of refining the Project concepts in preparation for successful project financing and implementation. We greatly look forward to the opportunity to leverage our team's diverse skillsets in order to advance groundwater sustainability in the Vina subbasin. Please feel free to contact us with any questions regarding this proposal.

Respectfully,

Chase Hurley
Managing Member
(209) 704-5105
churley@waterandlandsolutions.com

Maddie Munson
Senior Water Specialist
(530) 933-0821
mmunson@waterandlandsolutions.com

PHASE 1 SCOPING AND FEASIBILITY ENGAGEMENT PROPOSAL

Project Understanding

The Vina Subbasin Surface Water Supply Feasibility Analysis (Vina Analysis), authored by WLS, evaluated the Project and confirmed its technical feasibility while identifying key implementation barriers—including cost competitiveness and permitting constraints—that are directly aligned with the focus of this Phase 1 scope.

TWD is positioned to evaluate and implement projects to deliver surface water within its district boundaries to reduce groundwater usage in the Vina Subbasin. Phase 1 specifically looks to identify opportunities to strategically reduce Project costs and permitting timelines, while positioning the Project for Proposition 4 funding in the near future.

WLS is uniquely positioned to prepare this analysis within a limited timeframe and budget due to our intimate understanding of the underlying technical, institutional, and financial analysis. Our team can immediately build from that foundation, eliminating ramp-up time and ensuring continuity in assumptions, stakeholder context, and strategic direction. This continuity is critical given the compressed timeline to support a Proposition 4 funding strategy and Vina Groundwater Sustainability Agency (GSA) consistency determination.

Approach to Phase 1 Scope of Work

WLS and P&P will deliver a focused Phase 1 effort that directly addresses the three key barriers identified by TWD—cost competitiveness, Section 408 permitting, and funding readiness—while positioning the Project for near-term implementation. The WLS Team approach will comprise four tasks as follows:

Task 1: Project Management and Collaboration
Task 2: Strategic Scoping
Task 3: Vina GSA Consistency Determination Support
Task 4: Phase 2 Scope

Task 1: Project Management and Collaboration

WLS will ensure close coordination with the project team and TWD to ensure the scope of work is completed efficiently and according to expectations. As part of facilitating project collaboration, WLS will organize weekly calls with P&P for the duration of the project (assumed at two months). TWD staff will be invited to join on a monthly basis, or more frequently as needed.

Task 2: Strategic Scoping

WLS and P&P will work collaboratively to draft a brief scoping and feasibility memo (10 pages) that will build directly on the feasibility study and focus on actionable next steps:

<u>Cost Re-engineering and Funding Strategy</u>

- Refine cost structure from the Vina Analysis regarding water rates, O&M, and capital amortization. This will require engagement between necessary parties, including but not limited to Western Canal Water District, Butte County, Vina GSA, and landowners. The goal is to optimize the cost per acre-foot ($/AF) of the project.
- Following further refinement of water rates, identify pathways to bridge the gap between surface water costs and groundwater costs, including partnerships with Vina GSA.
- Strategize opportunities to align designs with Proposition 4 funding opportunities, including a "pilot implementation phase" approach that could be part of a Sustainable Groundwater Management Grant in order to reduce near-term per-acre-foot costs.

<u>Permitting Strategy</u>

P&P will lead an evaluation of a permitting strategy, including Section 408 permitting at Cottonwood Creek. WLS and P&P will work together to identify permitting alternatives, key risks, schedule implications, and a recommended path forward.

<u>Proposition 4 Positioning</u>

WLS will utilize preliminary designs included in the Vina Analysis, or P&P's alternative concepts as applicable, to position the Project for funding opportunities, including Proposition 4.

- Identify the most competitive funding pathways for the $386.25 million in Proposition 4 funding expected to be available in 2026-2027 for sustainable groundwater management projects, including but not limited to Sustainable Groundwater Management Grants and Conveyance Assistance.

- Develop a clear positioning narrative and strategy aligned with program objectives (groundwater sustainability, regional conveyance, multi-benefit outcomes).
- Outline grant approach and key elements for competitiveness.

Deliverables will include draft and final Strategic Scoping and Feasibility Memo (10 pages), and a final presentation to the TWD board.

Task 3: Vina GSA Consistency Determination Support

WLS will prepare a refined project description suitable for submission to the Vina GSA for a consistency determination, leveraging and updating the existing Project narrative. WLS will support TWD staff in Vina GSA Consistency Determination processes, as needed.

Deliverables will include a project description suitable for a Vina GSA Consistency Determination and any additional materials, as needed, to support that process such as additional documentation and presentation materials.

Task 4: Phase 2 Scope

In collaboration with P&P, WLS will develop a practical and implementation-ready Phase 2 scope, including:

- Engineering refinement needs
- Permitting pathway (CEQA/NEPA, Section 408)
- Hydraulic and infrastructure analysis
- Grant application support

Deliverables will include a draft Scope of Work for Phase 2.

Project Budget, Schedule & Deliverables

WLS, with support from P&P, proposes a focused, high-efficiency work plan that builds directly on the prior feasibility analysis to deliver the Phase 1 objectives within the available budget. WLS and P&P are prepared to begin immediately upon award and complete all Phase 1 deliverables within the June–July 2026 timeframe identified in the RFP. The following schedule and budget are anticipated, consistent with the attached rate sheets for WLS and P&P:

WATER & LAND SOLUTIONS

		Budget by Task	May 25-29	June 1-5	June 8-12	June 15-19	June 22-26	June 29-July 3	July 6-10	July 13-17	July 20-24	July 27-31	August
	Complete scope, contracting & project kick-off		X										
Task 1	PROJECT MANAGEMENT & COLLABORATION	$ 3,000.00											
	Deliverable: Meeting notes												
Task 2	STRATEGIC SCOPING	$ 10,425.00											
	Deliverable: Draft Feasibility Memo outlining refined designs, capital costs, O&M, water rates, permitting strategy & Prop 4 positioning								X				
	Deliverable: Final Feasibility Memo											X	
	Deliverable: Final Presentation to TWD Board												X
Task 3	CONSISTENCY DETERMINATION SUPPORT	$ 2,025.00											
	Deliverable: Refined project description											X	
	Deliverable: Consistency determination documentation and presentation materials												X
Task 4	PHASE 2 SCOPE	$ 4,500.00											
	Deliverable: Scope for Phase 2											X	

	TOTAL BUDGET	**$ 19,950.00**

Team and Key Personnel

WLS has partnered with P&P to deliver a combined strategic and technical team. As the original author of the Vina Analysis, WLS provides continuity and efficiency – eliminating duplication of effort and ensuring consistency in assumptions and analysis. WLS has direct experience aligning projects with state funding programs, including SGMA and emerging Proposition 4 opportunities, while coalescing groundwater dependent growers. P&P is skilled in developing water district designs that are realistic and implementable, while navigating complex permitting requirements.

Team

Water and Land Solutions, LLC (WLS)

WLS is a water consulting firm formed in 2018. The genesis for company formation was declining water supplies from the combination of limited average surface water supplies along with SGMA. Our specialties include land use consulting, permitting, engineering and construction management, project financing, and land acquisition for water storage facilities. We work with farmers, water districts, and GSAs to prepare for this new normal. The core business philosophy of WLS is based on the ability to organize, manage and understand the mentality of the people they represent through effectively engaging with neighbors, regulators, agencies and new partners to reach the stated goals and objectives.

The company is based in Merced County, with staff in the Sacramento Valley.

WLS will provide strategic planning, policy analysis, funding strategy, and stakeholder coordination.

Provost & Prichard Engineering Group (P&P)

Founded in 1968, P&P has built a long-standing reputation for delivering innovative engineering, environmental, and planning solutions throughout California and the western United States. With 11 offices across California and one in Boise, Idaho, our multidisciplinary team provides expertise in civil, agricultural, transportation, structural, electrical, environmental, water and wastewater, surveying, GIS, construction management, community planning, and public affairs services. A core strength of our practice is environmental permitting and regulatory compliance, including CEQA and NEPA documentation, U.S. Army Corps of Engineers Sections 10, 404, and 408 permitting, Regional Water Quality Control Board Section 401 certifications and waste discharge requirements, California Department of Fish and Wildlife Section 1602 notifications, and U.S. Fish and Wildlife Service Section 7 consultations. Our familiarity with state and federal agencies, combined with decades of experience navigating complex environmental processes, allows us to effectively support clients through permitting, agency coordination, and project delivery from planning through construction.

P&P will provide targeted engineering insight, including cost structuring, constructability considerations, and input on Section 408 pathways and infrastructure feasibility. Their experience with irrigation district infrastructure and regional water conveyance systems will complement WLS's policy and planning expertise.

Key Personnel

Staff expected to work on this project from the WLS Team have been involved in various aspects of land and water use consulting and project financing for more than 30 years. WLS also expects and welcomes input and collaboration with TWD staff.

- **Project Lead and Senior Water Specialist, WLS**
  Maddie Munson, MS (12 years of experience)
  Ms. Munson will serve as Project Manager and strategic advisor. She played a central role in the development of the Vina Analysis and has direct experience working with Butte County, the Vina GSA, and regional partners on SGMA implementation and surface water supply strategies.
- **Managing Member, WLS**
  Chase Hurley, BS (30 years of experience)
- **Managing Member, WLS**
  Brad Samuelson, MS (30 years of experience)
- **Grants Administration Team-Outreach Coordinator, WLS**
  Yvonne Petroni, AA (13 years of experience)
- **Engineering Lead, P&P**
  Danny Kerns, PE (17 years of experience)
- **Permitting Lead, P&P**
  Amy Giacomini (4 years of experience)

Primary Point of Contact

Maddie Munson, Senior Water Specialist
mmunson@waterandlandsolutions.com
(530) 933-0821

Maddie Munson, Senior Water Specialist

Ms. Munson has 12 years of experience in both the public and private sectors, focused on government relations at the state and local levels. As a Senior Water Specialist at WLS, Ms. Munson has led multiple permitting efforts, complex water supply analyses, grant project management, groundwater recharge pilot projects, coalition building among diverse groups of landowners, and many other projects focused on communicating complex policy issues to a wide range of audiences. Prior to her work with Water & Land Solutions, she worked as a Senior Account Executive at a Sacramento Public Affairs and Lobbying firm specializing in agricultural and natural resource issues, and a Senate Fellow in the California State Senate.

Chase Hurley, Managing Member

Mr. Hurley has 30 years of experience in the agricultural industry, focused on agricultural production, water resources, and operations management. His professional experience includes 13 years of employment with the San Luis Canal Company & Henry Miller Reclamation District representing landowners, protecting historical water rights and providing irrigation water and drainage service to over 35,000 acres. He also has vast experience in project management, water acquisition and the public policy arena.

Brad Samuelson, Managing Member

Mr. Samuelson has 30 years of experience in both the public and private sectors, focused on environmental management and groundwater sustainability. His professional experience includes eight years of employment with the University of California, Merced as a Director of Environmental Planning providing expert wetland and endangered species compliance leadership. He has also spent several years in the agricultural industry focusing on maximizing grower returns while being great stewards of our resources. Mr. Samuelson is a managing member for WLS and is very well acquainted with water and environmental issues routinely encountered farmers, local government, and water agencies.

Yvonne Petroni, Grants Administration Team-Outreach Coordinator

Ms. Petroni has over 10 years of experience working in the private sector of Agriculture in the Central Valley region of California. Since 2023 she has worked to secure grant funding and carry out the grant administration duties for the various important and innovative projects, as a part of the WLS team. She is results-driven and passionate about effectively promoting grant programs.

Danny Kerns, PE, Technical Advisor

Danny Kerns has more than 17 years of professional experience, currently serving as Principal Engineer. He has been involved in a wide variety of engineering projects including agricultural water resource consulting and design, construction coordination and management, municipal water resources, commercial, flood plain studies, and engineering consulting for groundwater sustainability agencies. Danny has experience preparing engineering studies, design plans and specifications, cost estimating, permitting, surveying, environmental data collection and analysis, submittal preparation, and construction oversight and inspection. In addition to his consulting work, he is also an experienced educator, currently teaching Fluid Mechanics in a laboratory setting at California State University, Chico.

Amy Giacomini, Permitting Lead

Amy Giacomini, Associate Planner, brings strong technical expertise in project management and regulatory permitting, including experience with U.S. Army Corps of Engineers Section 404 and Section 408 permits, Regional Water Quality Control Board Section 401 water quality certifications, Central Valley Flood Protection Board encroachment permits, and California Department of Fish and Wildlife Lake and Streambed Alteration Agreements. In addition, Amy has experience preparing Indirect Source Review applications and developing CEQA documents.

Experience and References

The following representative projects highlight the WLS Team's experience directly relevant to the key elements of this Phase 1 effort, including SGMA implementation, permitting strategy, infrastructure planning, and funding alignment.

Vina Subbasin Surface Water Supply Feasibility Study

Name of Contact: Kami Loeser
Name of Organization: Butte County Department of Water and Resource Conservation
Telephone Number: (530) 552-3590
Email Address: KLoeser@buttecounty.net
WLS led development of the Vina Subbasin Surface Water Supply Feasibility Study, evaluating nine initial concepts and advancing four projects through fatal flaw analysis, including the South Vina Extension Project.

Relevance to this effort:

- Established baseline cost, infrastructure, and feasibility assumptions

- Identified key barriers (cost and Section 408 permitting) now being addressed in Phase 1
- Included extensive stakeholder coordination across agencies and landowners

Orland-Artois Water District Annexation

Name of Contact: Justin Dahl
Name of Organization: Orland-Artois Water District
Telephone Number: (530) 865-4304
Email Address: jdahl@oawd.org
WLS led the annexation of approximately 11,000 acres of groundwater dependent farmland into the Orland-Artois Water District to facilitate access to surface water supplies and improve long-term groundwater sustainability. P&P supported engineering analysis, infrastructure planning, and permitting.

Relevance to this effort:

- Developed and evaluated conveyance infrastructure concepts and cost estimates, directly applicable to South Vina Extension planning
- Navigated multi-agency coordination, including LAFCo, CEQA/NEPA compliance, and district approvals
- Advanced a project from concept to implementation-ready planning and funding positioning
- Secured USBR WaterSMART grant funding, demonstrating experience aligning projects with competitive funding programs

Yolo-Zamora Groundwater Recharge Pilot Project

Name of Contact: Kristin Sicke
Name of Organization: Yolo Subbasin Groundwater Agency
Telephone Number: (530) 662-0265
Email Address: ksicke@yolosga.org
WLS is leading a multi-phase groundwater recharge initiative in the Yolo Subbasin, including permitting, pilot recharge implementation, and development of a long-term feasibility study to support regional water supply reliability.

Relevance to this effort:

- Developed and executed permitting strategies involving CDFW, CEQA exemptions, and multi-agency coordination—directly relevant to Section 408 pathway evaluation

- Designed and implemented pilot-scale projects to test feasibility and reduce uncertainty prior to full-scale investment
- Conducted stakeholder coordination across landowners, districts, and agencies, similar to anticipated South Vina Extension needs
- Preparing a feasibility study specifically designed to position projects for Proposition 4 and federal funding programs

Corning Subbasin Groundwater Recharge Planning and Implementation

Name of Contact: Lisa Hunter
Name of Organization: Corning Subbasin GSA
Telephone Number: (530) 934-6540
Email Address: lhunter@countyofglenn.net
WLS supported groundwater recharge planning and implementation across four subbasins in Tehama and Glenn Counties, contributing to the successful award and implementation of $15 million in SGMA grant funding.

Relevance to this effort:

- Identified and advanced multiple water supply and recharge strategies, including surface water diversion and in-stream recharge
- Coordinated with GSAs, districts, and landowners to support SGMA implementation and project development
- Helped secure and implement state grant funding, demonstrating experience aligning projects with SGMA and state funding priorities
- Provided on-the-ground project development and stakeholder engagement, ensuring concepts are practical and implementable

Friant-Kern Canal at Big Dry Creek Groundwater Recharge Project

Name of Contact: Kassy Chauhan
Name of Organization: Fresno Irrigation District
Telephone Number: (559) 233-7161
Email Address: kchauhan@fresnoirrigation.com
P&P provided permitting and regulatory compliance services for the Friant-Kern Canal at Big Dry Creek Groundwater Recharge Project in Fresno County, California. The project includes construction of a riprap energy dissipation area and new diversion facility designed to convey

water from the Friant-Kern Canal into Big Dry Creek for groundwater recharge purposes. P&P served as Permitting Project Manager and designated representative for the District, coordinating project permitting, agency communication, and compliance activities throughout planning and construction.
Relevance to this effort:

- Managed complex permitting and regulatory coordination for a groundwater recharge project involving multiple state and federal agencies
- Prepared and coordinated permits including USACE Section 408 and Section 404, Section 401 Water Quality Certification, CDFW Lake and Streambed Alteration Agreement, and Central Valley Flood Protection Board Encroachment Permit

Laton North Recharge Project

Name of Contact: Scott Sills
Name of Organization: Laguna Irrigation District
Telephone Number: (559) 923-4239
Email Address: info@lagunaid.com
P&P provided permitting and regulatory compliance services for the Laton North Recharge Project in Fresno County, California. The project includes construction of a groundwater recharge basin and modifications to existing infrastructure, including maintenance of an inlet structure to accommodate an additional mainline pipe. P&P served as Permitting Project Manager and designated representative for the District, supporting project permitting, agency coordination, and compliance oversight throughout project development and construction.
Relevance to this effort:

- Managed permitting and agency coordination for groundwater recharge infrastructure improvements
- Prepared and coordinated permits including USACE Section 408 and Section 404, Section 401 Water Quality Certification, CDFW Lake and Streambed Alteration Agreement, and Central Valley Flood Protection Board Encroachment Permit

Attachments

Water & Land Solutions, LLC
2026 Rate Schedule

	Rate/Hour
Principal	$305
Senior Water Specialist	$225
Water Specialist	$175
GIS Specialist	$105
Accounting	$85
Water Operator	$75

PROVOST&PRITCHARD
CONSULTING GROUP

2026 STANDARD FEE SCHEDULE

The rates outlined herein are effective for the period January 1, 2026 through December 31, 2026. Such rates will be adjusted annually on January 1 of each subsequent year. Such adjustment shall be mutually agreed upon by the Client and Consultant and shall be reflective of then current market conditions.

STAFF TYPE	FEE RANGE
ENGINEERING	
Assistant Engineer	$128.00 – $156.00
Associate Engineer	$149.00 – $180.00
Senior Engineer	$188.00 – $225.00
Principal Engineer	$235.00 – $295.00
Associate Structural Engineer	$148.00 – $178.00
Senior Structural Engineer	$187.00 – $225.00
Principal Structural Engineer	$235.00 – $275.00
Assistant Electrical, I&C Engineer	$134.00 – $162.00
Associate Electrical, I&C Engineer	$170.00 – $200.00
Senior Electrical, I&C Engineer	$210.00 – $250.00
Principal Electrical, I&C Engineer	$260.00 – $300.00
SPECIALISTS	
Assistant Specialist	$107.00 – $127.00
Associate Specialist	$133.00 – $163.00
Senior Specialist	$170.00 – $208.00
Principal Specialist	$218.00 – $278.00
Assistant Biologist	$108.00 – $123.00
Associate Biologist	$128.00 – $155.00
Senior Biologist	$162.00 – $184.00
Principal Biologist	$192.00 – $232.00
Assistant Geologist/Hydrogeologist	$117.00 – $142.00
Associate Geologist/Hydrogeologist	$148.00 – $172.00
Senior Geologist/Hydrogeologist	$182.00 – $212.00
Principal Geologist/Hydrogeologist	$222.00 – $262.00
Principal Tunneling Consultant	$258.00 – $288.00
PLANNING	
Assistant Planner	$110.00 – $130.00
Associate Planner	$137.00 – $158.00
Senior Planner	$165.00 – $193.00
Principal Planner	$201.00 – $231.00

STAFF TYPE	FEE RANGE
TECHNICAL	
Assistant Technician	$96.00 – $113.00
Associate Technician	$120.00 – $144.00
Senior Technician	$150.00 – $178.00
CONSTRUCTION SERVICES	
Associate Construction Manager	$146.00 – $166.00
Senior Construction Manager	$173.00 – $197.00
Principal Construction Manager	$207.00 – $237.00
Construction Inspector (1)	$183.00 – $228.00
Construction Inspector OT (1)	$233.00 – $278.00
Construction Inspector Dbl OT (1)	$260.00 – $305.00
SUPPORT	
Administrative Assistant	$86.00 – $106.00
Project Administrator	$100.00 – $126.00
Senior Project Administrator	$134.00 – $216.00
Intern	$76.00 – $91.00
SURVEYING SERVICES	
Assistant Surveyor	$122.00 – $153.00
Licensed Surveyor	$173.00 – $213.00
1-Man Survey Crew	$215.00
1-Man Survey Crew (1)	$255.00
1-Man Survey Crew OT (1)	$280.00
2-Man Survey Crew	$335.00
2-Man Survey Crew (1)	$360.00
2-Man Survey Crew OT (1)	$380.00

(Field work not including survey equipment billed at individual standard rate plus vehicle as appropriate.)

(1) Prevailing wage rates shown for San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kings, and Kern counties; other counties as quoted.

Additional Fees

Expert Witness/GIS Training:
As quoted.

Travel Time (for greater than one (1) hour from employee's base office):
$95/hour (unless the individual's rate is less)

Project Costs

Mileage: IRS value + 15%

Outside Consultants: Cost + 15%

Direct Costs: Cost + 15%

Geosyntec consultants

1111 E Herndon Ave, Suite 217
Fresno, CA 93720
PH 559.228.9086
www.geosyntec.com

May 8, 2026

Mr. Tovey Giezentanner
General Manager
Tuscan Water District
32003 Dove Canyon Dr
Trabuco Canyon, CA 92679

Subject: Proposals
Phase 1 Scoping and Feasibility Engagement
South Vina Extension Water Supply Project

Dear Mr. Giezentanner:

Geosyntec Consultants Inc. (Geosyntec) has prepared this proposal to provide engineering support to the Tuscan Water District (TWD) to prepare a concise strategic scoping and feasibility package. This proposal was prepared in response to the April 24, 2026, request from TWD regarding the South Vina Extension Water Supply Project. Geosyntec previously prepared the 2025 Feasibility Analysis that evaluated multiple water delivery options within the Vina Subbasin. The Feasibility Analysis identified two barriers to implementation. First was the cost of the delivered water to landowners and the second was the potential need to conduct a USACE Section 408 review. TWD is seeking to address both issues with a focused strategic and engineering analysis.

SCOPE OF WORK

The scope of services will focus on providing a strategic evaluation of the 2025 Feasibility Analysis. The scope of services will be limited to positioning the project for the July 2026 Vina GSA consistency determination and Proposition 4 funding application.

Task 1: Evaluate Proposition 4 Eligibility

Geosyntec will review the possibility of whether the proposed capital costs can be funded through Proposition 4. The focus of the review will determine if the costs can be structured as a "Pilot Implementation Phase" and with early-period operations and maintenance capitalized into the grant funds. The overall goal would be to reduce costs for landowners.

Task 2 – Evaluate strategy for 408 permit

Geosyntec will review alternative methods to avoid triggering a Section 408 review at Cottonwood Creek. One of the options that will be considered is to evaluate if the project qualifies under a maintenance exemption. Each alternative method will be evaluated to assess the feasibility and risk profile.

Task Order 3 – Proposition 4 Planning

Geosyntec will evaluate Proposition 4 solicitations and identify the one with the most promising chance of success to target. High level strategy will be prepared to identify competitive considerations.

Task Order 5 – Prepare Project Description

A project description will be prepared to submit to Vina GSA in support of a consistency determination by July 2026.

Task 6: Phase 2 Scope and Fee Estimate

Geosyntec is prepared to support TWD as needed once Phase 2 is authorized.

SCHEDULE

Geosyntec proposes the following schedule for the project:

- Phase 1 - Tasks 1-3 will be completed by July 30, 2026.
- Vina GSA Consistency Determination – The project description will be submitted by July 30.
- Phase 2 - Determined once the work is awarded.

FEES

Our cost estimate for the proposed scope of work is estimated to be $20,000. The work will be performed on a time and materials basis in accordance with the Geosyntec 2026 Rate Schedule. The fees presented are our best estimate at this time and may vary for each task. However, we will not exceed the total amount with prior authorization. Monies may be shifted to different tasks without exceeding the overall budget.

AGREEMENT

We understand that TWD will provide an agreement to address terms and conditions.

CLOSURE

Geosyntec appreciates the opportunity to continue to serve TWD. If you find this proposal acceptable, please sign below to authorize us to proceed. Should you have any questions or require additional information, please contact Amer Hussain at (559) 479-2013.

Sincerely,

Amer A. Hussain, P.E.
Principal Engineer

TUSCAN WATER DISTRICT
Staff Memorandum

TO: Board of Directors, Tuscan Water District
FROM: Tovey Giezentanner, General Manager
DATE: May 14, 2026
RE: Item 8: Concept Proposal for State Water Efficiency and Enhancement Program (SWEEP) Block Grant under the Proposition 4 Climate Bond

Action Requested. Adopt Resolution No. 2026-XX authorizing the General Manager to submit a concept proposal to the California Department of Food and Agriculture (CDFA) for a SWEEP block grant under the Proposition 4 Climate Bond, with the Tuscan Water District serving as lead applicant and fiduciary.

Background. The State Water Efficiency and Enhancement Program (SWEEP) is administered by CDFA and provides competitive grants for on-farm irrigation efficiency projects that reduce water use and greenhouse gas emissions. Under the Proposition 4 Climate Bond, CDFA is making a new round of SWEEP funding available through the block grant model, which allows a regional lead applicant to administer a competitive sub-grant program across a defined service area. Concept proposals are due to CDFA by May 15, 2026. Invited applicants will submit full proposals in June, with awards announced in summer 2026 and program implementation beginning in late 2026 or early 2027.

Staff has worked with regional partners over the past several weeks to develop a concept that aligns with TWD's mission, leverages existing administrative and technical capacity, and meets CDFA's stated priorities for the Proposition 4 round.

Summary / Analysis. The concept proposes a $4,000,000 regional SWEEP block grant serving agricultural producers in Butte, Yuba, and Sutter counties. The structure builds on the operating model already in use for the existing Butte County SWEEP block grant, with additional regional capacity added to extend the service area south.

Lead Applicant and Partner Structure. TWD would serve as lead applicant, financial fiduciary, and CDFA liaison. The Butte County Farm Bureau (BCFB) would serve as the subrecipient responsible for day-to-day program management, outreach, and administrative support, continuing its role from the current Butte SWEEP block grant. Technical assistance to producers would be delivered by two regional contractors: the Agricultural Groundwater Users of Butte County (AGUBC), continuing the technical assistance role it currently performs in Butte; and the Sutter County Resource Conservation District (Sutter RCD), which would deliver technical assistance in Yuba and Sutter counties, including bilingual outreach and use of the Sutter–Yolo Mobile Irrigation Lab.

Budget Framework. Of the $4,000,000 request, approximately 77 percent ($3,080,000) would flow directly to producers as competitive on-farm project grants, and approximately 23 percent ($920,000) would fund program administration and technical assistance. The administrative and TAP allocation would be divided among the four partners under standard CDFA block grant categories. Final budget figures will be set in the full proposal.

TWD's Role. As lead applicant, TWD would hold the grant agreement with CDFA, manage subaward agreements with BCFB and the TAP contractors, oversee compliance and reporting, and provide final scoring and selection oversight for the competitive funding round. The day-to-day program operations would be carried out by BCFB and the TAP contractors under TWD's oversight, consistent with how comparable block grants are administered.

Alignment with District Purposes. On-farm irrigation efficiency is a recognized demand reduction strategy under the Vina Subbasin Groundwater Sustainability Plan and aligns with TWD's authority to support projects that contribute to groundwater sustainability within the Subbasin. Serving as lead applicant on a regional block grant also strengthens TWD's role as an implementing agency and builds administrative capacity that can support future grant pursuits.

Equity and Producer Focus. The concept includes a meaningful commitment to serving smaller farms and socially disadvantaged farmers and ranchers (SDFRs), consistent with CDFA's Proposition 4 priorities and the Canella Act. The addition of Sutter RCD as a regional technical assistance partner is intended to extend program reach into producer communities that have been underserved in prior SWEEP cycles.

Risk and Commitment Level. Submitting a concept proposal does not commit the District to any expenditure or contractual obligation. If the concept is invited to full proposal, staff will return to the Board for further direction before submission. If a grant is awarded, the Board will separately consider and approve the grant agreement, subaward agreements, and any related budget actions before the program is implemented.

Recommendation. The General Manager recommends that the Board adopt Resolution No. 2026-XX authorizing submission of the concept proposal.

Attachment: Resolution No. 2026-XX – Authorizing Submission of a Concept Proposal for a SWEEP Block Grant under the Proposition 4 Climate Bond

RESOLUTION NO. 2026-XX

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE TUSCAN WATER DISTRICT AUTHORIZING SUBMISSION OF A CONCEPT PROPOSAL FOR A STATE WATER EFFICIENCY AND ENHANCEMENT PROGRAM (SWEEP) BLOCK GRANT UNDER THE PROPOSITION 4 CLIMATE BOND

WHEREAS, the Tuscan Water District ("District") is a California water district formed to support groundwater sustainability and water resource management within the Vina Subbasin; and

WHEREAS, the State Water Efficiency and Enhancement Program ("SWEEP"), administered by the California Department of Food and Agriculture ("CDFA"), provides competitive grants to support on-farm irrigation efficiency projects that reduce water use and greenhouse gas emissions; and

WHEREAS, CDFA has made a new round of SWEEP funding available under the Proposition 4 Climate Bond through a regional block grant model, with concept proposals due on or before May 15, 2026; and

WHEREAS, on-farm irrigation efficiency is a recognized demand reduction strategy under the Vina Subbasin Groundwater Sustainability Plan, and serving as lead applicant on a regional SWEEP block grant is consistent with the District's purposes and authorities; and

WHEREAS, District staff has worked with the Butte County Farm Bureau, the Agricultural Groundwater Users of Butte County, and the Sutter County Resource Conservation District to develop a concept for a regional SWEEP block grant covering Butte, Yuba, and Sutter counties, with the District serving as lead applicant and fiduciary; and

WHEREAS, submission of a concept proposal does not obligate the District to any expenditure or contractual commitment, and any subsequent full proposal, grant agreement, subaward agreements, or related budget actions will be brought back to the Board for separate consideration and approval;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Tuscan Water District as follows:

Section 1. The recitals set forth above are true and correct and are incorporated herein by this reference.

Section 2. The Board supports the development and submission of a concept proposal to CDFA for a regional SWEEP block grant under the Proposition 4 Climate Bond, with the Tuscan Water

District serving as lead applicant and fiduciary and with the Butte County Farm Bureau, the Agricultural Groundwater Users of Butte County, and the Sutter County Resource Conservation District as partner organizations.

Section 3. The General Manager is hereby authorized to prepare, sign, and submit the concept proposal to CDFA on behalf of the District, and to take such other actions as are reasonably necessary to convey the District's interest and partner commitments to CDFA in connection with the concept submission.

Section 4. If the concept is invited to full proposal, the General Manager shall return to the Board for further direction before submitting a full proposal. Any grant agreement, subaward agreements, and related budget actions arising from a grant award shall be subject to separate Board consideration and approval.

Section 5. This Resolution shall take effect immediately upon its adoption.

PASSED AND ADOPTED by the Board of Directors of the Tuscan Water District at a special meeting held on May 14, 2026, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

____

Rich McGowan, Board President

ATTEST:

____

Rayme Antonowich, Board Secretary

TUSCAN WATER DISTRICT
Staff Memorandum

TO: TWD Board of Directors
FROM: Tovey Giezentanner, General Manager
DATE: May 14, 2026
RE: Item 7: FY 2026-27 Annual Property Tax Roll Enrollment — Process and Timeline

Action Requested. Receive this informational update on the District's FY 2026-27 annual assessment enrollment process with the Butte County Auditor-Controller. No formal action is requested at this meeting; staff will return on June 17, 2026 with a certifying resolution for Board adoption.

Background. On April 15, 2026, the Board adopted the FY 2026-27 budget of $472,069 at a per-acre assessment rate of $4.91 (Item 6, on motion of Director Mendonca, seconded by Director Mori; carried unanimously) and directed the General Manager to initiate the annual assessment process with Butte County and return with a full outline of process and timeline. On May 11, 2026, the Butte County Auditor-Controller's Property Tax Division distributed its annual instructional packet for taxing agencies enrolling charges on the FY 2026-27 secured property tax roll. This memorandum responds to the April 15 directive.

Summary / Analysis.

What Carries Forward From Year 1. The foundational elements of the District's assessment authority remain in place and do not require new Board action. The January 15, 2025 property-owner election (87.61% approval) established the Proposition 218 authority for the levy, with a Year 2 maximum of $7.14 per acre per the Engineer's Report. Resolution 25-04 (August 5, 2025) elected the alternative collection method under Water Code §37203, placing the levy on the County secured roll. Tax Code 67675 is assigned to the District and continues. The Direct Assessment Agreement with the County remains in effect; beginning with the 2025-26 cycle the County eliminated the annual re-execution requirement, and the existing agreement carries forward unless cancelled. Because the District has an established tax code, the County's June 10 deadline for new tax code requests (Attachment 8) does not apply this year.

Rate Authority. The Board's adopted rate of $4.91 per acre for FY 2026-27 is well below the $7.14 per acre Year 2 maximum authorized by the Proposition 218 Engineer's Report and represents a meaningful reduction from the $6.45 per acre rate levied in FY 2025-26, reflecting both the substantial reserves carried forward from Year 1 and pressures on the agricultural economy discussed at the April 15 meeting.

Annual Submittal Package. For FY 2026-27, staff will prepare and submit the following to the Auditor-Controller no later than August 10, 2026, per Government Code §26911: (a) a Board resolution certifying the parcel listing, the State Code authority, compliance with Proposition 218 and other applicable laws, the absence of any property-valuation factor in the levy, and the County's indemnification; (b) the signed Governing Authorization Certification Form (Attachment 1) identifying Water Code §37200 et seq. as the enabling authority and Water Code §37203 as the placement authority; (c) the signed Proposition 218 / Compliance Certification and Hold Harmless Statement (Attachment 2); (d) the Property Tax Data Form

(Attachment 4) identifying the District's billing name, contact, and phone number for the tax bill; and (e) the parcel listing in the County's prescribed Excel format (12-digit APN, dollar amount divisible by two, tax code 67675). A final Certification of Property Tax Bill Levy will be returned to the County no later than September 1, 2026.

Schedule Over the Next Two Months.

- **May 14, 2026 (this meeting):** Informational update; no formal action.
- **June 17, 2026 (regular Board meeting):** Adoption of the annual certifying resolution authorizing the FY 2026-27 levy at $4.91 per acre, authorizing the General Manager to execute and submit the Governing Authorization Certification, the Proposition 218 / Compliance Certification, the Property Tax Data Form, and the parcel listing, and approving the form of the parcel listing for submission.
- **Mid-July 2026:** Reconciliation of the District's parcel records against the County's edit list, which the Auditor publishes after year-end rollover to identify parcel splits and combinations.
- **By August 10, 2026:** Submission of the complete annual packet, including the Excel parcel listing, to the Auditor-Controller per Government Code §26911.
- **By September 1, 2026:** Return of the signed final Certification of Property Tax Bill Levy to the County.

Additional Context. County administrative costs are unchanged from prior practice: a $0.30 per-parcel enrollment fee, offset against the District's December and April secured property tax disbursements, and a $10 per-item correction fee for any change made after the tax roll is extended in mid-September. Any post-extension increase must be a minimum of $50 per parcel. These costs are reflected in the Assessment Collection line of the adopted FY 2026-27 budget.

TUSCAN WATER DISTRICT
Staff Memorandum

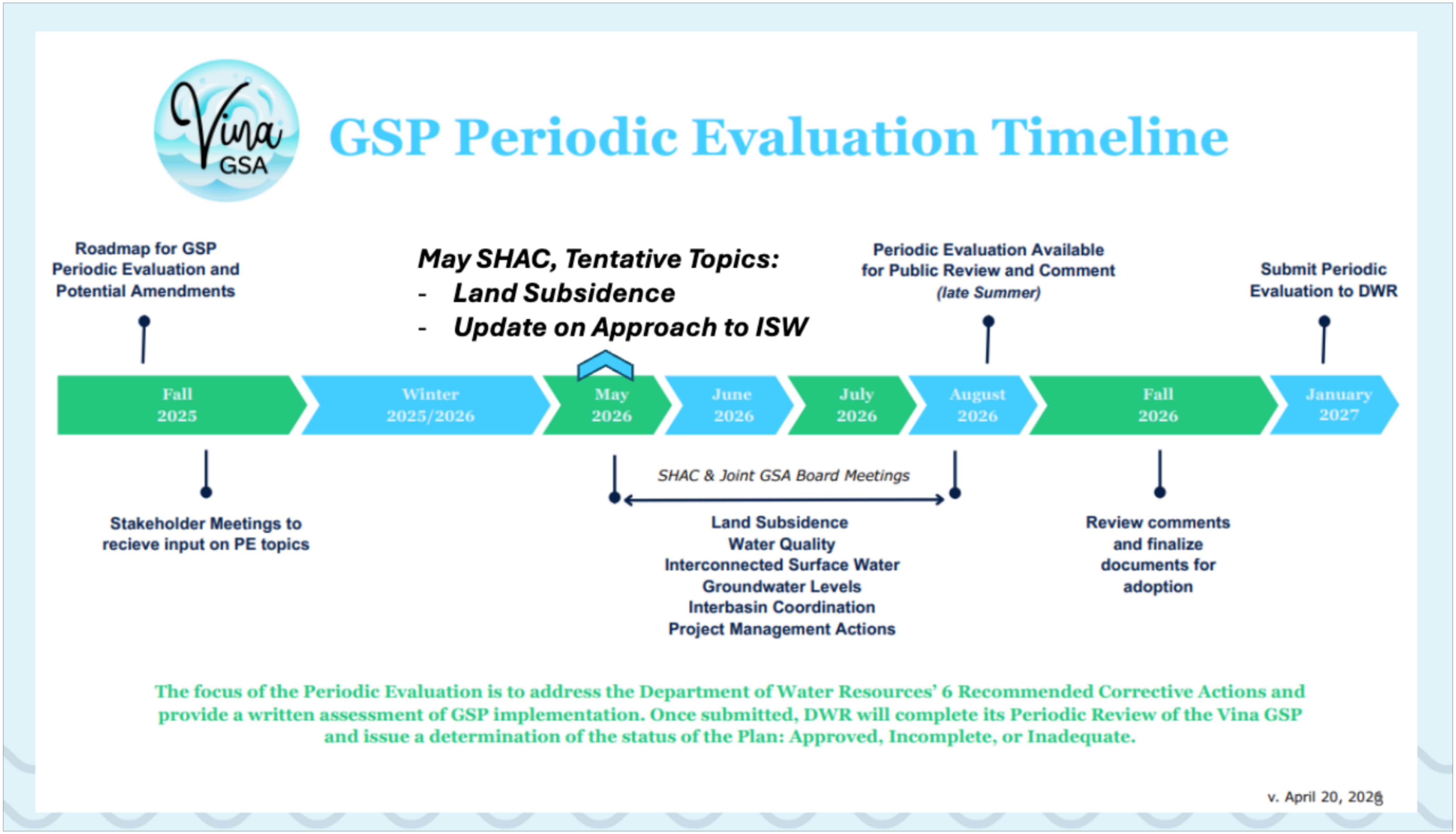
TO: Board of Directors
FROM: Tovey Giezentanner, General Manager
DATE: May 14, 2026
RE: Item 8: 2026 General District Election — Preliminary Overview

Action Requested. Informational only; no Board action is requested at this time.

Background. The next Tuscan Water District general election will be held **Tuesday, November 3, 2026**. Consistent with the Board's adopted term-staggering structure, the 2026 election will fill the five odd-numbered directorships — Seats 1, 3, 5, 7, and 9 — with the even-numbered seats (2, 4, 6, and 8) to be filled at the November 2028 general district election. The summary below highlights the key statutory dates. Staff will return on June 17, 2026 with a comprehensive review of the calendar and any Board actions required in advance of the July 1, 2026 statutory deadlines.

Key Board-Facing Dates.

Date	Action
July 1, 2026	Secretary delivers Notice of Offices to be Filled to County Clerk (EC §§ 10509, 10524)
July 6 – Aug. 5, 2026	Publication window for Notice of Election (EC §§ 12112, 10515)
July 13 – Aug. 7, 2026	Declaration of Candidacy filing window; Candidate Statements due with Declaration (EC §§ 10510, 13307)
July 16, 2026	Deadline for the Board to authorize vote-by-mail in lieu of vote-by-proxy (EC § 10531)
Aug. 5, 2026	Last day for Board to adopt ordinance updating assessment roll (Wat. Code §§ 35003, 35003.1)
Aug. 12, 2026	Extended filing deadline if any incumbent does not file (EC § 10516)
Nov. 3, 2026	Election Day
Nov. 5, 2026	Canvass of returns commences (EC § 10547)
Dec. 4, 2026	New directors take office at noon (EC § 10554; Wat. Code § 34701)


Vina GSA
GSP Periodic Evaluation Timeline
Roadmap for GSP Periodic Evaluation and Potential Amendments
May SHAC, Tentative Topics:
- Land Subsidence
- Update on Approach to ISW
Periodic Evaluation Available for Public Review and Comment
(late Summer)
Submit Periodic Evaluation to DWR
Fall 2025
Winter 2025/2026
May 2026
June 2026
July 2026
August 2026
Fall 2026
January 2027
SHAC & Joint GSA Board Meetings
Stakeholder Meetings to recieve input on PE topics
Land Subsidence
Water Quality
Interconnected Surface Water
Groundwater Levels
Interbasin Coordination
Project Management Actions
Review comments and finalize documents for adoption
The focus of the Periodic Evaluation is to address the Department of Water Resources' 6 Recommended Corrective Actions and provide a written assessment of GSP implementation. Once submitted, DWR will complete its Periodic Review of the Vina GSP and issue a determination of the status of the Plan: Approved, Incomplete, or Inadequate.
v. April 20, 2026

SHAC Recommendations

Despite differing perspectives on timing and approach, the SHAC reached **unanimous consensus** on the following recommendations to the Board:

- **Periodic Evaluation Recommendation:**
  The SHAC recommends the Periodic Evaluation describe the following regarding the Domestic Well Mitigation management action: during the next implementation period, the GSA will develop a Well Mitigation Program that fits the needs of the subbasin.

- **Near-Term Action Recommendation:**
  In addition, the SHAC recommends the GSA Board dedicate funding in the FY 2026–27 Annual Budget to initiate the development of a Well Mitigation Program in early 2027 after all SGM Grant Projects are complete, as not to overload staff capacity.

Requested Action

Consider the following action:

1. Direct staff to include in the Vina Subbasin Periodic Evaluation a statement that the GSAs intend to develop a Domestic Well Mitigation Program during the next implementation period (2027–2032), with the program to be tailored to the specific conditions and needs of the subbasin.

2. Direct staff to include in the proposed FY 2026–2027 budget funding to initiate development of a Domestic Well Mitigation Program with planning to begin in early 2027.

Attachments

A. LWA Tech Memo: Vina Subbasin Domestic Well Survey & Well Risk Assessment

B. Domestic Well Mitigation Programs - Summary Matrix

C. Well Registry Programs and Linkages to Mitigation

Agenda Item 9c

Proposed Edits and Retained Provisions — Vina GSA Subsidence Strawman Proposal

Prepared for the Tuscan Water District Board, Special Meeting — May 14, 2026

On April 24, 2026, Vina GSA staff and consultants released a strawman proposal for the land subsidence Sustainable Management Criteria (SMC), responding to DWR Recommended Corrective Action 5 in advance of the January 2027 Periodic Evaluation. The strawman correctly establishes an InSAR-driven monitoring framework as RCA 5(b) directs. The table below sets out the landowner position section by section: rows 1–9 are proposed edits where the strawman's discretionary choices diverge from the DWR Land Subsidence BMP, the four DWR-approved Sacramento Valley comparator GSPs (Red Bluff, Los Molinos, Corning, Colusa — all approved February 2025), or the same engineering team's 2027 Periodic Evaluation draft for the neighboring Wyandotte Creek Subbasin. Rows 10–13 are strawman provisions that are accepted as written.

Landowner Position — Section by Section

#	Section / Topic	Strawman as Drafted	Landowner Position	Why
1	**Minimum Threshold (MT)**	0.2 ft/yr at any RMS, OR 0.5 ft / 5-yr cumulative (stacked triggers)	**PROPOSED EDIT —** 0.5 ft / 5-yr cumulative only, attributable to declining groundwater levels.	No DWR-approved Sacramento Valley basin uses a single-pixel annual-rate MT. Matches Red Bluff, Los Molinos, Corning, Butte, and the same engineer's Wyandotte Creek draft.
2	**Undesirable Result — Trigger 2**	>0.1 ft/yr across 10 contiguous PLSS sections for 2 consecutive years (Colusa-style)	**PROPOSED EDIT —** Removed.	Colusa adopted this structure for a basin with measured subsidence; Vina has none. Untethers the UR from the land-use-harm requirement of 23 CCR § 354.28(c)(5)(A).
3	**Undesirable Result — Trigger 1**	MT exceedance (annual-rate) + confirmed infrastructure impact, 2 yrs	**PROPOSED EDIT —** MT exceedance (cumulative) + confirmed infrastructure impact + groundwater-level causation finding, 2 yrs.	Updates the MT reference to the cumulative trigger and adds the Red Bluff / Los Molinos causation gate ("as a result of declining GWL").
4	**Relationship to Groundwater Conditions**	Groundwater-level framework abandoned entirely	**PROPOSED EDIT —** Groundwater-level framework retained as leading indicator alongside InSAR; sequencing language added making subsidence-driven PMAs conditional on observed subsidence.	BMP § 6.8 endorses the GWL framework in basins without observed subsidence; BMP § 7.4.2 sequences Scenario 2 PMAs after detection. Parallels the Wyandotte Creek 2027 Periodic Evaluation draft.
5	**Interim Milestones (IM)**	"0.0 ft/yr maintained" (duplicate of MO)	**PROPOSED EDIT —** No IM established. (or 0.0 ft/yr)	BMP § 6.5: "interim milestones is not necessary" in basins without observed subsidence and with MO at zero. Butte's "No IM identified" already DWR-accepted.
6	**Measurement Uncertainty**	"Approximately 0.05 to 0.10 ft/yr" range	**PROPOSED EDIT —** "< 0.10 ft/yr" (single value).	Eliminates interpretive disputes near the boundary. Anchored to BMP § 6.3 ("zero or the measurement error of the monitoring equipment").
7	**Sustainability Indicator Description**	Geologic-substrate finding omitted; conditional risk pathway only	**PROPOSED EDIT —** Geologic-substrate finding restored, with SVSim specific-yield (Sy ≈ 0.085) quantitative support and the four-year (WY 2022–25) empirical record of no inelastic subsidence.	DWR's 2023 Staff Report accepted "subsurface materials… not susceptible to subsidence." Strongest empirical anchor for the Subbasin's Scenario 2 posture.

8	**Monitoring Network — Spatial Criteria**	"Areas of groundwater extraction (west of Highway 99)" leads	**PROPOSED EDIT —** Critical infrastructure leads; mechanism-based criteria (lithology, GWL decline) follow; Management Area coverage added.	23 CCR § 354.28(c)(5)(A) ties subsidence MTs to identified land uses and property interests, not to pumping geography.
9	**Monitoring Network — Infrastructure List**	Highway 99, Highway 32, City of Chico, Durham	**PROPOSED EDIT —** Adds irrigation district infrastructure, Cal Water service area, and consultation with infrastructure operators.	BMP § 5.2 calls for GSAs to "broadly encompass any infrastructure, land use, and property interest."
10	**Measurable Objective (MO)**	0.0 ft/yr of land subsidence at representative monitoring locations	**RETAIN AS WRITTEN —** 0.0 ft/yr accepted.	BMP-consistent. § 6.4: "In basins that have not experienced land subsidence, the measurable objective should be set at zero."
11	**InSAR + GPS Monitoring Backbone**	DWR-provided InSAR data, plus one available GPS site in the Vina Subbasin, as the monitoring backbone	**RETAIN AS WRITTEN —** InSAR + 1 GPS site accepted as the monitoring backbone.	RCA 5(b) is disjunctive ("remote sensing data, survey monuments, or GPS stations"); 23 CCR § 354.34(c)(6) is disjunctive. DWR has approved InSAR-driven networks in Red Bluff (8 pixels), Los Molinos (9 pixels), Corning, and Colusa. No record exists of DWR rejecting an InSAR-only network in any California basin.
12	**Annual InSAR Review Framework**	InSAR data evaluated at least annually, with consideration of both annual rates and cumulative deformation trends	**RETAIN AS WRITTEN —** Annual review with annual-and-cumulative trend evaluation accepted.	Consistent with BMP § 6.1.2's review-cycle framework. The annual review structure is correct; only the MT it is evaluated against is changing per Edit 1.
13	**Periodic Refinement of Monitoring Locations**	Number and distribution of representative monitoring locations periodically reviewed and refined over time, with long-term trend-evaluation continuity preserved	**RETAIN AS WRITTEN —** Periodic refinement framework accepted.	Consistent with BMP § 6.1's periodic-evaluation framework. Preserves continuity of trend evaluation across future GSP cycles.

Defensibility. *Taken together, this position fully satisfies DWR Recommended Corrective Action 5: a quantitative undesirable-result definition tied to identified infrastructure and to declining groundwater levels, and a monitoring network that directly measures land elevation change via InSAR. Every provision is anchored in the DWR Land Subsidence BMP, in 23 CCR §§ 354.28(c)(5) and 354.34(c)(6), or in a DWR-approved Sacramento Valley comparator GSP. Full redline, edit-by-edit rationale, and supporting research are in the May 3, 2026 Strawman Redline and Research Memo (v2).*

Vina Groundwater Sustainability Agency
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MEMORANDUM

To: All Stakeholders

From: Christina Buck, Asst. Director Butte County Dept. Water and Resource Conservation

Date: April 24, 2026

Subject: **Strawman Proposal for Land Subsidence SMC for Discussion and Relevant Context**

Relevant Context

The attached strawman proposal for the Sustainable Management Criteria (SMC) related to Land Subsidence is provided to facilitate discussion and receive public input on whether the SMC for Land Subsidence should be amended in the Groundwater Sustainability Plan (GSP) in response to the Department of Water Resources' (DWR) Recommended Corrective Actions. The following provides important relevant context to support discussions. This topic is anticipated to go to the Vina Stakeholder Advisory Committee (SHAC) in May and the Joint Boards in June.

No Observed Land Subsidence in Vina Subbasin

Under the Sustainable Groundwater Management Act (SGMA), land subsidence is one of six sustainability indicators that is required to be managed in the GSP to avoid "undesirable results," which is defined as significant and unreasonable land sinking caused by excessive groundwater pumping. The 2025 Water Year Annual Report (and previous annual reports) show that no inelastic land subsidence has been recorded in the Vina Subbasin. Below, Figure 5-2 is included for quick reference from the 2025 Annual Report showing "no significant change" of vertical displacement over a 5-year period. The entire report is available online.

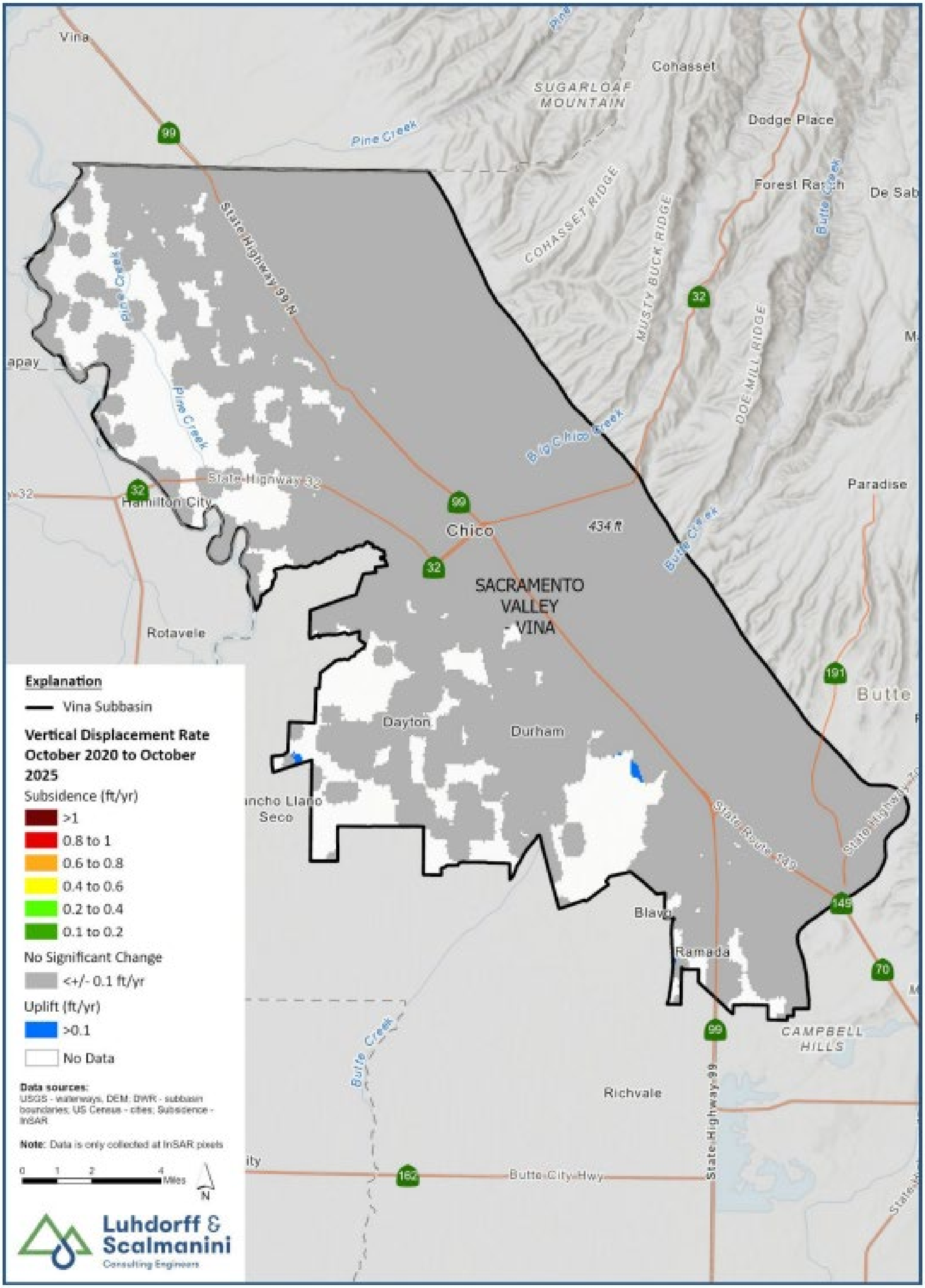

Figure 5-2. Vina Subbasin Vertical Displacement in Ground Surface from 10/2020 to 10/2025

DWR Recommended Corrective Actions

DWR provided recommended corrective actions (RCAs) in its GSP Determination Letter identifying several areas for improvement with respect to the land subsidence sustainability indicator. It is DWR's expectation that RCAs should be considered by the GSAs in the first periodic evaluation of the GSP (due to be submitted in January 2027). Provided below is Recommended Corrective Action 5, as stated in the Determination Letter:

> *Provide additional information on criteria used to identify undesirable results, and sustainable management criteria for land subsidence, including:*
> a. *Provide a clear, quantitative definition of when undesirable results for land subsidence may occur in the Subbasin, as required by the GSP regulations, to support the selection of land subsidence minimum thresholds that demonstrate avoidance of undesirable results.*
> b. *Establish sustainable management criteria for land subsidence for the Subbasin utilizing a monitoring network that directly measures land elevation change such as remote sensing data, survey monuments, or global positioning system stations.*

The Vina Subbasin Groundwater Sustainability Plan (2022) currently uses groundwater levels as a proxy, using the groundwater level SMC and monitoring network for land subsidence as well. This needs to be addressed.

Recently Released DWR Best Management Practices (BMP) on Land Subsidence

In January 2026, DWR released its Best Management Practices (BMP) on Land Subsidence. This document provides guidance to Groundwater Sustainability Agencies on how to monitor, evaluate, and establish Sustainable Management Criteria for land subsidence in a manner that identifies and avoids significant and unreasonable impacts to infrastructure and land use. It describes four different land subsidence management scenarios and suggests different approaches depending on the conditions in the subbasin. The Vina Subbasin falls into **Scenario 2**, which describes conditions where little or no subsidence has been observed to date, but groundwater levels may be allowed to decline below historical lows (based on how Groundwater Levels Minimum Thresholds are set), creating a risk of inelastic subsidence and requiring monitoring and SMC that identify and avoid resulting impacts. Land Subsidence is a sustainability indicator DWR has provided clear guidance on, in addition to the RCAs.

Neighboring Subbasins

Additionally, the approaches neighboring subbasins have taken regarding Land Subsidence monitoring and SMC may also be of interest to the Vina Subbasin. This is summarized in Table 5 of the 'Joint GSP Evaluation for the North Sacramento River Corridor' Tech Memo and is included below.

Requested Input

Attached to this Memo is a preliminary approach or "strawman" that has been provided to solicit input, encouraging stakeholders to engage and give feedback on whether the SMC for Land Subsidence should be amended in the GSP. Please reach out to cbuck@buttecounty.ca.gov with questions or to schedule a time to connect and discuss this further. An open, public meeting will also be scheduled to support further dialogue on the topic.

MONTGOMERY & ASSOCIATES

Table 5. Summary of Land Subsidence SMC

Subsubasin	Approved GSP Section Reference	MT	Undesirable Results (UR)	MO	InSAR Network?	Five-Year IM (2027)	Current Conditions*
Vina**	*Section 3.7. p. 194-195*	*GWL MT Used as Proxy*	*GWL UR Used as Proxy*	*GWL MO Used as Proxy*	Used as Supplement	*GWL IM Used as Proxy*	*On track to meet IM (Section 5.2.3. p. 38)*
Butte**	*Section 4.3.5. p. 225-226*	0.5 foot over a five-year period	25% of monitoring locations fall below MT	0.25 foot over five-year period	Used as Supplement	No IM identified	No indication of UR *(Section 5.2. p. 41)*
Red Bluff	*Section 3.2.3. p. 312-314*	0.5 foot over a five-year period	0.5 foot over a five-year period – *result of declining GWL*	one foot over 20 years	Yes – eight pixels collocated near WL RMS	-0.25 feet	No indication of UR *(Section 5.2. p. 35)*
Los Molinos	*Section 3.2.3. p. 306*	0.5 foot over a five-year period	0.5 foot over a five-year period – *result of declining GWL*	one foot over 20 years	Yes – nine pixels collocated near WL RMS	-0.25 feet	No indication of UR *(Section 5.2. p. 37)*
Corning	*Section 6.9. p. 483-491*	0.5 foot over a five-year period	0.5 foot over a five-year period – *result of declining GWL*	0 ft/yr	Yes	< 0.1 ft/yr	No Indication of UR *(Section 5.2. p. 37)*
Colusa *(only subbasin with current measurable subsidence)*	*Section 5.4.5. p. 388-393*	Cumulative subsidence of two feet (from Jan. 2024) in 1 PLSS section***, *or* >0.1 ft/yr across 10 contiguous PLSS sections for two consecutive years	Cumulative subsidence of >two feet (from Jan. 2024) in one PLSS, *or* >0.1 ft/yr across 10 contiguous PLSS sections for two years	0 ft/yr	Yes	0.3 ft/yr	No indication of UR – Measured subsidence (>0.1 feet) occurred in three locations, but were not contiguous PLSS *(Section 6.1.4. p. 47-50)*

ft/yr = feet per year

*Current Conditions as described in WY 2024 Annual Report. Note that the sections indicated referencing relevant section in the most recent, 2024, Annual Report, which was made public in early spring 2025.
**Vina and Butte Subbasins have an RCA to revise their monitoring network to include InSAR data
***PLSS section: Defined as one square mile, or 640 acres

Land Subsidence Sustainable Management Criteria – Strawman Proposal for Discussion

This is provided to facilitate discussion and the potential development of a Plan Amendment to address DWR's Recommended Corrective Action related to Land Subsidence. This draws from DWR's Land Subsidence BMP released in January 2026 and approaches used by neighboring subbasins and others across the state. This is written as direct language that could be used to amend the GSP and/or used in the Periodic Evaluation.

Sustainability Indicator Description

Land subsidence in the Subbasin is evaluated using direct measurements of land surface deformation, primarily through Interferometric Synthetic Aperture Radar (InSAR) data, supplemented by available Global Positioning System (GPS) measurements where applicable. These datasets provide spatially distributed estimates of vertical land surface change and are used to assess both the rate and cumulative magnitude of subsidence across the Subbasin.

Consistent with the Department of Water Resources (DWR) Land Subsidence Best Management Practice (BMP), the Subbasin is characterized as having no documented history of significant inelastic land subsidence, but recognizes that subsidence may occur if groundwater elevations decline sufficiently to induce compaction of fine-grained sediments. Accordingly, the Sustainable Management Criteria (SMC) are designed to identify conditions under which subsidence could result in significant and unreasonable impacts to beneficial uses and users, including infrastructure and land use.

Monitoring Network

The complete monitoring network will include all available InSAR data and any GPS monitoring sites available within the Vina Subbasin. These datasets will be used for analysis and basin setting understanding.

Representative land subsidence monitoring locations in the Vina Subbasin are selected from the full InSAR dataset based on data quality, spatial distribution, hydrogeologic conditions, proximity to infrastructure, and, where feasible, co-location with groundwater monitoring wells. These locations provide a consistent framework for evaluating Sustainable

Management Criteria, while the full InSAR dataset is used to assess basin-wide subsidence conditions and identify emerging trends. (See Attachment A below for more details)

The RMS land subsidence monitoring network will consist of:

- DWR-provided InSAR data, evaluated across representative pixels distributed throughout the Subbasin;
- Available GPS monuments used to corroborate InSAR-derived displacement estimates (one site in Vina);

Representative monitoring locations are defined using spatially distributed InSAR pixels and, where feasible, nearby groundwater level monitoring wells to support interpretation of relationships between groundwater conditions and subsidence. Locations are selected to support spatial evaluation of subsidence trends with emphasis on:

- Areas of groundwater extraction (west of highway 99)
- Areas with fine-grained sediments
- Locations near critical infrastructure (wells, roads/highways)

InSAR data are evaluated at least annually, with consideration of both annual rates and cumulative deformation trends.

Measurement Uncertainty

Subsidence rates less than approximately 0.05 to 0.10 feet per year are considered within the range of InSAR measurement uncertainty and are not interpreted as indicative of inelastic land subsidence.

Measurable Objective (MO)

0.0 feet per year of land subsidence at representative monitoring locations, recognizing that minor variation within measurement uncertainty does not indicate inelastic subsidence. [This is consistent with DWR's Land Subsidence BMP.]

Minimum Threshold (MT)

A rate greater than 0.2 feet per year of subsidence at any representative monitoring location, or 0.5 foot cumulative subsidence over a 5-year period at the same location.

Interim Milestones (IMs)

Subsidence rates maintained at 0.0 feet per year of land subsidence at representative monitoring locations, recognizing that minor variation within measurement uncertainty does not indicate inelastic subsidence.

Undesirable Results

Subsidence exceeding the Minimum Threshold that results in significant and unreasonable impacts to beneficial uses and users, including infrastructure, namely highways, roads, drainage infrastructure, or well casings.

This occurs when:
1. The Minimum Threshold (0.2 ft/yr) is exceeded for two consecutive years at the same representative monitoring location with confirmed associated impacts to infrastructure, or
2. >0.1 ft/yr rate is exceeded across 10 contiguous PLSS sections* for two consecutive years. [similar to Colusa subbasin approach]

*PLSS section: Defined as one square mile, or 640 acres

Relationship to Groundwater Conditions

Subsidence is associated with reductions in groundwater elevations. Groundwater levels are evaluated alongside InSAR data to assess risk of inelastic compaction and inform management actions.

Attachment A: Land Subsidence Monitoring Network

Representative InSAR Monitoring Locations

To support evaluation of land subsidence, the Vina Subbasin utilizes **InSAR-derived land surface deformation data across the full Subbasin extent**. All available InSAR data are reviewed annually to evaluate spatial patterns, identify potential areas of deformation, and assess overall subsidence conditions.

For purposes of Sustainable Management Criteria (SMC) evaluation and long-term tracking, a subset of **representative monitoring locations** is designated from the full InSAR dataset. These representative locations are not intended to replace the full dataset, but rather to provide a **consistent, stable, and interpretable set of monitoring points** for evaluating compliance with SMC over time.

Representative monitoring locations are defined using the following criteria:

- **Data Quality and Reliability**
  Selected locations are based on InSAR pixels exhibiting consistently high data quality, including stable coherence and minimal evidence of processing artifacts or anomalous variability over the available time series.
- **Spatial Representation of the Subbasin**
  Monitoring locations are distributed across the Subbasin, including each management area, to capture spatial variability in groundwater conditions and potential subsidence response.

- **Hydrogeologic and Pumping Conditions**
  Locations are selected in areas representative of:
  - Concentrated groundwater extraction (west of highway 99)
  - Fine-grained sediment deposits where compaction risk may be higher
  - Areas with observed groundwater level declines or greater variability
- **Proximity to Critical Infrastructure**
  Representative locations include areas near infrastructure that could be sensitive to land subsidence, such as roads, pipelines, and flood conveyance features, to ensure that monitoring captures conditions relevant to beneficial uses and users. This includes…highway 99, highway 32, locations throughout the City of Chico, and the community of Durham…
- **Integration with Groundwater Monitoring**
  Where feasible, representative InSAR locations are selected near existing groundwater level monitoring wells to support evaluation of the relationship between groundwater elevations and land surface deformation.

In many cases, a representative monitoring location consists of a **central InSAR pixel supported by a small group of adjacent pixels**, allowing for confirmation that observed deformation patterns are spatially consistent and not attributable to localized data artifacts.

The number and distribution of representative monitoring locations are periodically reviewed and may be refined over time as additional data become available or as understanding of subsidence conditions evolves. However, changes to representative locations will be made in a manner that maintains continuity in long-term trend evaluation.

This approach is consistent with DWR's monitoring and land subsidence BMP guidance, which emphasizes the use of **spatially distributed data to assess basin-wide conditions**, while also identifying **representative monitoring locations sufficient to detect conditions that could lead to significant and unreasonable impacts**.

AGRICULTURAL GROUNDWATER USERS OF BUTTE COUNTY

Staff White Paper · May 2026

Vina Subbasin GDE Technical Study — Issues and Recommendations

Overview. The March 2026 Vina GSA Groundwater-Dependent Ecosystem Technical Study (ESA) provides a useful regional screening of potential GDEs in the Subbasin. AGUBC supports SGMA-consistent protection of verified groundwater-dependent ecosystems. The Study's proposed regulatory framework, however, rests on methodological choices that, if adopted without modification, would impose pumping constraints disconnected from demonstrated environmental harm. The framework is also inconsistent with SGMA's statutory text and DWR's Best Management Practice guidance.

The headline 464 figure is a methodology choice, not a finding. The Study analyzed six hydrologic scenarios. The count of polygons classified as "likely GDE" varies by more than an order of magnitude across those scenarios: 464 (Spring 90th percentile, 2020-2024), 100 (Spring 2015), 64 (Spring 2021), 38 (Fall 90th percentile), 21 (Fall 2015), and 17 (Fall 2021). Five of the six scenarios yield 100 or fewer polygons. ESA recommends the highest figure — 464 — as the regulatory universe without identifying that selection as a policy choice. The Fall 90th percentile, 2020-2024, equally a "typical" hydrologic baseline, yields 38 polygons — a 92 percent reduction. Notably, the season selected drives more of the variance in the result than the hydrologic year selected: the Spring-to-Fall ratio at the 90th percentile is approximately 12 to 1, while the year-to-year ratio within Spring (90th percentile to 2021) is approximately 7 to 1. ESA's selection of a spring-only baseline therefore embeds a methodology choice with greater regulatory consequence than the year choice. The choice of regulatory universe is not a technical finding; it is an ESA policy decision that should be made transparently to the GSA Board with full bracketed analysis of all six scenarios.

The proposed Undesirable Result floor is set at the driest year on record and falls below the 2015 statutory reference point. ESA recommends that connected GDE area shall not fall below 437 acres (Spring 2021) for three consecutive years. The Study itself acknowledges Spring 2021 as "the lowest water year on record since 2000." Setting the floor at the driest single year on record conflates drought with management failure.

Water Code § 10721(x)(1) — the SGMA undesirable result definition — provides that "overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." This statutory carve-out reflects the Legislature's understanding that SGMA regulates management decisions, not weather. DWR's *Sustainable Management Criteria* BMP applies the same principle to depletion-of-interconnected-surface-water thresholds, directing GSAs to consider "historical rates of stream depletion for different water year types" when setting those thresholds.

The Study's own data confirm the problem. Spring 2015 — itself a critically dry year — yielded 100 likely-GDE polygons. Spring 2021 yielded 64. The proposed regulatory floor therefore sits below the January 1, 2015 statutory reference point established by Water Code § 10727.2(b)(4). The three-consecutive-year trigger does not cure this defect; consecutive dry years (as occurred during 2020–2022) would mechanically trigger an undesirable result finding even where management has not changed and pumping has not increased.

The Study's own evidence does not establish a strong groundwater-vegetation link. The Study reports a correlation coefficient of −0.17 between groundwater elevation and NDVI vegetation health across all potential GDEs (p. 23), with 45 percent of polygons showing a negative relationship and 48 percent showing a positive relationship — a distribution indistinguishable from statistical noise. The Study acknowledges that "uncertainties and data gaps remain regarding the relationship between shallow groundwater levels and GDE NDVI." A coefficient of −0.17 cannot do the analytical work that an undesirable result finding requires under DWR's BMP framework, which conditions such findings on identification of the cause of the groundwater conditions and articulation of criteria defining when those conditions become significant and unreasonable.

Agricultural applied water may support the same GDEs the proposed criteria seek to protect. The Study concedes (p. 35–36) that applied water for irrigated agriculture "has ancillary benefits to GDEs" and that changes to pumping "may have negative consequences … to GDEs." This tradeoff is acknowledged but not analyzed quantitatively. Without such analysis, pumping restrictions designed to protect GDEs could measurably harm the ecosystems the proposed criteria seek to protect — an outcome inconsistent with the Vina GSP's stated objectives.

Recommendations. AGUBC recommends incorporating the following:

- **Bracketed scenario reporting.** All six TM scenarios shall be presented as policy options. Selection of the regulatory universe shall be presented transparently as a policy choice by the GSA Board, not embedded as a technical finding.
- **Dual-season screening criterion.** A polygon shall qualify as a likely GDE only where groundwater connection is demonstrated in both spring and fall measurements. Sustained year-round groundwater connection is the ecological definition of a groundwater-dependent ecosystem; spring-only connection may reflect vernal pool, ephemeral riparian, or winter-rainfall hydrology rather than dependence on the regional aquifer.
- **2015 baseline with causation requirement.** Consistent with Water Code §§ 10721(x)(1) and 10727.2(b)(4) and the BMP's directive that GSAs identify and investigate the causes of undesirable results, an Undesirable Result finding for depletion of interconnected surface water shall not be triggered solely by drought-year conditions. The regulatory

reference point shall be conditions as of January 1, 2015, and any finding shall be supported by analysis demonstrating that observed change is attributable to GSA-controlled pumping rather than natural hydrologic variability.

- **Shallow-aquifer monitoring before binding criteria.** The 2022 GSP RMS network is screened in the deeper aquifer, as the Study acknowledges on p. 32. The Vina GSA Board approved the SGM-funded shallow-aquifer monitoring network — nine new shallow wells, one multi-completion well, three to four stream gages, and continuous monitoring at eight domestic wells — on December 11, 2024, with grant funds required to be expended by March 2026. Binding GDE criteria shall be deferred to the 2032 Periodic Evaluation, allowing several water years of shallow-aquifer-specific data from this network to inform any subsequent regulatory determinations.
- **Applied-water tradeoff analysis.** A quantitative analysis of agricultural applied water's net effect on GDEs shall precede any pumping-restriction-based GDE criteria.

Conclusion. AGUBC values both the ecological resources of the Vina Subbasin and the agricultural economy that has shaped it. We support a Periodic Evaluation that reflects best-available science, distinguishes management-driven from climate-driven change, complies with the statutory and BMP framework that governs Undesirable Result findings, and preserves the operational flexibility SGMA contemplates.

ESA

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memorandum

date	March 27, 2026
to	Vina Groundwater Sustainability Agency
cc	Rebecca Fairbanks, Butte County; Ryan Fulton, LWA
from	Byron Amerson, ESA; Jason Wiener, ESA
subject	Vina Groundwater Subbasin – Groundwater Dependent Ecosystem Technical Study

Summary of Findings

Key findings: A desktop analysis of groundwater dependent ecosystems (GDEs) in the Vina Subbasin using depth-to-groundwater (DTG) and rooting depth thresholds identified 464 likely GDEs under typical spring conditions (41 percent of all potential GDEs mapped in the Subbasin by the Natural Communities Commonly Associated with the Groundwater dataset were identified as likely GDEs). Likely GDEs were concentrated in the northwestern portion of the Subbasin between the Sacramento River and Southern Pacific Railroad. Groundwater levels at likely GDEs were found to exhibit high seasonal variability. For instance, only 38 of these likely GDEs (8 percent) maintained groundwater connectivity during typical fall conditions. Under drought conditions representative of 2015 and 2021, 78 to 86 percent of those GDEs identified as likely GDEs experienced DTG exceeding their rooting depths, indicating widespread vulnerability to groundwater level declines during dry periods.

Review of Normalized Derived Vegetation Index (NDVI) values, a widely used and reliable vegetation metric used to assess ecosystem health, at all potential GDEs identified as likely GDEs and not likely GDEs based on spring 90th percentile conditions for the period of record from 1985 through 2024 found median NDVI at likely GDEs was greater than median NDVI at not likely GDEs for all years in the record, suggesting groundwater related factors play a role in higher NDVI values at likely GDEs. During 2021 and 2022 NDVI values at all potential GDEs generally decreased, however values rebounded in 2023 and 2024 to pre-drought levels. While NDVI remains a promising tool for monitoring and assessing GDE ecological health in the Subbasin, uncertainties and data gaps remain regarding the relationship between shallow groundwater levels and GDE NDVI and how other biotic/abiotic factors and processes influence changes in NDVI.

Management implications: Based on likely GDEs being those whose associated rooting depths were hydrologically connected with groundwater levels during typical spring conditions (i.e., 90th percentile DTG levels), the region where the majority of likely GDEs were found to become disconnected between spring 90th percentile and spring 2015 conditions is recommended as a priority area for establishing

potential monitoring sites. Likely GDEs in this region occupy the margin of groundwater accessibility and can provide an early warning of changes in regional groundwater levels that may be affecting GDEs. More generally, establishing fixed monitoring locations to assess ecological baseline conditions at representative GDEs and subsequent periodic monitoring of ecological conditions at the same monitoring locations can provide insight into how environmental conditions and groundwater management may be influencing GDE function, integrity, and ecological health through time. An approach for long-term GDE monitoring completed for the adjacent Wyandotte Creek Subbasin is described in ESA (2026) and could be applied to the Vina Subbasin.

While it is recommended that monitoring should focus on the transition zone near the Southern Pacific Railroad, where the boundary between likely and not likely GDEs is most pronounced. Additional monitoring sites that include representative GDEs from the northwestern portion of the Subbasin that maintain connectivity during typical conditions are recommended to establish baseline reference conditions for comparison.

Background

The original Vina Subbasin Groundwater Sustainability Plan (Vina GSP) submitted to the California Department of Water Resources (DWR) in 2022 creates the framework for sustainable management of groundwater in the Vina Subbasin (Subbasin) under the Sustainable Groundwater Management Act (SGMA). The Vina Groundwater Sustainability Agency (GSA) was established through a Joint Powers Agreement (JPA) between the County of Butte, the City of Chico, and the Durham Irrigation District (DID). The 2022 Vina GSP includes a detailed characterization of groundwater conditions in the Subbasin, establishment of a sustainability goal and sustainable yield, and description of projects and management actions the GSA will implement to maintain sustainable groundwater management through 2042 and beyond.

Pursuant to Recommended Corrective Actions (RCAs) provided in DWR's Determination Letter on the 2022 Vina GSP,[1] the GSA is required to submit an amended GSP to DWR by January 28, 2027. The amended Vina GSP and associated Periodic Evaluation are currently underway and will address DWR's RCAs and include updated Sustainability Management Criteria (SMCs) and monitoring networks for nearly all SGMA sustainability indicators. Findings and recommendations from this analysis will be incorporated into the amended GSP and Periodic Evaluation as determined by the GSA board.

Under SGMA, Groundwater Sustainability Agencies are required to identify and consider the interests and impacts to beneficial uses and users of groundwater, including environmental users of groundwater such as groundwater dependent ecosystems (GDEs). GDEs are defined by the State of California as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR § 351(m)). These diverse habitats often host rare species like giant garter snakes and anadromous salmonids, many of which are protected under endangered species acts. Examples of GDEs include riparian forests, rivers, and oak woodlands. GDEs can generally be differentiated into vegetative GDEs and instream GDEs depending on whether they rely on shallow groundwater for root uptake or on groundwater discharging into surface water bodies. Vegetative GDEs typically consist of plant communities with root systems that tap directly into shallow groundwater, often termed phreatophytes. Instream GDEs are ecosystems within or immediately adjacent to water bodies that depend on the discharge of groundwater. These ecosystems are often essential for aquatic species, including fish and invertebrates that rely on consistent surface water flows. GDEs are also often closely tied to interconnected surface water (ISW), as groundwater pumping that reduces streamflows can harm the species that comprise or use GDEs.

Previous GDE Identification and Data Gaps

As summarized in DWR's *Statement of Findings Regarding the Approval of the Sacramento Valley Basin – Vina Subbasin Groundwater Sustainability Plan*[2], the Vina GSP utilized the Natural Communities Commonly Associated with the Groundwater (NCCAG) dataset to identify GDEs. Per the Vina GSP, the NCCAG dataset defines two habitat classes: wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and vegetation types commonly

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[1] https://www.vinagsa.org/files/1d5d486d9/Vina_GSP2023_Determination.pdf
[2] https://www.vinagsa.org/files/1d5d486d9/Vina_GSP2023_Determination.pdf

associated with the sub-surface presence of groundwater (phreatophytes). The Vina GSP provides figures showing the locations of all potential GDEs identified by the NCCAG database within the Vina Subbasin[3]. The Vina GSP states that GDE's dependence on groundwater was analyzed based on: land use changes; proximity to perennial surface water supplies; areas accessing supplemental water supplies; adjacency to irrigated agriculture; dependency on agricultural-dependent surface water; and non-survival of vegetation during drought years. Additionally, the potential GDE dataset was further reviewed against land use classifications to identify unlikely GDEs based on adjacency to agricultural operations[4]. Based on this analysis, the Vina GSP classified the potential GDEs as "Not likely a GDE" or "Likely a GDE" showing their locations on maps[5]. Additionally, the maps also show the location of Valley Oak Dominated Areas which are classified as "Likely a GDE" because, per the Vina GSP, this species can access groundwater over a wide range of depths[6].

DWR indicated that the Vina GSP "adequately describes the historical and current groundwater conditions related to chronic lowering of groundwater level." However, DWR found that "more information is required to fully understand groundwater conditions related to… depletions of interconnected surface water.[7]"

Data Gaps

Both the Vina GSP and the DWR Statement of Findings identified significant data gaps regarding shallow groundwater conditions and surface water depletion as it pertains to GDEs, including:

- Highly variable aquifer characteristics and uncertain vertical hydrologic connectivity between geologic units;
- Lack of available shallow groundwater data to fully characterize ISW and GDE conditions and set specific ISW SMCs;
- Uncertainty regarding the distribution and groundwater dependency of identified GDEs;
- Insufficient data to analyze interaction between surface water and groundwater pumping within the primary aquifer system;
- and lack of suitable tools to estimate the location, quantity, and timing of stream depletion due to basin-wide pumping.

Subsequent to DWR's 2023 Determination Letter the Vina GSP has completed the *Data Gap Identification and Data Improvement Project*[8], which enhances understanding of the hydrogeology and groundwater users in the Subbasin, and will support updates to the GSP and the successful management

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3 Vina Subbasin GSP, Figure 2-28, p. 146, Figure 2-29, p. 147.
4 Vina Subbasin GSP, Section 2.2.7.4, p. 150.
5 Vina Subbasin GSP, Appendix 2-A, pp. 283-284.
6 Vina Subbasin GSP, Section 2.2.7.4, p. 150, Appendix 2-A, pp. 283-284.
7 Page 17 of DWR's determination.
8 https://www.vinagsa.org/data-gap-identification-and-data-improvement-project

of the Subbasin. As part of that effort fourteen (14) additional shallow wells not included in the original Vina GSP monitoring network were identified that could fill spatial gaps in the monitoring network. These wells are located within the City of Chico as part of the City's nitrate monitoring program, on CSU Chico's campus, Neal Road landfill, and at other Department of Toxic Substances Control (DTSC) groundwater contamination monitoring sites (e.g., Chico Central Plume, municipal airport, etc.).

Desktop Analysis Objectives and Scope

This analysis was conducted to document the baseline condition of the Subbasin's GDEs, document GDE susceptibility to changing groundwater conditions, and address certain GDE data gaps identified in the 2022 Vina GSP. The analysis accomplished these objectives through:

- Characterization of shallow aquifer zone groundwater conditions (baseline hydrologic conditions) to refine the location and extent of GDEs within the Subbasin. This characterization can be used to improve understanding of potential impacts to GDEs associated with potential changes in groundwater levels.

- Characterization of ecological conditions of GDEs, where ecological condition refers to metrics related to vegetation growth, water stress, and general ecological vigor that provide a representative qualification of how a GDE is functioning with respect to providing habitat and hydrologic connectivity.

The overall approach for refining the existing mapping of potential GDEs was to compare seasonally estimated depth to groundwater (DTG) observations at potential GDEs with best available information on vegetation rooting depths to determine whether groundwater is accessible to the dominant plant communities present at potential GDEs under different hydrologic conditions. This "rooting depth threshold" method provides a consistent way to evaluate which mapped potential GDE features are supported by groundwater. The goal of this analysis was to create accurate GDE maps for SGMA compliance and aid selection of representative GDEs as part of potential future long-term GDE monitoring.

The overall approach for characterizing GDE ecological conditions was to assess regional trends in Normalized Derived Vegetation Index (NDVI) at all potential GDEs. NDVI is a widely used and reliable vegetation metric used to assess vegetation growth and water stress that is easily calculable and readily extractable from many long term satellite monitoring programs and is useful for inferring ecosystem health.

The step-wise process and data inputs used to conduct these analyses are described below. Notably, these analyses do not address data gaps or uncertainties related to surface water depletions that are being addressed under separate efforts that will be incorporated into the amended GSP and associated Periodic Evaluation currently underway.

Study Area

The Study Area for this analysis was the Vina Subbasin as described in the 2022 Vina GSP. The Vina Subbasin lies in the eastern central portion of the larger Sacramento Valley Groundwater Basin. It is bounded on the west by the Sacramento River and Butte Subbasin; on the south by the south by the Butte and Wyandotte Creek Subbasins; on the north by the Butte-Tehama county line; and east by the edge of the alluvial basin as defined by DWR Bulletin 118 - Update 2003 (DWR, 2003). It is surrounded by the Butte and Corning Subbasins to the west, the Los Molinos Subbasin to the north, the Butte and Wyandotte Creek Subbasins to the south, and the Sierra Nevada foothills to the east.

GDE Mapping Refinement Methods

Groundwater Connectivity of Mapped Potential GDEs

The NCCAG dataset remains the best available data for mapping potential GDEs in the basin and thus was used "as-is" as the starting point for the analysis. The NCCAG dataset undoubtably includes localized commission (e.g., inclusion of potential GDEs that are not GDEs) and omission (e.g., exclusion of potential GDEs) errors at spatial scales below the mapping accuracy of the individual datasets used to generate the NCCAG dataset (e.g., <1 acre). While an accurate mapping of potential GDEs is important and required under SGMA, it is also unrealistic to produce a "perfect" map that accounts for each vegetative community or patch of vegetation and aquatic habitat that may rely on groundwater. What is deemed more important for this analysis is a mapping that accurately captures the spatial distribution and relative ecological diversity of potential GDEs across the landscape. For instance, are potential GDEs generally mapped where they would be expected at appropriate densities and spatial configurations, and do they represent the mosaic of ecological communities that would be expected to be present. The NCCAG dataset, especially when coupled with other locally available data, does an excellent job in this regard. Therefore, the NCCAG mapping enables analysis of GDE hydraulic connectivity with regional groundwater conditions and provides an appropriate dataset for understanding the spatial distribution of GDEs and managing groundwater resources to avoid significant and unreasonable impacts to these beneficial uses/users.

The first preparatory step of the GDE mapping refinement was to assign vegetation rooting depths based on mapped vegetation in the NCCAG dataset. Rooting depths were taken from updated values developed in a 2024 statewide study of vegetation health in groundwater dependent ecosystems (Rohde et al., 2024). Following the methodology of Rhode et al. (2024) we assigned refined rooting depths based on the dominant plant species for each NCCAG polygon defined by the "Vegetation" field of that dataset (**Table 1**). We adopted these rooting depths because they better capture seasonal variation in groundwater levels and other conditions that influence plant growth across California. Compared to values from the Nature Conservancy's original Plant Rooting Depth Database[9], these revised rooting depths are generally deeper and provide a more realistic representation of rooting potential. Several species were not included in the Rhode et al. (2024) analysis (e.g., Alder). Rooting depths for these species were derived from either the TNC Rooting Depth Database or were based on vegetation proxies and professional judgment.

9 https://www.groundwaterresourcehub.org/where-we-work/california/plant-rooting-depth-database/

TABLE 1. ADJUSTED ROOTING DEPTH FOR DOMINANT VEGETATION FOR POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS.

Genus	Common Name	Adjusted Rooting Depth (ft.)	Source
Acer	Box Elder	16.0	Rhode et al., (2024)[a]
Ailanthus	Tree of Heaven	5.0	Estimate[b]
Alnus	Alder	6.5	TNC rooting depth database[c]
Arundo	Arundo	9.1	Rhode et al., (2024)[a]
Baccharis	Coyote Bush	11.1	Rhode et al., (2024)[a]
Flooded Veg	Flooded Vegetation	7.1	Estimate[b]
Heterotheca	Aster sp.	1.0	Estimate[b]
Juglans	Walnut	13.2	Rhode et al., (2024)[a]
Leymus	Basin Wildrye	2.96	Estimate[b]
Persicaria	Knotweed	1.0	Estimate[b]
Platanus	Sycamore	16.3	Rhode et al., (2024)[a]
Populus	Cottonwood	11.9	Rhode et al., (2024)[a]
Quercus	Oak	18.2	Rhode et al., (2024)[a]
Rosa	Rose	6.54	Rhode et al., (2024)[a]
Rubus	Blackberry	9.9	TNC rooting depth database[c]
Sambucus	Elderberry	3.0	Estimate[b]
Salix	Willow	7.2	Rhode et al., (2024)[a]
Schoenoplectus	Tule	2.2	TNC rooting depth database[c]
Typha	Cattail	3.6	TNC rooting depth database[c]
Vitus	Grape	1.0	Estimate[b]
River	River	20.0	Estimate[b]

Notes:

a. https://doi.org/10.3389/fenvs.2019.00175
b. Estimates are based on professional judgment due to a lack of data and are subject to revision as better information becomes available
c. https://www.groundwaterresourcehub.org/where-we-work/california/plant-rooting-depth-database/

Those potential GDEs that were classified as "riverine" and "palustrine" in the "Wetland" field of the NCCAG dataset (Klausmeyer et al., 2018) were a special case because it was unclear if and how they were addressed in the Rhode et al. (2024) study. Based on the Cowardin classification in the "Wetland" field of the NCCAG data set and the corresponding "CalVegType" vegetation type from the VegCAMP data set, dominant species for each palustrine class were developed (**Table 2**). Cowardin riverine classes were assigned a composite "River" class. Adjusted rooting depths from Rhode et al. (2024) were then assigned to the former palustrine classes. A threshold DTG of 20 feet was assigned to the riverine class with the assumption that river and streambeds within 20 feet of the 90th percentile water table (e.g., 90 percent of DTG values were at least this deep or deeper over the period of record) are connected to the regional groundwater system (TNC, 2021).

TABLE 2. ROOTING DEPTHS FOR PALUSTRINE AND RIVERINE POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS.

Cowardin Class	Common Name	Adjusted Rooting Depth (ft.)
Palustrine, Aquatic Bed, Permanently Flooded	River	20.0
Palustrine, Aquatic Bed, Rooted Vascular, Permanently Flooded	River	20.0
Palustrine, Aquatic Bed, Semipermanently Flooded	Blackberry	9.9
Palustrine, Emergent, Persistent, Seasonally Flooded	Blackberry	9.9
Palustrine, Emergent, Persistent, Semipermanently Flooded	Blackberry	9.9
Palustrine, Forested, Broad-Leaved- Evergreen, Seasonally Flooded	Sycamore	16.3
Palustrine, Forested, Emergent, Persistent, Seasonally Flooded	Sycamore	16.3
Palustrine, Forested, Scrub-Shrub, Seasonally Flooded	Sycamore	16.3
Palustrine, Forested, Seasonally Flooded	Sycamore	16.3
Palustrine, Scrub-Shrub, Broad-Leaved- Evergreen, Seasonally Flooded	Box Elder	16.0
Palustrine, Scrub-Shrub, Broad-Leaved- Evergreen, Seasonally Flooded, Alkaline	Box Elder	16.0
Palustrine, Scrub-Shrub, Broad-Leaved- Evergreen, Semipermanently Flooded	Box Elder	16.0
Palustrine, Scrub-Shrub, Emergent, Persistent, Seasonally Flooded	Box Elder	16.0
Palustrine, Scrub-Shrub, Seasonally Flooded	Box Elder	16.0
Palustrine, Unconsolidated Bottom, Permanently Flooded	Cattail	3.6
Palustrine, Unconsolidated Bottom, Semipermanently Flooded	Cattail	3.6
Riverine, Lower Perennial, Aquatic Bed, Floating Vascualar, Permanently Flooded	River	20.0
Riverine, Lower Perennial, Aquatic Bed, Rooted Vascular, Permanently Flooded	River	20.0
Riverine, Lower Perennial, Aquatic Bed, Semipermanently Flooded	River	20.0
Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded	River	20.0
Riverine, Lower Perennial, Unconsolidated Bottom, Semipermanently Flooded	River	20.0
Riverine, Lower Perennial, Unconsolidated Shore, Seasonally Flooded	River	20.0
Riverine, Unknown Perennial, Unconsolidated Bottom, Semipermanently Flooded	River	20.0
Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded	River	20.0
Riverine, Upper Perennial, Unconsolidated Shore, Seasonally Flooded	River	20.0
Seep or Spring	Cattail	3.6

After preparing the potential GDE dataset with rooting depths, we overlaid the geographic centroid of each polygon on DTG rasters to extract a representative DTG value for each polygon under different hydrologic conditions. The DTG datasets used in this analysis were developed in partnership with Larry Walker and Associates (LWA) who initially developed a series of seasonal (i.e., spring and fall) shallow groundwater elevation rasters at 230 ft x 230 ft resolution using shallow monitoring well data from 2000-2025. Wells used to generate these data include wells from the Vina GSP groundwater level monitoring network identified as shallow wells (i.e., those screened in the upper and lower Quaternary deposits) and additional shallow wells identified by the *Data Gap Identification and Data Improvement Project*. The result from LWA was a total of 50 shallow groundwater elevation rasters, one for spring and one for fall for each year between 2000 and 2025. The shallow groundwater elevation rasters were converted to DTG rasters through computing the difference between the bare earth ground surface and groundwater levels (earth surface elevation – groundwater elevation = DTG). Bare-earth elevation data were obtained as a ~1.6 ft resolution raster derived from 2018 Lidar collected for the 2018–2019 USGS QL2 Lidar: Northern California Wildfires project.[10] Regionally this produced DTG estimates across 25 years and a total of 50 spatially explicit DTG datasets covering the basin.

For each potential GDE, we evaluated six representative DTG conditions: (1) the spring and fall 90th percentile DTG value, representing DTG conditions that occurred 90 percent of the time, (2) spring and fall 2015, the second lowest water year since 2000, and (3) and spring and fall 2021, the lowest water year since 2000. The 90th percentile DTG values represent the upper threshold of regularly occurring groundwater conditions that would be encountered most of the time.

For each condition, each polygon was classified based on whether DTG remained within the revised rooting depths. Years 2015 and 2021 were both classified as critically dry by DWR[11] and represent low and very low water table elevations, respectively. These conditions provide a basis for documenting GDE conditions under drought conditions and potentially inform how groundwater management and associated SMCs (e.g., MO and MT) may affect the interests of beneficial uses and users of groundwater.

Polygons where DTG stayed within rooting depths for the spring 90th percentile were identified as likely GDEs, and polygons where DTG exceeded rooting depths were classified as not likely GDEs. For 2015 and 2021, those GDEs where DTG either remained within or exceeded the rooting depth were identified for comparative purposes (e.g., GDEs identified as likely GDEs may have become temporarily hydrologically disconnected under these conditions).

GDE-Surficial Geology Intersection

Surficial geology and the potential for soils that create localized perched soil water systems that are partly or fully disconnected from the deeper aquifer were spatially represented using the ‘restrictive depth layer’ attribute from the National Resource Conservation Survey (NRCS) Soil Survey Geographic Database (SSURGO).[12] The soils data was supplemented with 2018 mapping of vernal pool habitat by Witham (2021). Vernal pools are temporary wetlands that hold water for several months, due to impermeable hardpan or clay layers, and thus provide a secondary dataset for resistive soils/geologic formations. These data were overlain with potential GDEs to identify ecological communities that are likely supported by shallow perched water.

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10 https://apps.nationalmap.gov/lidar-explorer/#/

11 https://data.ca.gov/dataset/cdec-water-year-type-dataset

12 Depth to nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. If no restrictive layer is described in a map unit, it is assumed no restrictions are present within 150 in (12.5 ft) of the ground surface.

Regional Potential GDE Health Methods

The ecological health[13] of GDEs are affected by several factors including climate, pests, land management, water quality, and access to groundwater (Brown et al., 2011; Groeneveld, 2008; Patten et al., 2008; Cooper et al., 2006; Elmore et al., 2006; Huntington et al., 2016). GDE health is commonly assessed through measurement of a variety of vegetation metrics, including growth, species diversity, reproduction, interactions between species, and survivorship (Rohde et al., 2019). These vegetation metrics essentially serve as an indicator of vegetation health for GDEs. Both ground-based and remotely sensed techniques are available for obtaining vegetation metrics. Remote sensing has the benefit of being more cost effective to apply at scale compared to ground-based measurements, can provide long term temporal trends of vegetation metrics, and many studies have demonstrated the utility of satellite remote sensing to monitoring metrics of vegetation health (Vogelmann et al., 2012; Huang et al., 2010; Asner et al., 2016; Healey et al., 2018). Normalized Derived Vegetation Index (NDVI), a derived product from remotely sensed satellite data, is the most widely used vegetation metric in the literature and is a reliable measure of the photosynthetic chlorophyll content in leaves and vegetation cover, which are proxies for vegetation growth and water stress and are variables for inferring ecosystem health (Rouse et al., 1974; Jiang et al., 2006). NDVI values range from +1.0 to -1.0. Areas of barren rock, sand, or snow usually show very low NDVI values (for example, 0.1 or less). Sparse vegetation such as shrubs and grasslands or senescing crops may result in moderate NDVI values (approximately 0.2 to 0.5). High NDVI values (approximately 0.6 to 0.9) correspond to dense vegetation such as that found in temperate and tropical forests or crops at their peak growth stage. NDVI is easily calculable and readily extractable from many long term satellite monitoring programs including the Landsat mission.

For this analysis, NDVI data available from the TNC GDE Pulse tool[14] were used to assess regional trends in NDVI at all potential GDEs for the available period of record from 1985 through 2024. Specifically, the TNC GDE Pulse tool provides average NDVI for all the Landsat pixels that fall within each potential GDE polygon for each year corresponding to the annual dry-month (June 1 to September 30) medoid producing one NDVI value for each potential GDE per year. These data were then stratified based on the classifications from the GDE mapping refinement to compare NDVI values between GDEs identified as likely GDEs and not likely GDEs. Lastly, the potential GDE-NDVI data was compared to local precipitation data available from the TNC GDE Pulse tool[15] and the LWA shallow groundwater data to document the interplay and correlations between regional scale GDE vegetation metrics, precipitation, and groundwater levels.

Results

GDE Mapping Refinement

The number and pattern of GDEs identified as likely GDEs versus not likely GDEs depended on the season (i.e., spring or fall) and the DTG condition used for evaluation (i.e., 90th percentile 2015, or 2021).

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[13] Health here generally refers to metrics related to vegetation growth, water stress, and general ecological vigor.

[14] https://gde.codefornature.org/#/methodology

[15] Annual precipitation for each GDE polygon derived from Parameter-elevation Regressions on Independent Slopes Model (PRISM) data.

For the spring 90th percentile condition, of the 1,228 potential GDEs in the Subbasin 464 were found to be hydrologically connected to groundwater (i.e., DTG was at or above rooting depths) and thus identified as likely GDEs (41 percent of total potential GDEs). For the spring 2015 and spring 2021 conditions 100 and 64 potential GDEs were found to be connected to groundwater, respectively. For fall conditions the number of GDEs connected to groundwater was 38 (3 percent), 21 (2 percent), and 17 (1 percent) for the 90th percentile, 2015, and 2021 conditions, respectively.

Of the 464 GDEs that were identified as likely under spring 90th percentile conditions (i.e., connected to groundwater) 100 stayed connected to groundwater under spring 2015 conditions. Thus, between the spring 90th percentile and spring 2015 conditions, DTG transitions from being within to exceeding the rooting depth for 364 potential GDEs. This amounts to 78 percent of likely GDEs identified under the spring 90th percentile condition becoming dewatered under groundwater conditions as low as spring 2015. Of the potential GDEs identified as likely GDEs under spring 90th percentile conditions, 400 became dewatered under fall 2021 conditions. This amounts to 86 percent of likely GDEs identified under the spring 90th percentile condition becoming dewatered under the spring 2021 conditions. A similar pattern of dewatering was found for the fall conditions for each DTG condition.

Of the 464 GDEs identified as Likely GDEs during spring under the 90th percentile conditions, only 38 (8 percent of Likely GDEs based on spring conditions) remained connected to groundwater during the fall 90th percentile condition, only 21 remained connected during the fall 2015 condition, and only 17 remained connected during fall 2021 conditions. This finding indicates a notable seasonal pattern in groundwater connectivity in the Vina Subbasin for likely GDEs.

Table 3 summarizes the aerial coverage of GDEs in the Subbasin for the three conditions.

TABLE 3. SUMMARY OF REFINED GDE MAPPING

Season and Condition	GDE Area (acres)		Percent of Subbasin	
	Connected	Disconnected	Connected	Disconnected
Spring 90th percentile DTG	3,442	4,032	1.9%	2.2%
Fall 90th percentile DTG	726	6,748	0.4%	3.6%
Spring 2015 DTG	1,005	6,469	0.5%	3.5%
Fall 2015 DTG	210	7,264	0.1%	3.9%
Spring 2021 DTG	437	7,037	0.2%	3.8%
Fall 2021 DTG	192	7,282	0.1%	3.9%

Notes: Spring 90th percentile condition were used as the basis for determination of likely versus not likely GDEs. Other season and DTG conditions are shown for comparative purposes.

Spatially, under typical spring conditions, represented by the 90th-percentile DTG value, DTG remained within the rooting zone for potential GDEs in the northwestern portion of the Subbasin along the Sacramento River. This area of elevated groundwater levels is bounded by the Sacramento River to the west and extends eastward to approximately the Southern Pacific Railroad and southward to around Bidwell Sacramento River State Park. Additional likely GDEs occur in the western portion of the Subbasin along many of the surface waters that are tributary to the Sacramento including along Dircus Slough, Pine Creek, Rock Creek, Mud Creek, Big Chico Creek, Little Chico Creek, Angel Slough, and Butte Creek. East of the railroad, and across much of the southern portion of the Subbasin, DTG is typically deeper than the rooting depth of potential GDEs (**Figures 1 and 2**). The region of elevated groundwater and likely GDEs is spatially consistent with the combined extent of the Sacramento River's 100-yr meanderbelt, historic meanderbelt, and adjacent undifferentiated stream alluvium as mapped by Helley and Harwood (1985). Fewer likely GDEs occur to the east in areas where surface geology mapped by Helley and Harwood (1985) as comprised of geologic controls of the Modesto, Red Bluff, and Riverbank formations or other basin deposits. The spatial pattern of likely GDEs is also consistent with findings from the 2022 Vina GSP indicating that:

- A continuous saturated zone (i.e., the floodplain sediments) exists within the floodplain of the Sacramento River connecting the shallowest aquifer to the river and the Sacramento River is generally a gaining river throughout most, if not all of its length throughout the Vina Subbasin.
- In the upland areas outside of the Sacramento River floodplain many of the Subbasin's creeks flow seasonally and often dry up in late summer or are dry for an entire year during dry conditions. The distance between the streambed and groundwater level of uplands streams upstream of the Sacramento River floodplain typically exceeds 20 feet and these upland streams are predominantly losing reaches that provide recharge to the aquifer.

Under fall 90th-percentile conditions the overall pattern and extent of DTG within the rooting zone of potential GDEs is similar to spring, but the area where DTG remains within the rooting zone contracts westward becoming largely constrained to areas immediately adjacent to the Sacramento River, Pine Creek and Mud Creek. Along much of the Sacramento River, DTG for potential GDEs that were within the rooting zone in spring deepens beyond the rooting zone by fall (Figures 1 and 2). Results for both spring and fall 2015 and 2021 were similar to the fall 90th-percentile condition (**Figures 3, 4, 5, and 6**).

From a plant community perspective, among potential GDEs identified as "not likely GDEs" under the spring 90th percentile condition, 77 percent were dominated by just five plant species: valley oak (25 percent), Himalayan blackberry (16 percent), willow sp. (15 percent), cottonwood (14 percent), and sycamore (6 percent). However, it is relevant to consider the relative abundance of different species in the basin when summarizing findings in this manner (i.e., vegetation of those GDEs identified as not likely GDEs). For instance, if willow *sp*. account for a large percentage of potential GDEs it might be expected that they also account for a large percentage of potential GDEs identified as not likely GDEs. Adjusting for the relative abundance of different dominant species in the basin,[16] the analysis revealed that 88 percent of potential GDEs classified as not likely GDEs were dominated by seven genera with forage ratios of 1.0 (Alder, Tule, knotweed, coyote brush, wildrye, Sambucus, and Tamarix), indicating these vegetation types appear in the not likely GDE category at rates consistent with random chance. In contrast, traditionally strong riparian and GDE-associated species, including willows, cottonwoods, valley oaks, and sycamores, all showed forage ratios below 1.0, meaning they were underrepresented among sites classified as not likely GDEs relative to their overall abundance in the Subbasin. This suggests that the screening methodology is working conservatively and that classifications of "not likely GDE" are

[16] For each dominant vegetation type, the percentage of potential GDEs with that vegetation type identified as not likely GDEs was divided by the percentage of all potential GDEs with that vegetation type. This index is referred to as a "forage ratio" whereby values greater than one indicates a higher likelihood of being classified as not likely GDEs relative to simple random chance occurrence, whereas values ≤ 1 suggest the opposite.

driven primarily by factors other than vegetation type, such as proximity to irrigation, land use changes, or access to alternative water sources.

 Agenda Item 9d

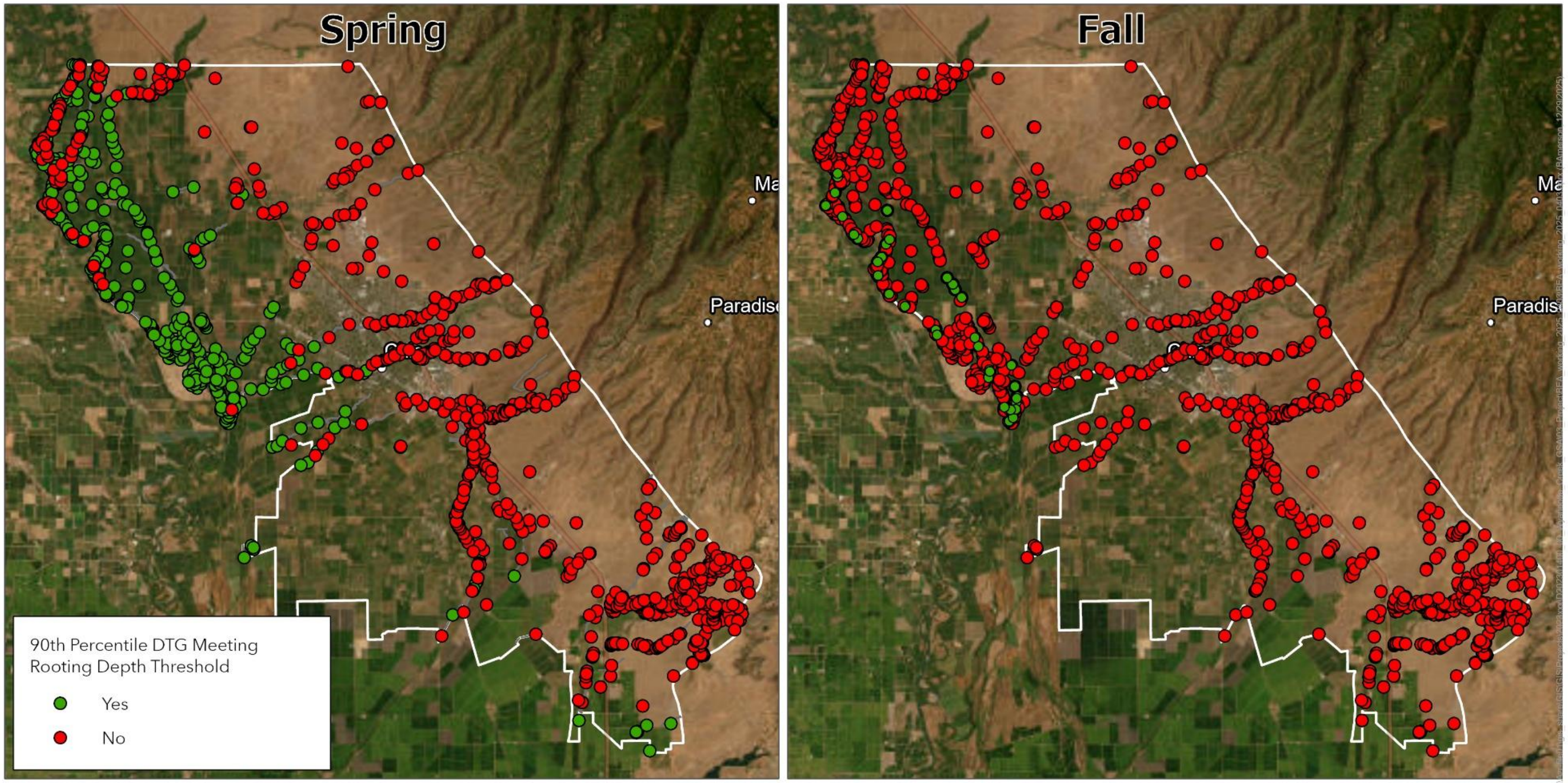

Figure 1
Potential groundwater dependent ecosystems meeting species rooting depth thresholds for typical (90th percentile) spring and fall groundwater elevations in the Vina subbasin.

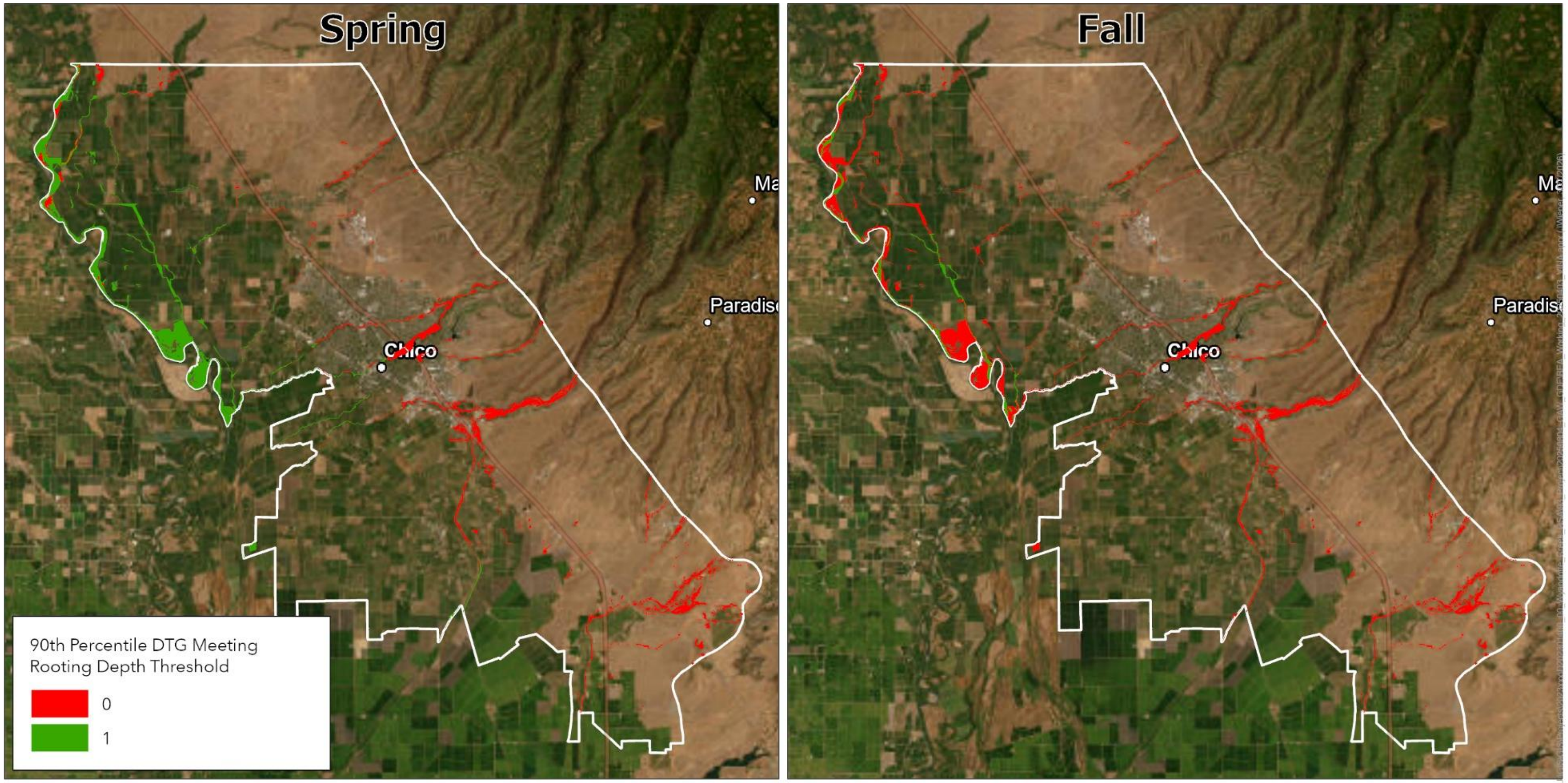

Figure 2
Polygons depicting potential groundwater dependent ecosystems meeting species rooting depth thresholds for typical (90th percentile) spring and fall groundwater elevations in the Vina subbasin.

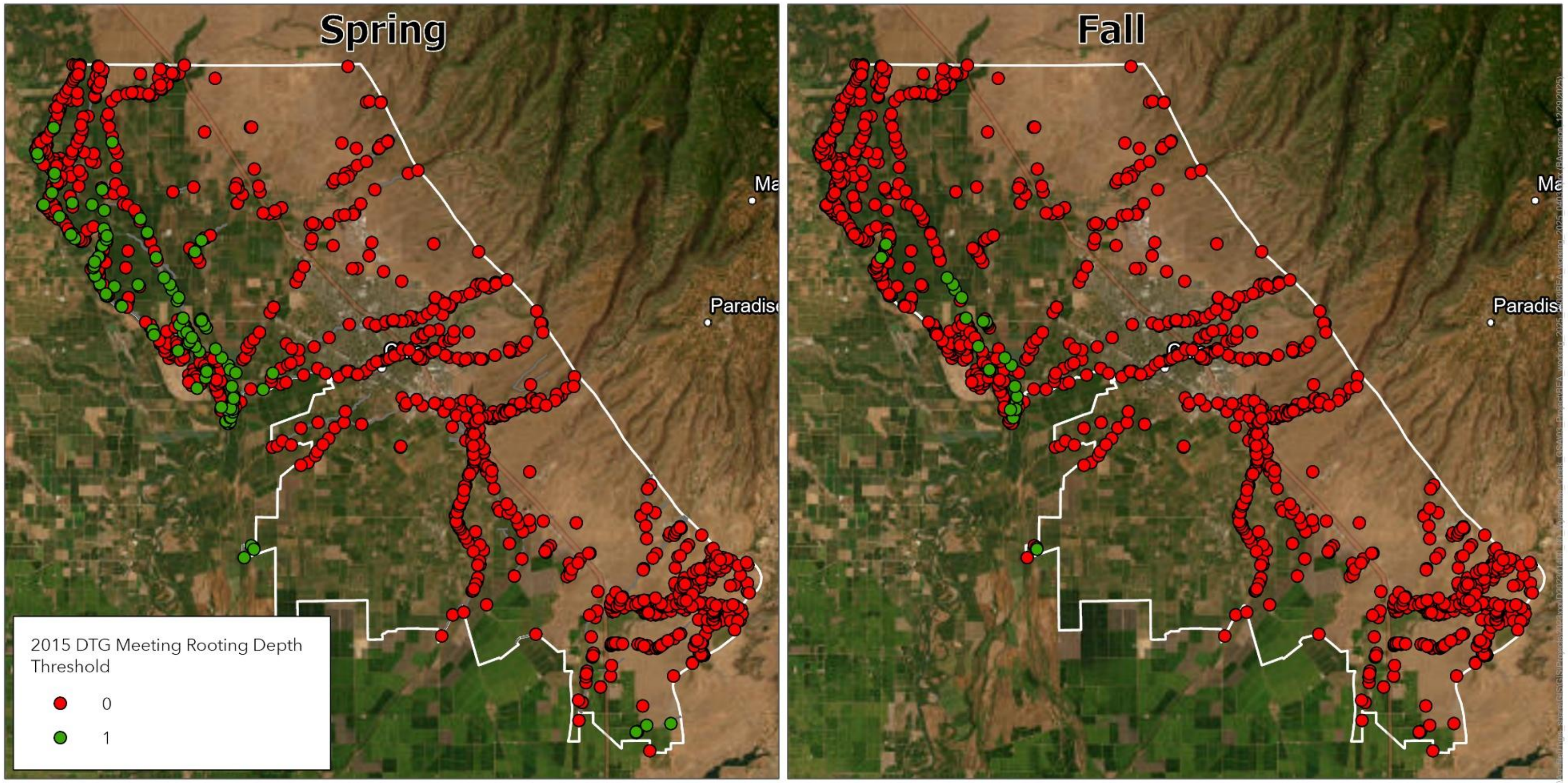

Figure 3
Potential groundwater dependent ecosystems meeting species rooting depth thresholds for spring and fall 2015 groundwater elevations in the Vina Subbasin.

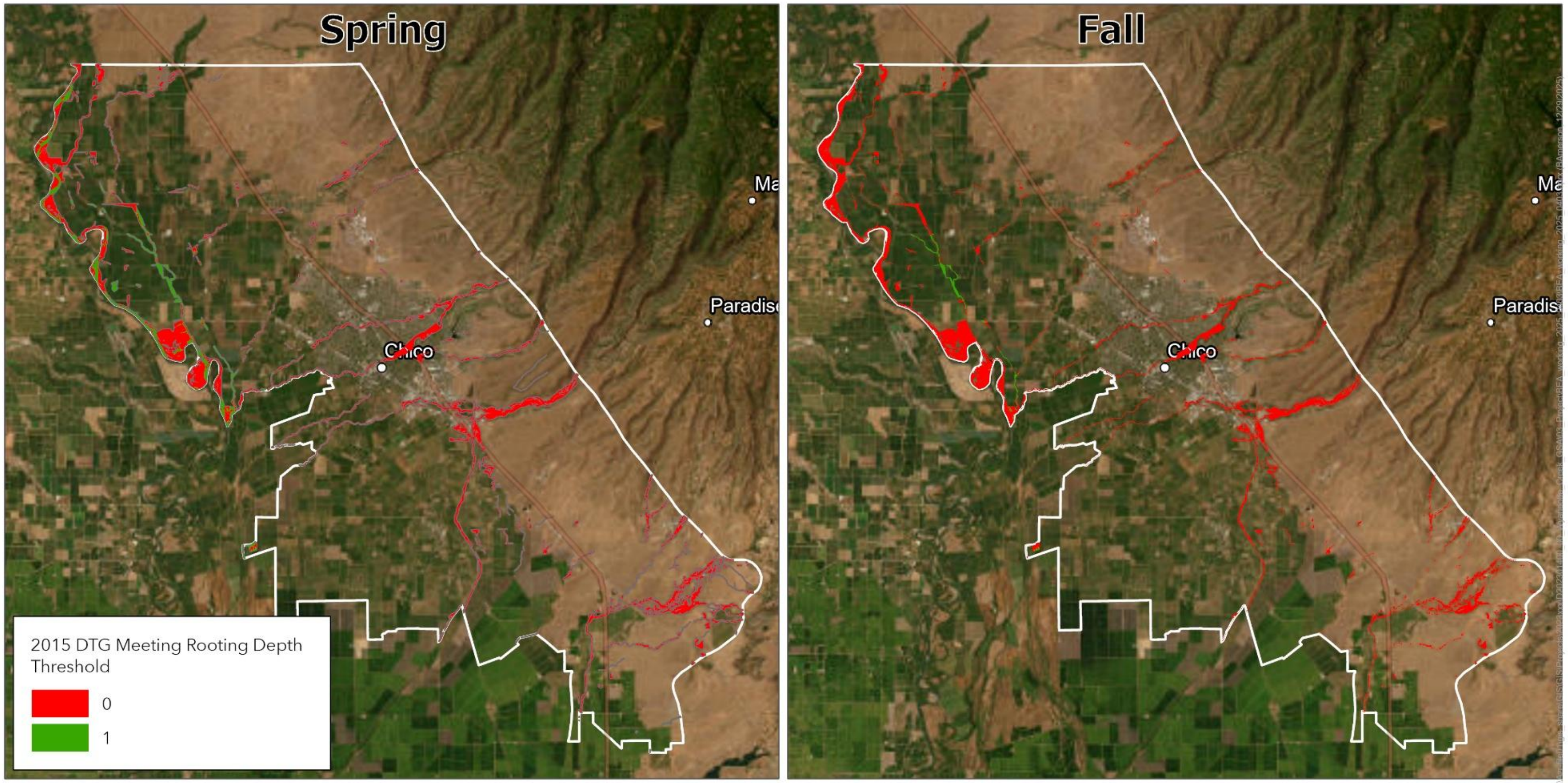

Figure 4
Polygons depicting potential groundwater dependent ecosystems meeting species rooting depth thresholds for spring and fall 2015 groundwater elevations in the Vina Subbasin.

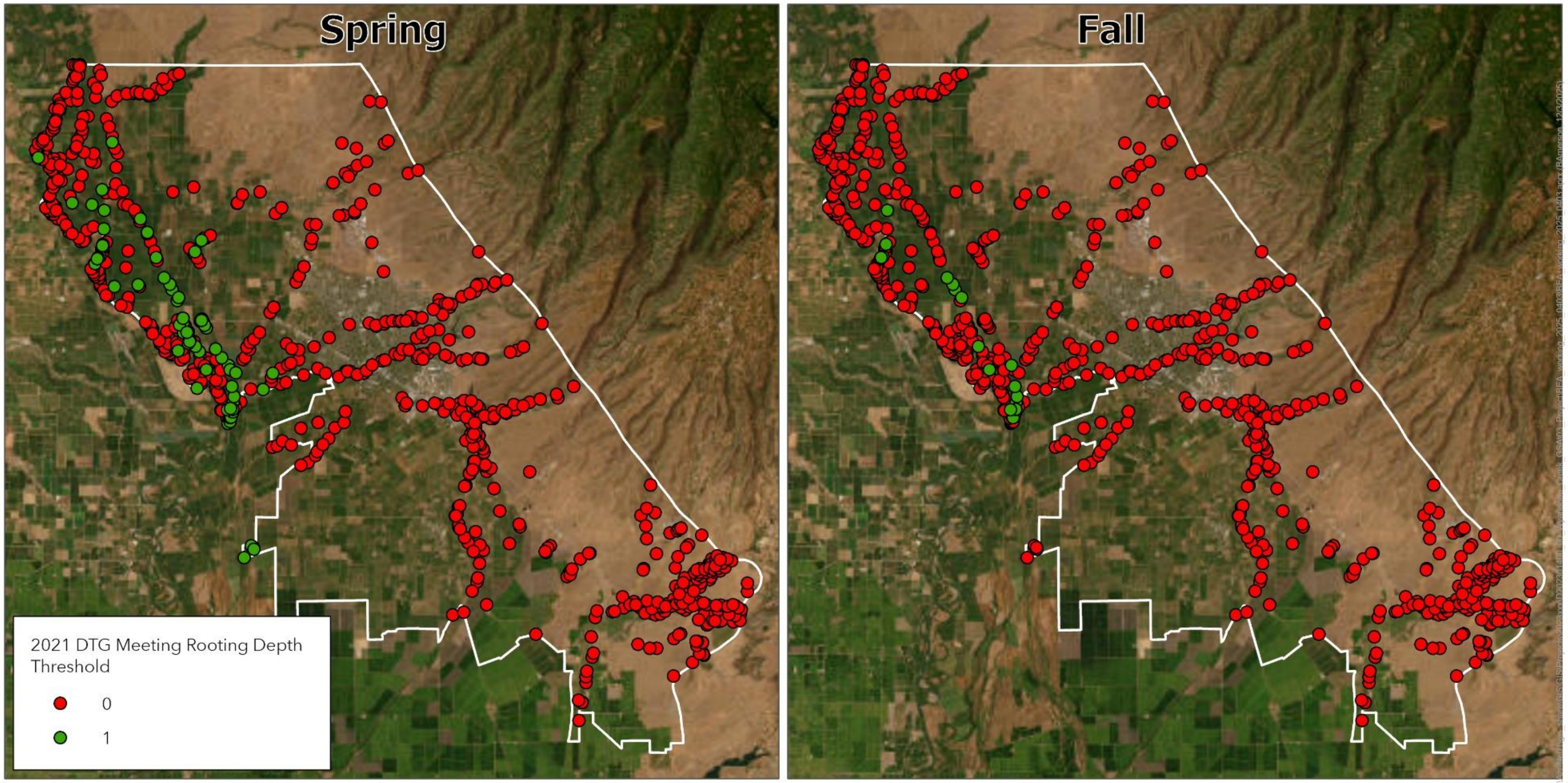

Figure 5
Potential groundwater dependent ecosystems meeting species rooting depth thresholds for spring and fall 2021 groundwater elevations in the Vina Subbasin.

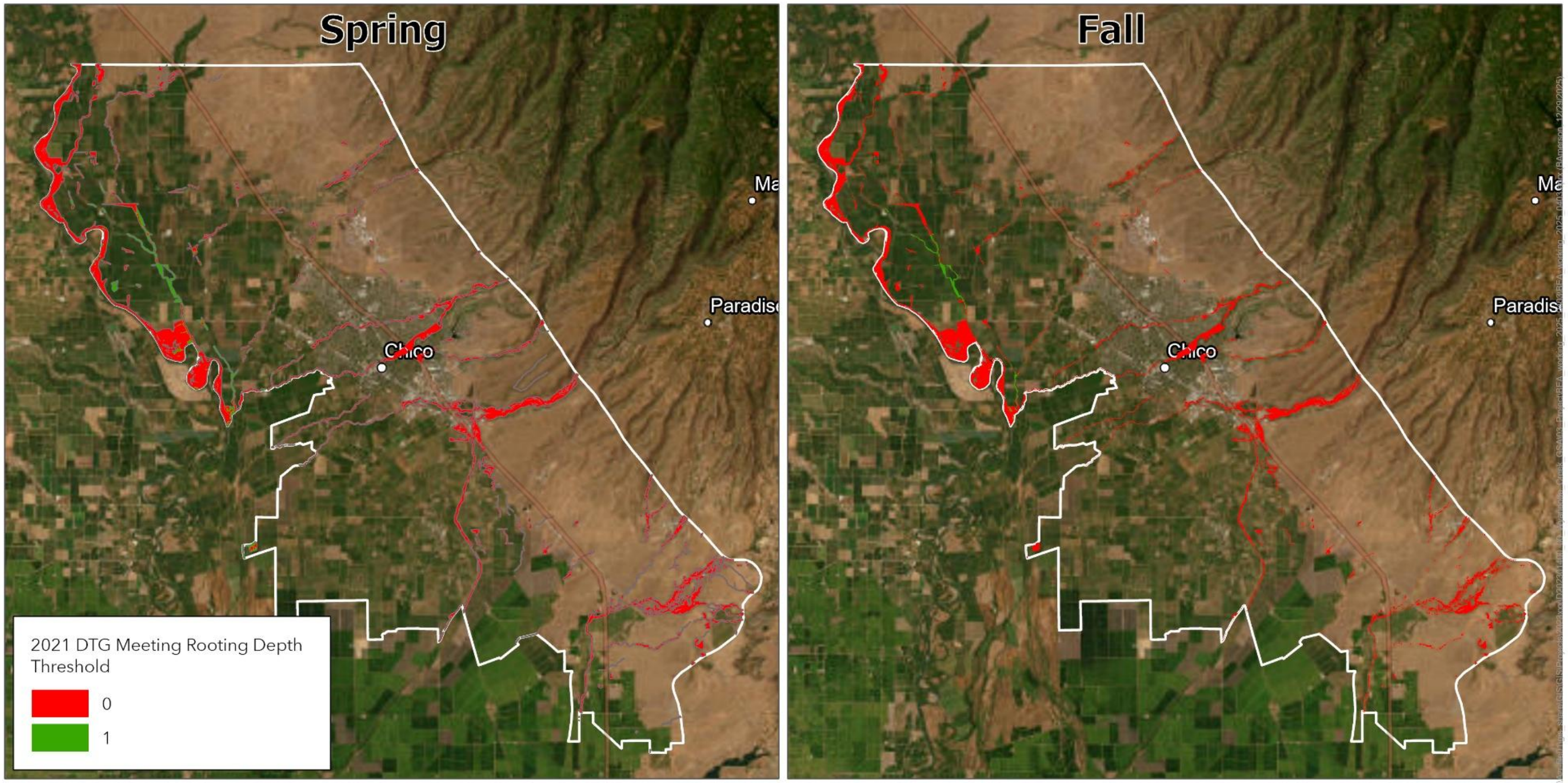

Figure 6
Polygons depicting potential groundwater dependent ecosystems meeting species rooting depth thresholds for spring and fall 2021 groundwater elevations in the Vina Subbasin.

GDEs and Surficial Geology

Depths to restrictive soil layers, mapping of areas likely to support vernal pool, and the refined GDE mapping results are depicted in **Figure 7**. Soils are generally deep (e.g., greater than 11 ft) in the western and central portions of the basin, along the Sacramento River and its floodplain, and along the basin's other creeks. Restrictive layers at depths between 3 and 7 feet are present in the southeastern and northern portion of the basin. The shallowest restrictive layers (e.g., less than 3 ft) occur along the eastern portion of basin.

Mapping of landscapes likely to support vernal pools was strongly co-located with soils having relatively shallow restrictive layers, nearly always occurring where restrictive layers were within 6 ft of the ground surface. Of the potential GDEs in the basin, 78 (6 percent) had their centroid in an area mapped with restrictive layers within 6 ft of the ground surface. Of these GDE 454 were identified by the refined mapping as not likely a GDE and 10 were identified as likely GDEs. Thus, approximately 2 percent of the 646 likely GDEs occurred in locations with relatively shallow restrictive soil layers. A total of 66 potential GDEs coincided with areas mapped as supporting vernal pools. Of these, based on the refined mapping 64 were identified as not likely GDEs and only 2 were identified as likely GDEs.

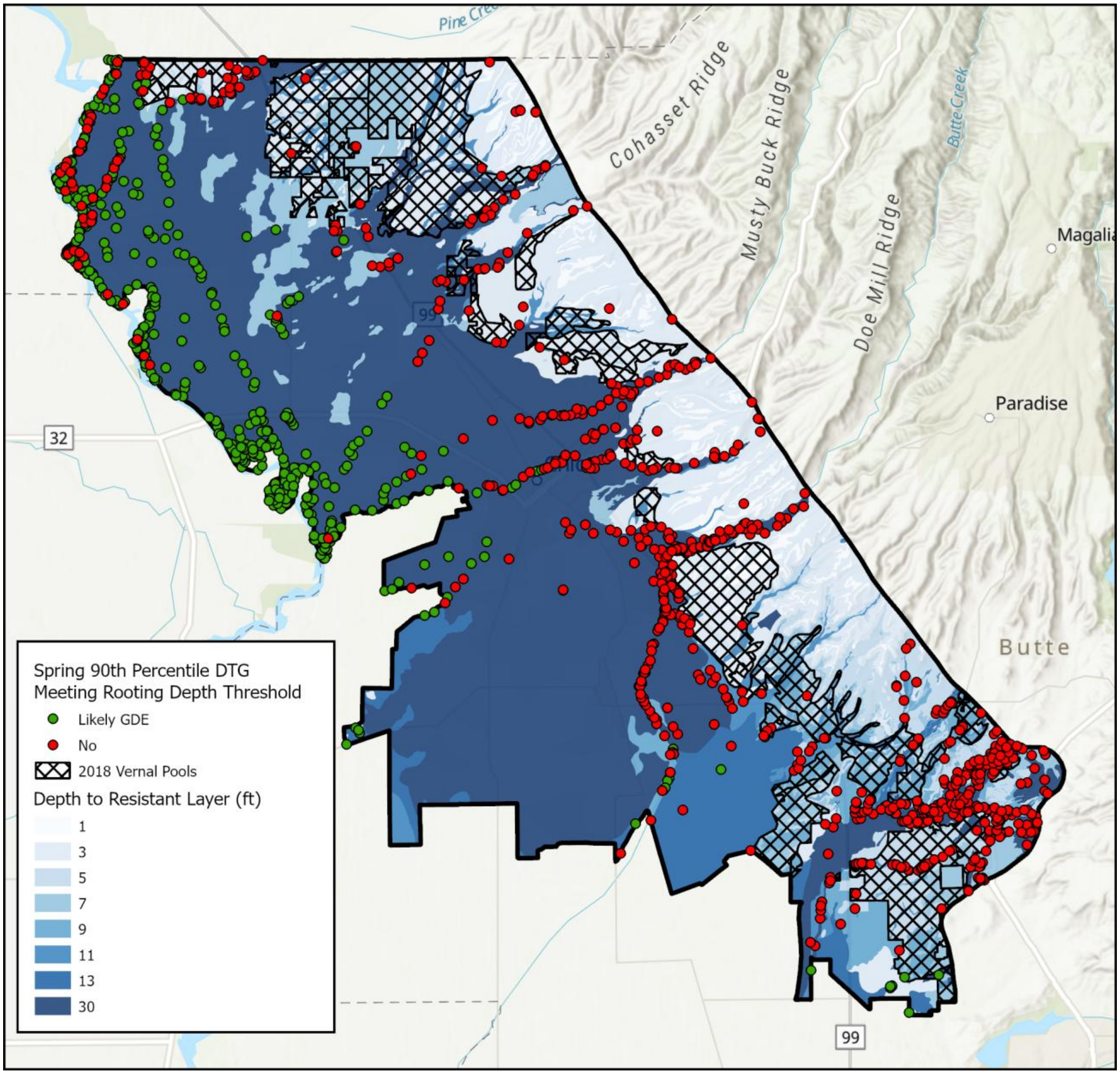

Figure 7 Depth to resistant soils layers, vernal pools, and centroids of potential groundwater dependent ecosystems meeting species rooting depth thresholds for typical (90th percentile) spring groundwater elevations in the Vina Subbasin.

Refined GDE Mapping and 2022 Vina GSP Mapping

We compared potential GDEs identified as "likely" and "not likely" in this analysis against those from the 2022 Vina GSP using the spring 90th percentile results (**Table 4**). Less than half (44 percent) were classified the same way by both methods. Only 530 of 1,228 potential GDEs showed agreement (diagonal cells in Table 4). Compared to the 2022 Vina GSP mapping, this analysis classified an additional 58 potential GDEs as likely GDEs (5 percent of all potential GDEs) but reclassified 640 potential GDEs from likely to not likely (52 percent of all potential GDEs).

The substantial difference in GDE likelihood determinations stems from methodological differences. The 2022 Vina GSP incorporated hydrologic conditions from prior years but did not use a repeatable, quantitative metric to screen potential GDEs. In contrast, as recommended by guidance from Rhode et al. (2018) this analysis used depth-to-groundwater (DTG) and rooting depth criteria as the primary determining factors. Such an approach was not able to be conducted during the 2022 Vina GSP development due to data limitations. The DTG time series method inherently captures historical groundwater hydrology through annualized DTG calculations based on observed groundwater levels and applies repeatable rooting depth thresholds derived from best available science.

TABLE 4 COMPARISON OF LIKELY AND NOT LIKELY GDES IDENTIFIED IN THIS ANALYSIS AND 2022 VINA GSP

Counts		2022 Vina GSP GDE Mapping	
		Likely	Not Likely
Refined GDE Mapping	Likely	406	58
	Not Likely	640	124

Regional Potential GDE Health Results

The NDVI values at all potential GDEs identified as likely GDEs and not likely GDEs based on spring 90th percentile conditions for the period of record from 1985 through 2024 are depicted as a time series of boxplots in **Figure 8**. NDVI values at all potential GDEs identified as connected and disconnected based on fall 90th percentile conditions for the same period are depicted in **Figure 9**. Mean annual precipitation at all potential GDEs for the same period is depicted in **Figure 10**. Several patterns emerge from these data:

- Median NDVI at likely GDEs is greater than median NDVI at not likely GDEs for all years in the record suggesting groundwater related factors play a role in higher NDVI values at likely GDEs.

- While there is year-to-year variability in the range and central tendency (e.g., median) of NDVI values for both GDEs identified as likely GDEs and not likely GDEs (e.g., 17 years where median NDVI decreases year-to-year and 22 years where year-to-year median NDVI increases for both classifications), the overall trend over the period of record is that of increasing NDVI values. Year-to-year changes in median NDVI at GDEs identified as likely GDEs and not likely GDEs are strongly correlated (i.e., correlation coefficient [r] value of 0.95) suggesting non-groundwater related factors play a strong role in regional NDVI trends at all potential GDEs.

- While NDVI values generally decreased during 2021 and 2022, values rebounded in 2023 and 2024 to pre-drought levels.

- The strength of increasing NDVI trends over the period of record is greater at GDEs identified as likely GDEs (i.e., NDVI values tend to increase more over the period of record at GDEs identified as likely GDEs compared to those identified as not likely GDEs).

- Over the period of record the majority of NDVI values at GDEs identified as likely GDEs range between 0.4 and 0.75, whereas values at GDEs identified as not likely GDEs range between 0.3 and 0.6. Both ranges are consistent with what would be considered as moderate NDVI values.[17]

- Year-to-year annual precipitation is volatile and while there is a slight positive correlation between median annual precipitation recorded across all potential GDEs and median annual NDVI across all potential GDEs ($r = 0.28$; higher precipitation results in slightly higher NDVI values),[18] the relationship is weak and generally not conclusive of the relationship between these metrics.

Beyond precipitation, the relationship between shallow groundwater levels and NDVI at potential GDEs was also explored. There was a slight negative correlation between median annual spring groundwater elevations across all potential GDEs and median annual NDVI across all potential GDEs ($r = -0.17$; deeper spring groundwater elevations result in slightly lower NDVI values),[19] however the relationship was weak and there was substantial variability between these metrics (**Figure 11**). [20] The strength of this relationship generally did not change when sub-setting potential GDEs to those identified as likely GDEs or identified as not likely GDEs as determined from the refined mapping.[21]

At the scale of individual GDEs the relationship between temporal trends in NDVI and spring groundwater elevations were also variable. For instance, across all potential GDEs, 45 percent had a negative relationship between NDVI and shallow DTG (i.e., as DTG increased [deeper groundwater levels] NDVI values decreased), 48 percent had a positive relationship (i.e., as DTG increased [deeper groundwater levels] NDVI values increased), and the remaining 7 percent had no relationship (i.e., slope equal to zero).[22] Sub-setting potential GDEs to those identified as likely GDEs and not likely GDEs had a slight effect on the breakdown of these trends, whereby likely GDEs shifted toward having more positive relationships and not likely GDEs shifted toward having more negative relationships. Spatially, there was no regional pattern in terms of potential GDE's relationships between changes in shallow groundwater elevations and GDE NDVI values (**Figure 12**). Rather, there appear to be patches of GDEs that exhibited similar relationships (e.g., positive trend vs negative trend) but these were intergraded across the Subbasin. Takeaways from these findings are summarized below and recommendations for how NDVI may be used to monitor and assess changes to GDEs are described in the *Recommendations* section.

- At the Subbasin scale the relationship between shallow groundwater elevations and GDE NDVI values is not straightforward or linear likely due to other factors that influence GDE ecological health, autoregressive or antecedent (e.g., previous conditions) factors that result in delayed

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17 https://www.usgs.gov/special-topics/remote-sensing-phenology/science/ndvi-foundation-remote-sensing-phenology

18 For each year, median precipitation and median NDVI across all potential GDEs were calculated and compared.

19 For each year, median spring groundwater elevation from LWA shallow groundwater elevation data and median NDVI across all potential GDEs were calculated and compared.

20 Note, there was a slightly negative correlations between median NDVI at GDEs and median spring groundwater elevations (e.g., shallower spring groundwater elevations result in slightly higher NDVI values).

21 The direction of the relationship (i.e., positive) and magnitude (i.e., r value) did not change when comparing median annual spring groundwater elevations across and median annual NDVI at GDEs identified just as likely and just as not likely, respectively.

22 Relationships are based on least-square linear regression slope between NDVI values and LWA shallow groundwater elevations between 2000 and 2024.

responses, resiliency (e.g., lack of response), or masked responses due to mortality, recovery, or succession.

- At the individual GDE level relationships between changes in shallow groundwater elevations and GDE NDVI values were also not straightforward, likely owing to several of the same factors as described at the regional scale.

- While rates of change in NDVI values were relatively small, typically within ±0.01 per ft of change in groundwater elevation, potential GDEs experienced a range of changes in NDVI values from 2000 to 2024 with the largest increase being 0.79 and the largest decrease being -0.35. Interpretation of changes in NDVI remains a challenge with no broadly accepted threshold for changes that indicate significant shifts in vegetation health, density, or land cover. Available studies suggest that increases in NDVI on the order of 0.1 correspond to reduced mortality and increased greenspace but depend on initial NDVI values (e.g., Martinez and Labib, 2023). Between 2000 and 2024 approximately 33% of potential GDEs (404 of 1228) experienced an increase in NDVI greater than 0.1 and approximately 5% of potential GDEs (67 of 999) experienced a decrease in NDVI greater than 0.1 (Figure 12). Sub-setting potential GDEs to those identified as likely GDEs and not likely GDEs had a slight effect on the breakdown of these trends, whereby likely GDEs shifted toward having more NDVI increases and not likely GDEs shifted toward having more NDVI decreases.

- While NDVI remains a promising tool for monitoring and assessing GDE ecological health in the Subbasin, uncertainties and data gaps remain regarding the relationship between shallow groundwater levels and GDE NDVI and how other biotic/abiotic factors and processes influence changes in NDVI.

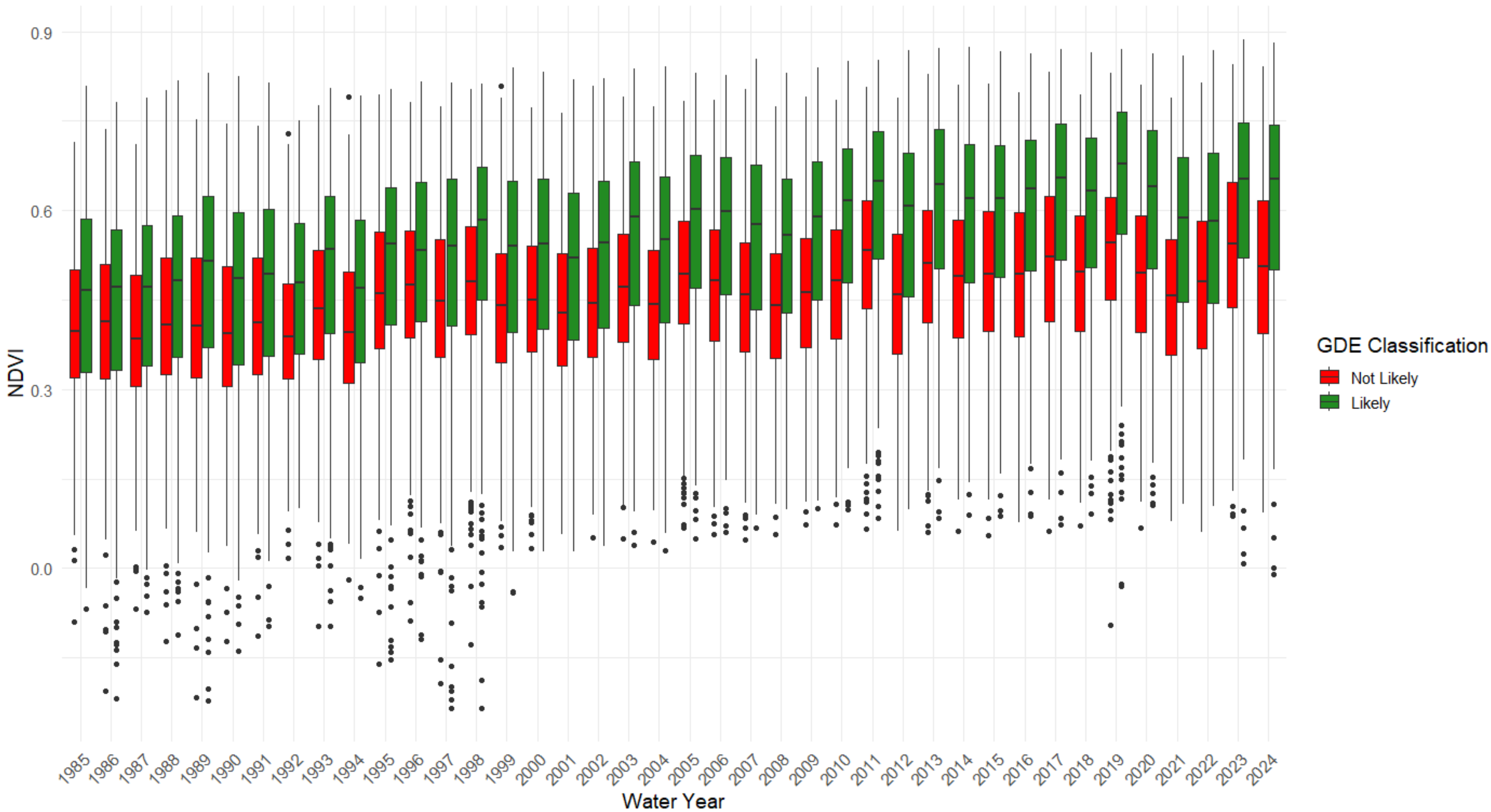


Figure 8 Box plots of NDVI at GDEs identified as likely GDEs and not likely GDEs based on spring 90th percentile conditions from 1985 to 2024.

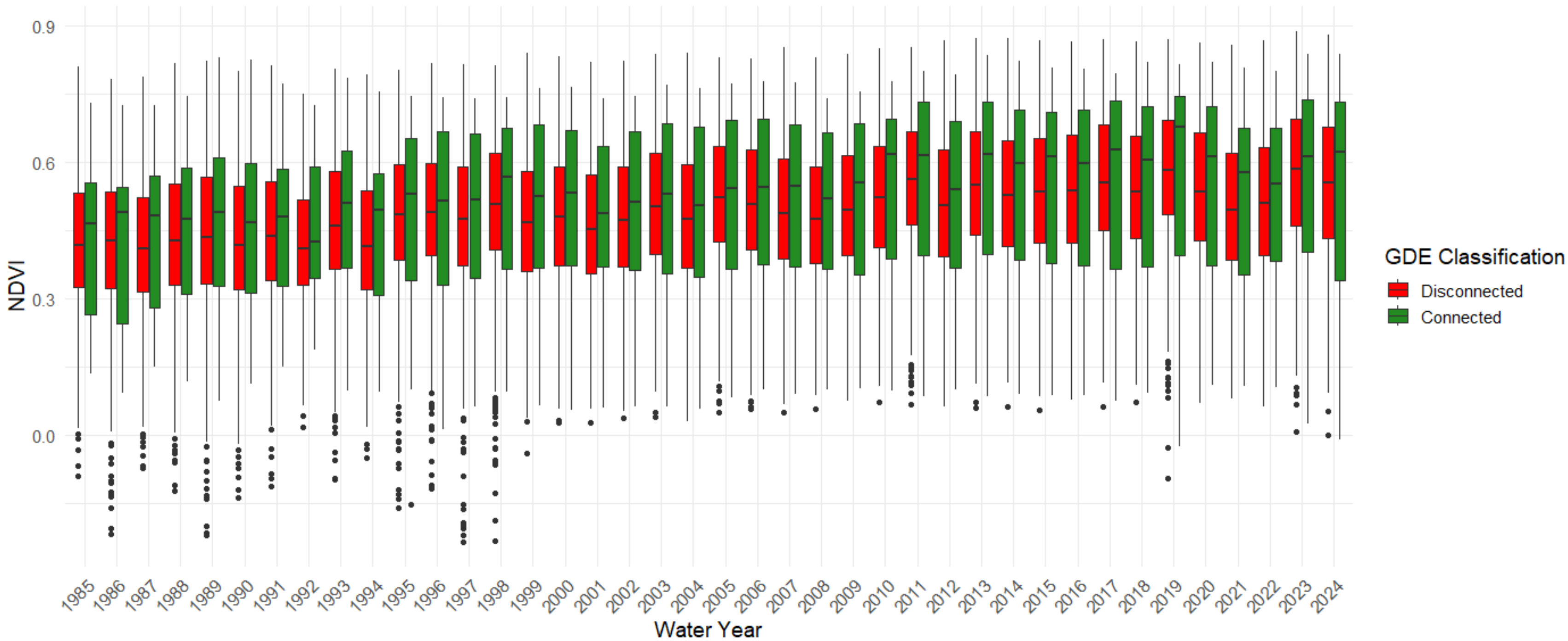


Figure 9 Box plots of NDVI at connected and disconnected GDEs based on fall 90th percentile conditions from 1985 to 2024.

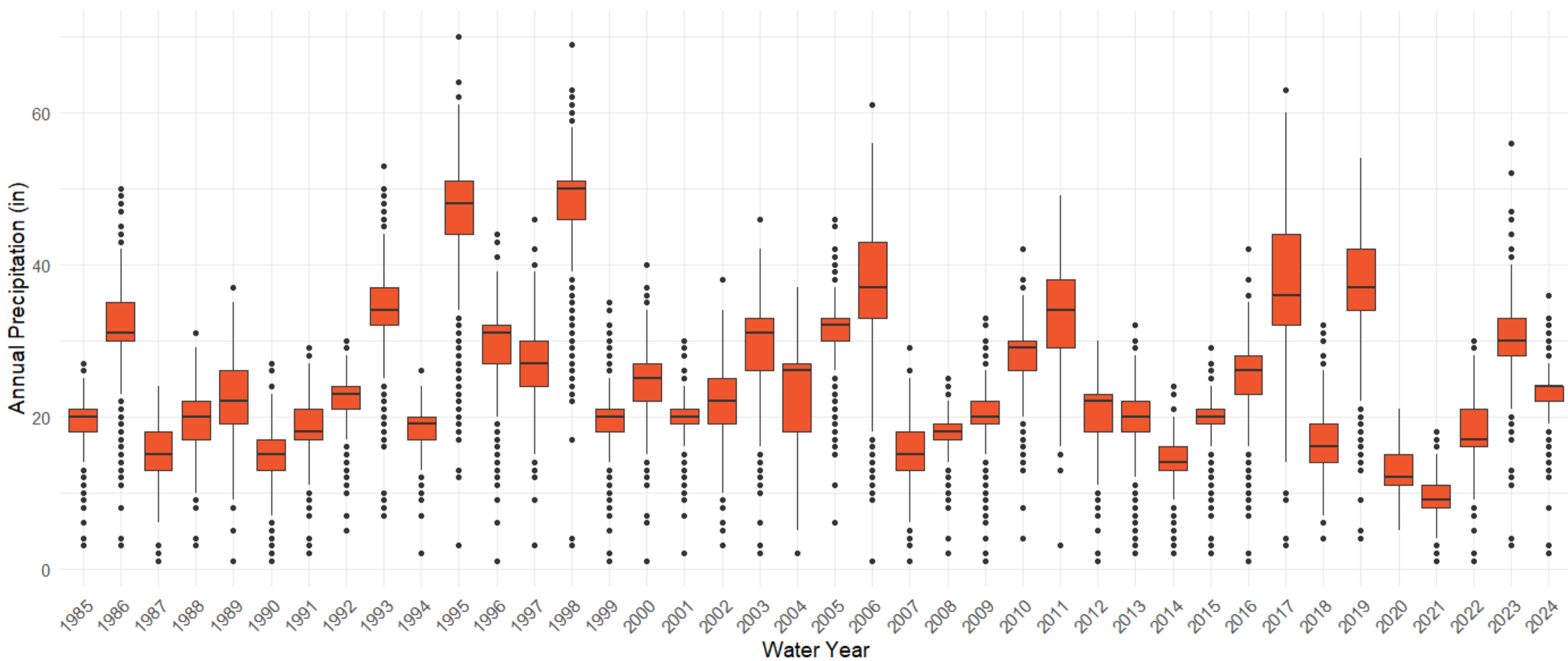
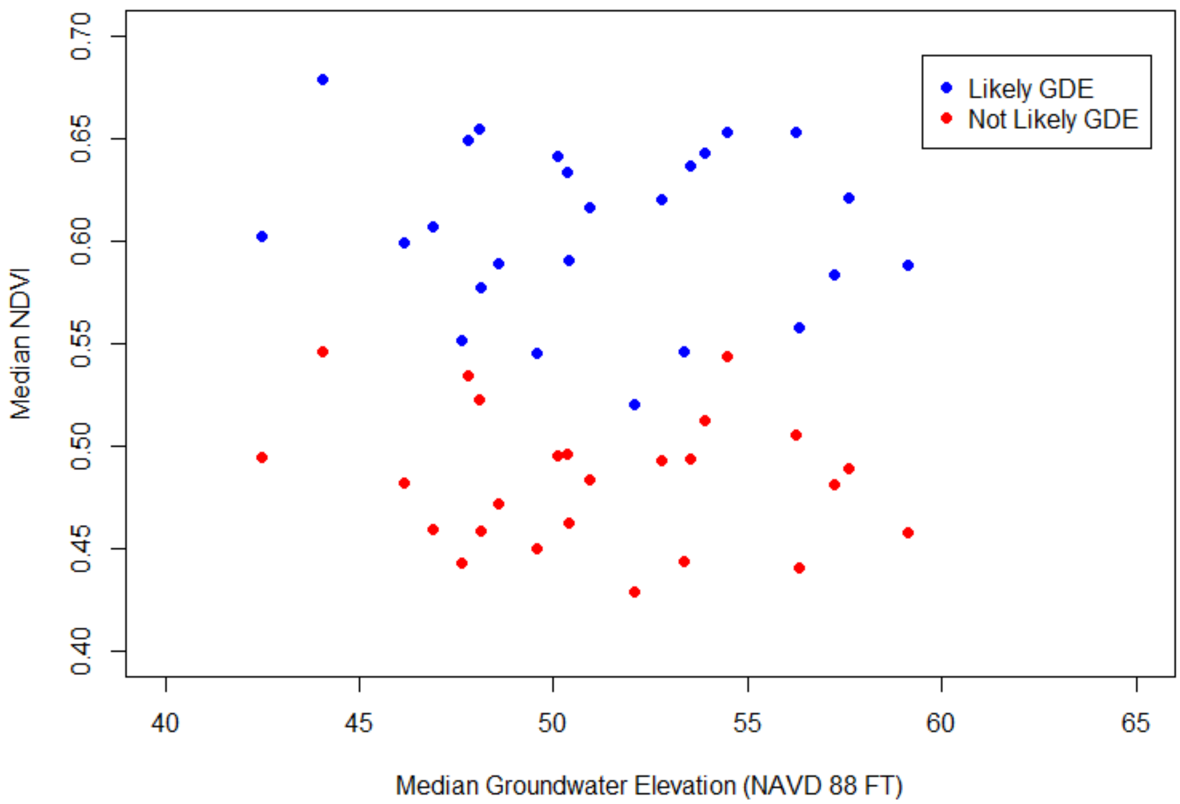


Figure 10 Box plots of annual precipitation at all potential GDEs from 1985 to 2024.



Note: Each point represents one year of data.

Figure 11 Median NDVI at all potential GDEs versus median groundwater elevation at all GDEs from 2000 to 2024.

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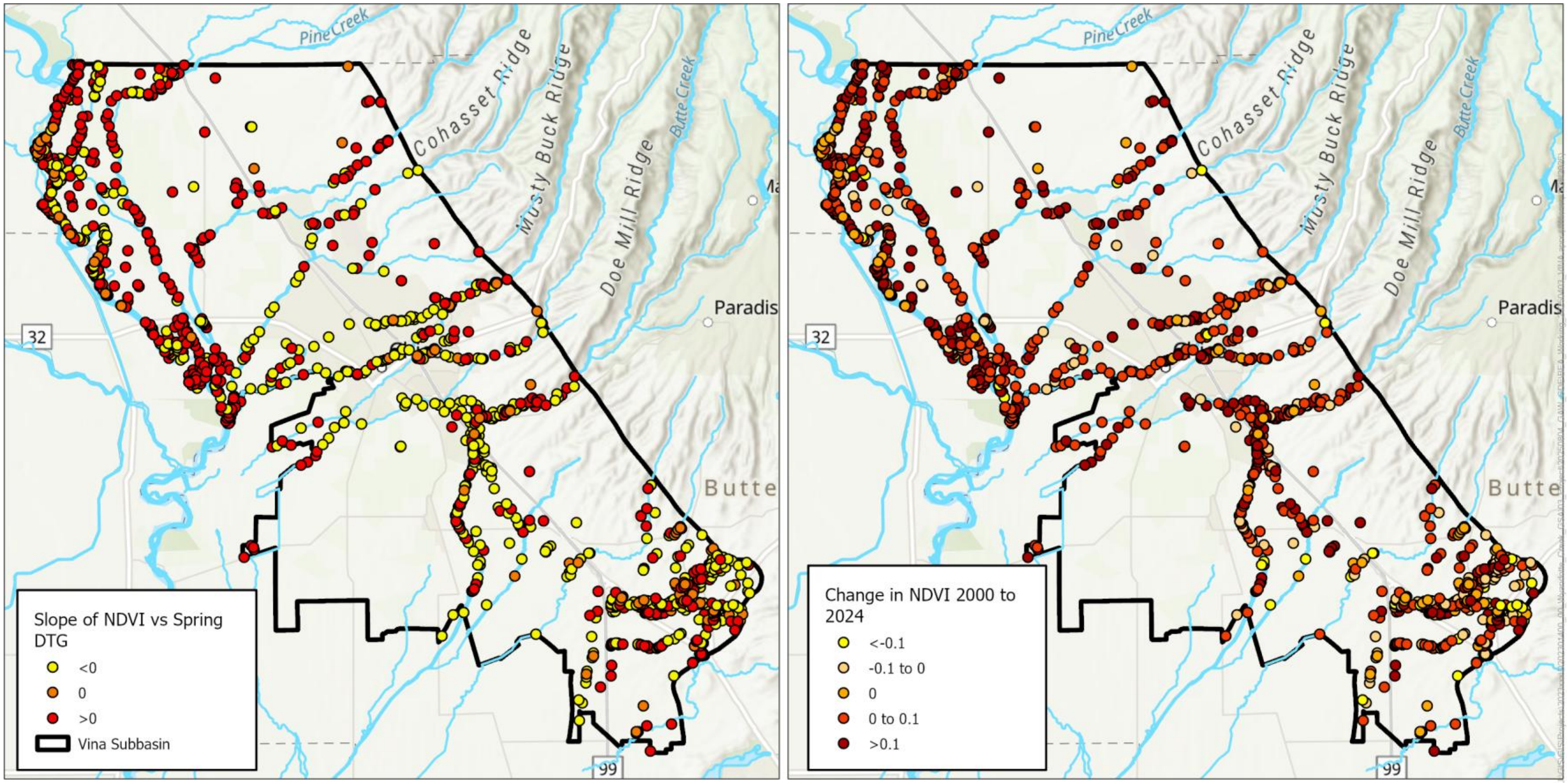

Notes: Negative slopes indicate NDVI decreased as DTG increased and positive slope indicate NDVI increased as DTG increased.

Figure 12 Left Panel: Linear regression slope of NDVI vs spring DTG from shallow groundwater rasters at all potential GDEs from 2000 to 2024. Right Panel: Change in NDVI from 2000 to 2024 at all potential GDEs.

Discussion

GDEs Recommended to be Considered Under SGMA

The GDE mapping refinement analysis for the spring 90th percentile groundwater elevation conditions identified a total of 464 of the 1,228 potential GDEs from the NCCAG dataset as being identified as likely GDEs. These likely GDEs were generally located along the Sacramento River and its floodplain and along lowland valley portions of Dircus Slough, Pine Creek, Rock Creek, Mud Creek, Big Chico Creek, Little Chico Creek, Angel Slough, and Butte Creek. Moving eastward from the Sacramento River floodplain, a northwest-southeast trending boundary line traverses the central part of the Subbasin where DTG begins to exceed GDE rooting depths, and most potential GDEs east of this boundary had DTG deeper than rooting depth thresholds and were identified as not likely GDEs (Figure 1 and Figure 2). This boundary corresponds to increasing landscape elevation toward the eastern foothills, where the regional groundwater table begins to separate from the land surface, consistent with the geologic setting. Overall, the potential GDEs identified as likely GDEs under the spring 90th percentile groundwater elevation conditions are likely to function as GDEs, whereas those east of the northwest-southeast boundary would not, under contemporary conditions (i.e., 2000-2025), be considered GDEs because DTG is consistently too great. Therefore, the set of GDEs mapped as likely GDEs based on the spring 90th percentile groundwater elevation conditions are recommended as the set of GDEs to be considered by the GSA when assessing impacts to GDEs.

Likely GDEs located along the northwest-southeast boundary provide a good opportunity for monitoring potential impacts to GDEs as they appear most susceptible to historic changes in groundwater conditions. It is recommended that these GDEs be prioritized for monitoring network development, with field teams assessing the ecological health of a representative subset of these GDEs to support monitoring of GSA management impacts on GDE beneficial users. It is also recommended that monitoring efforts include a set of representative GDEs found to be less susceptible to historic changes in groundwater conditions to act as a ‘control’ group for comparison to GDEs that may be more susceptible to changes in groundwater conditions (see *Recommendations* section for additional discussion).

Hydrologic Sensitivity of Recommended GDEs

Subsurface hydrologic conditions at the recommended set of GDEs appear to exhibit high seasonal and drought condition variability. For instance, 78 percent (364 of 464 GDEs) of potential GDEs identified as likely GDEs under the spring 90th percentile conditions were found to transition to being disconnected under spring 2015 conditions, which represent critically dry conditions and the second lowest regional groundwater levels during the 2000-2025 period of record. Geographically the GDEs that went from connected to disconnected were scattered along the Sacramento River, the Sacramento River floodplain, and along other Subbasin surface waters. Under spring 2021 groundwater conditions, the lowest water year on record since 2000, a larger 86 percent (400 of 464 GDEs) of potential GDEs identified as likely GDEs under the 90th percentile conditions were found to transition to being disconnected. The spatial distribution of these GDEs that would become hydraulically disconnected was slightly broader than those under the spring 2015 conditions. If groundwater levels as low as those observed in spring 2021 were to persist and degrade the ecological health of GDEs, that outcome would likely be considered a significant and unreasonable impact, that is, an Undesirable Result, on these beneficial users of groundwater (e.g., Kibler et al., 2021).

Variation in seasonal conditions is exemplified by comparing spring and fall conditions. For example, between spring and fall 90th percentile conditions, 92 percent (426 of 464 GDEs) of potential GDEs identified as likely GDEs under the spring 90th percentile conditions were found to transition to being disconnected under fall conditions (Figure 1 and Figure 2).

GDEs, SMCs, and Monitoring Networks

As discussed in the *Background* section, SGMA requires Groundwater Sustainability Agencies to identify GDEs in their GSPs and to consider how SMCs for each sustainability indicator, including minimum thresholds (MTs) and measurable objectives (MOs), may affect the interests of beneficial uses and users of groundwater such as GDEs. To demonstrate progress toward achieving overall sustainability goals, monitor changes in conditions relative to MOs and MTs, and demonstrate progress toward achieving SMCs GSPs must develop appropriate monitoring networks for each sustainability indicator. SGMA also requires agencies to monitor impacts to beneficial users of groundwater.

Initial SMC's for SGMA's six sustainability indicators for the Subbasin were defined in the 2022 Vina GSP, which included interim SMCs for the Interconnected Surface Water (ISW) sustainability indicator. The 2020 Vina GSP also described the monitoring network proposed for each sustainability indicator including representative monitoring sites, data to be collected including the frequency of monitoring at each site, identification of data gaps, and plans to fill data gaps. The amended GSP and associated Periodic Evaluation currently underway will include updates to the SMCs and monitoring network from the 2022 Vina GSP including but not limited to:

- Updated SMCs that include description of new data collected since the 2022 Vina GSP, description of data gaps that remain, and description of active and future plans for ongoing data collection efforts and Project and Management Actions that will address data gaps and inform future updates.
    - Specifically related to GDEs, updates include description of how SMCs impact environmental beneficial users of groundwater such as GDEs.
    - Interim SMCs for ISW are expected to be updated with new, more targeted preliminary SMCs with the understanding that additional data will be collected for five more years to fill data gaps and finalized SMCs would be developed for the 2032 periodic evaluation.
- Updated monitoring networks that include description of ongoing and proposed monitoring network expansion.
    - Specifically related to GDEs, since the 2022 Vina GSP new stream gages, new wells near stream channels, and new wells for the shallow aquifer have been installed growing the ISW network and filling data gaps.

When monitoring impacts to beneficial users of groundwater such as GDEs, it is crucial to establish clear linkages between the data collected by monitoring networks and the resources being evaluated. For instance, representative monitoring site (RMS) wells are drilled and screened at different depths with each well designed to measure groundwater elevations at a selected zone in the underlying aquifer. RMS wells and SMCs for the Groundwater Level sustainability indicator are often drilled and screened in the deeper aquifer system and thus may not be representative of conditions in the shallow aquifer, which are more relevant too and representative of water available to support GDEs. This can result in observed DTG at RMS wells that are not representative of the shallow aquifer system. Such conflation can lead to mischaracterization of impacts to GDEs if MTs and MOs at these locations were used directly to assess impacts. Such issues, highlight the need to use appropriate monitoring network data (e.g., wells screened in the shallow aquifer) and the need to scrutinize and develop clear linkages between SMCs and beneficial users when assessing impacts.

Recommendations

GDE Management and Sustainable Management Criteria Considerations

GDEs within the Subbasin are assumed to depend on shallow groundwater to support mature vegetation and seedling establishment (Rood et al., 2003). Shallow groundwater level decline may result in reduced plant growth and, in more severe cases, lead to plant mortality (Shafroth et al., 2000; Kibler et al., 2023). However, seasonal fluctuations in groundwater levels are normal and once established, riparian species can survive periodic declines (Stromberg & Patten, 1992). Under SGMA, there is no sustainability indicator specific to GDEs. Rather management of GDEs is intertwined with SGMA's other sustainability indicators whereby it is required to assess how SMCs (e.g., MO and MT) may affect the interests of beneficial uses and users of groundwater. It is also required to monitor impacts to beneficial users of groundwater and define Undesirable Results[23] and assess potential effects of Undesirable Results on beneficial uses and users of groundwater. The recommended approach for the Vina Subbasin for monitoring impacts and managing groundwater in consideration of GDEs is to define management criteria that account for the natural variability in depth to groundwater and surface vegetation composition represented by NDVI across the Subbasin to avoid previously un-observed conditions (defined by historical variability in groundwater and GDEs), whereby criteria are measured in terms of groundwater level and NDVI.

Groundwater Level Criteria

With regard to groundwater levels, the first recommendation is to manage shallow groundwater levels such that, based on rooting depths developed in this analysis, the area of GDEs that are connected to shallow groundwater (i.e., shallow groundwater levels are at or above rooting depths) does not persistently fall below the 2021 minima, as this is an indicator of potential impacts to GDEs in excess of natural variability. For instance, conditions during 2021 appear to correspond to a decrease in regional NDVI values compared to adjacent years (Figure 8) potentially indicating declines in GDE health

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[23] Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.

occurred during this period, though as discussed in the *Regional Potential GDE Health Results* section there is uncertainty regarding the direct relationship between shallow groundwater levels and GDE NDVI. More specifically, it remains unknown if plant mortality occurred during this period and if the subsequent rebound in GDE NDVI values observed in 2023 through 2024 is associated with vegetation recovery or due to re-colonization that could include rapid colonization by non-native or invasive species (e.g., Kibler et al., 2023).

In addition to magnitude, the duration of groundwater decline is ecologically important to consider when determining potential impacts to GDEs, as prolonged periods of hydrologic disconnection with root zones increase potential for degrading plant health (Kibler et al., 2023). While 2021 was the lowest water year on record since 2000, the 3-year period of 2021-2023 was generally characterized by depressed groundwater levels. Thus, a possible interim criteria to defining an Undesirable Result that considers likely impact to GDEs is that the area of connected GDE (i.e., based on rooting depths and shallow groundwater levels) falls to levels observed during 2021 and remains there for three consecutive years.[24]

Notably, the proposed criteria is based on findings from this analysis and best available science but is not based on observed decline in plant heath (e.g., Shafroth et al., 2000; Rood et al., 2003; Kibler et al., 2023). Additional analysis of GDE responses to groundwater levels and field-based long-term monitoring of representative GDEs could be used to further support and refine the proposed interim criteria. Alternative monitoring approaches using existing and planned RMS wells and a subset of GDEs in close proximity to those wells that serve as a representative sample of Subbasin GDEs are also possible, but the details of such approaches would need to be refined as part of future Vina GSP amendments or Periodic Evaluations.

GDE ecological health (NDVI) Criteria

With regard to NDVI values, the recommendation for assessing potential impacts to GDEs in excess of natural variability is based on a statistical approach modified from the California Environmental Flow Framework (CEFF) for assessing flow alteration. To assess alteration of GDE ecological health the distribution of historical (water years 2000 to 2025, which generally corresponds to the historical period in the 2022 Vina GSP) NDVI values at likely GDEs would be compared to the distribution of future NDVI values at the same set of GDEs. The following rules would be used to assign an alteration status (**Figure 13**):

- If the future median NDVI value falls below the historical NDVI 25th percentile interval, then GDE ecological health is considered “likely altered” and could cause declines in GDE ecological health.

- If the future median NDVI value falls within 25th-75th percentile interval of historical NDVI values and more than 50% of future values fall within 10th-90th percentile, then GDE ecological health is considered “likely unaltered” and would not constitute an Undesirable Result.

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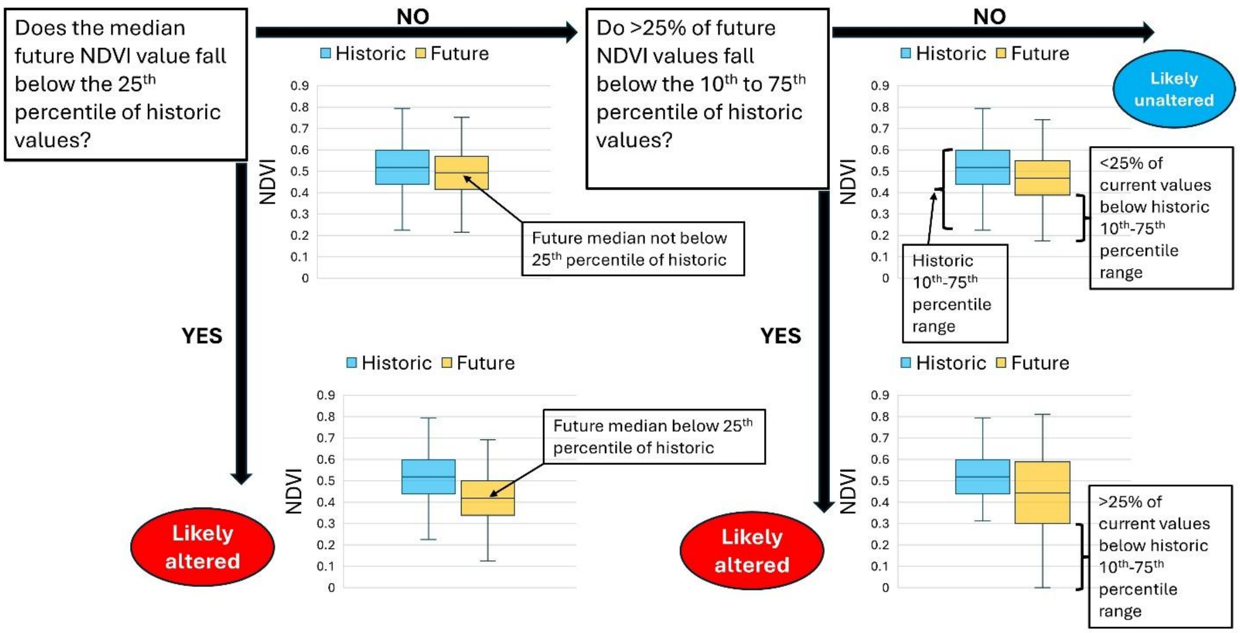
[24] This approach does not necessarily mean shallow groundwater levels are the same as those observed during fall 2021 but that observed levels result in the area of GDEs that are connected to shallow groundwater is at or below what was mapped in 2021 (i.e., 437 acres [Table 3]).

- If the future median NDVI value falls within the historical NDVI 25th-75th percentile interval, but more than 25% of future values fall below the historical NDVI 10th-75th percentile (i.e., there is a downward shift of future NDVI values such that a large percentage of future values fall within the lower range of historic values), then GDE ecological health is considered "likely altered" and could cause declines in GDE ecological health.



Notes: Flowchart starts in top-left corner. First check if future median NDVI value falls below the historical NDVI 25th percentile interval. If no move right, if yes move down. Next check if future median NDVI value falls below 25th-75th percentile interval of historical NDVI values or more than 50% of future values fall within historic 10th-90th percentile. If no move right, if yes move down. Next check if more than 25% of future values fall below the historical NDVI 10th-75th percentile. If no move right, if yes move down.

Historic and future NDVI data are shown as boxplots. 'Whiskers', horizontal lines at top and bottom of boxplots, are the 10th and 90th percentile values, respectively. The shaded boxes are the 25th-75th percentile range. The horizontal line in the shaded boxes is the median value.

Figure 13 Conceptual flowchart model for assigning GDE ecological health (NDVI) Criteria alteration status based on historic and future NDVI values at likely GDEs.

For the situations above that could constitute impacts to GDEs in excess of natural variability it is important to assess the cause(s) for declines in GDE ecological health. Within the context of SGMA, declines in GDE ecological health would only be considered an impact if declines were correlated with declines in groundwater levels due to groundwater management. Such correlations would need to be determined in the future based on monitoring of groundwater levels that would already be occurring in accordance with SGMA requirements and assessing compliance with other sustainability indicators. This could be achieved through statistical analysis comparing annual median NDVI values at all likely GDEs with area-weighted groundwater levels similar to the methods used in the TNC GDE Pulse tool.[25]

When determining the future distribution of NDVI values to use for comparison it is recommended that a five-year moving window is used as this is more representative of present-day conditions during the implementation horizon than using data from a single year (e.g., if the intent was to assess GDE health in the year 2030 the future distribution of NDVI values would be derived from NDVI data for the 2025-2030 period). Future NDVI values at likely GDEs should be calculated in the same manner as the historical dataset using the same methods as the TNC GDE Pulse tool. The ready availability of remote sensed satellite data (e.g., Landsat, Sentinel, etc.) makes this easily achievable.

Summary

Collectively, the Groundwater Level Criteria and GDE ecological health (NDVI) Criteria are viewed as complementary as they assess potential for impacts based on changes to GDE area and health, respectively. Thus, during an implementation year, even if GDE area may appear constant according to Groundwater Level Criteria, the GDE ecological health (NDVI) Criteria will provide an alternative lens into GDE conditions, and visa-versa. The specific approaches, including frequency and datasets used for GDE monitoring, would need to be defined as part of future Vina GSP amendments or Periodic Evaluations. Preliminary recommendations for monitoring implementation are as follows:

- On an annual basis, use spring shallow groundwater levels to estimate the area of likely GDEs that are connected to shallow groundwater (i.e., shallow groundwater levels are at or above rooting depths) and compare that to the area observed during spring 2021. If the area of likely GDE falls below levels observed during spring 2021 for two consecutive years early intervention may be warranted.

- On a 5-year basis, use NDVI derived from Landsat (~30 m resolution) or Sentinel (~10 m resolution) satellites to generate a distribution of future NDVI values to compare to the distribution of historical values. GDE NDVI values should be derived following the same method as those derived by the TNC GDE Pulse tool.[26] Analysis of future NDVI values on an annual basis could be completed to provide additional interim checks on GDE health, especially during drought periods, and may help to build a better understanding of the relationship between GDE NDVI and shallow groundwater conditions.

As described in the sections above, many factors besides groundwater levels can affect the ecological health of GDEs including but not limited to climate, surface hydrology, land use changes, and the occurrence of invasive species. It will be necessary to consider, and to the extent that data are available, to account for these factors when monitoring how GSA management actions affect the beneficial users represented by GDEs.

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[25] Like the TNC pulse methods, it will be necessary to control for covariates that may influence GDE ecological health such a climate, precipitation, and land use changes.

[26] https://gde.codefornature.org/#/methodology

Future monitoring and assessment of potential impacts to these GDEs should also acknowledge and consider the role of surface water and applied water at these locations. For instance, if monitoring indicates declines in the ecological health of these GDEs it will be necessary to decouple the relative roles of changes to groundwater elevations and surface water conditions (e.g., streamflows or applied water volumes). Further, it is important to acknowledge that applied water for irrigated agriculture, managed wetlands, or urban applications at or near these GDEs often represents a translation of groundwater pumped from the deep aquifer to the surface that supports multiple, direct, beneficial uses and users (e.g., agriculture and environmental) and has ancillary benefits to GDEs. As noted, changes to pumping and subsequent applied water may have negative consequences to the direct beneficial uses and users of that applied water but also to GDEs.

Ecological Condition and Long-term Monitoring

Identifying the ecological value of each potential GDE can help to prioritize limited resources as well as prioritize legally protected species or habitats that may need special consideration when setting sustainable management criteria (Rohde et al. 2018). The ecological value of a potential GDE is higher for those that possess natural or near-natural conditions or include species or habitats that have legal protection (Serov et al. 2012). An approach for assessing GDE ecological conditions completed for the adjacent Wyandotte Creek Subbasin is described in ESA (2026) and a similar approach could be applied to the Vina Subbasin to define beneficial users and ecological value of potential GDEs in the Vina Subbasin and inform possible future GDE monitoring.

Establishing fixed monitoring locations to assess ecological baseline conditions at representative GDEs and subsequent periodic monitoring at the same monitoring locations can provide insight into how environmental conditions and groundwater management may be influencing GDE function, integrity, and ecological health through time. An approach for long-term GDE monitoring completed for the adjacent Wyandotte Creek Subbasin is described in ESA (2026) and could be applied to the Vina Subbasin.

Data Gaps and Uncertainties

Several data gaps or uncertainties remain related to relationship between shallow groundwater levels and GDE health, and ecological processes in the Subbasin that influence the abundance, distribution, and ecological health of GDEs. These are summarized below along with possible options to fill these gaps.

- At both the Subbasin and individual GDE scales the relationship between shallow groundwater elevations and GDE NDVI values is not straightforward or linear and uncertainties and data gaps remain regarding how other biotic/abiotic factors and processes influence changes in NDVI. Additional analysis of relationships between shallow groundwater elevations and GDE NDVI values that include data on other biotic/abiotic factors (e.g., precipitation, surface water application, land use change) could help to better understand such relationships. Establishment of long-term monitoring sites at representative GDEs that include repeat surveys of critical baseline data such as canopy closure, diversity, regeneration, structural diversity, and ecosystem function (as measured by percentage of native species) along with ongoing monitoring of shallow groundwater levels would also help better understand ecological trends and relationships between GDE health and groundwater conditions.

- Modification of the flow regime and associated ecological and geomorphic processes along the Sacramento River and other Subbasin surface waters should to be considered when monitoring GDEs and assessing potential impacts under SGMA. For instance, modified flow regimes and construction of levees have resulted in a more channelized river systems, with reduced sinuosity, reducing the amount of adjacent riparian terrestrial habitats. Limitations on recruitment processes mean the health of many riparian communities may decline or experience succession to other community types regardless of groundwater conditions as late successional species die without replacement. The relative effect of changes in groundwater versus surface flow related factors will need to be decoupled as part of future monitoring and reporting under SGMA. Ongoing expansion of the monitoring network along with additional analysis will help address this topic.

- The potential for observed DTG at RMS wells to not be representative of the shallow aquifer system highlights the ongoing need to use appropriate monitoring network data (e.g., wells screened in the shallow aquifer) when monitoring GDEs and the need to scrutinize and develop clear linkages between SMCs and beneficial users when assessing impacts. Ongoing expansion of the monitoring network along with additional analysis will help address this topic. Specifically, additional wells and stream gages installed since the 2022 Vina GSP will collect data that will help fill this data gap.

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April 2026

VINA GROUNDWATER SUSTAINABILITY AGENCY

Technical Memorandum: Vina Subbasin Interconnected Surface Water

DRAFT

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Prepared for:
Vina Groundwater Sustainability Agency

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SECTION 1: PURPOSE

Under the Sustainable Groundwater Management Act (SGMA), depletion of interconnected surface water (ISW) is one of six key sustainability indicators for groundwater sustainability agencies (GSAs) to address during Groundwater Sustainability Plan (GSP) implementation. SGMA identifies that an undesirable result occurs if, among other reasons, groundwater use occurring in a basin causes depletions of ISW that significantly and unreasonably impact beneficial uses of the surface water (CWC § 10721(x)(6)). The Department of Water Resources (DWR) defines ISW as “surface water that is hydrologically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.” In practice, this refers to places where groundwater and surface water systems directly influence one another, such as streams and rivers that depend on groundwater to sustain their flows. Depletions of ISW under SGMA are only related to impacts caused by groundwater use. Groundwater pumping causes (1) a reduction of inflow to an ISW from groundwater or (2) an increase in outflow from an ISW to groundwater.

The GSA received grant funding through DWR’s Sustainable Groundwater Management Round 2 Grant Program to address data gaps identified in the 2022 GSP and recommended corrective actions from DWR’s Determination Letter. The 2022 GSP, Sections 3.8 and 4.10, identified several data gaps relevant to ISW, including limited shallow groundwater monitoring near streams, limited understanding of vertical connectivity between shallow and deeper aquifer zones, uncertainty in the location and timing of connected stream reaches, limitations in BBGM calibration for the uppermost model layer, and insufficient data to distinguish groundwater pumping effects from broader watershed, climate, and surface water management influences. New information collected since the adoption of the 2022 GSP includes:

- Establishing and enhancing the shallow groundwater level monitoring network representative of water table conditions which directly influence ISW depletions.
- Isotope study identifying losing and gaining stream reaches.
- Updated Butte Basin Groundwater Model (referred to as BBGM v. 1.3) extended through Water Year 2024.
- Topographic surveys to assess stream-aquifer connectivity.

This technical memorandum describes ISW interactions and presents preliminary results refining the identification of where ISW exist in the Vina Subbasin; the location, timing, and quantity of depletions; and remaining data gaps.

SECTION 2: BASIN SETTING

In the 2022 Vina Groundwater Sustainability Plan (GSP), the GSA acknowledged the need to characterize and monitor ISW. However, because shallow groundwater data was limited, the GSP did not establish Sustainable Management Criteria (SMC) specific to ISW depletion. Instead, groundwater level SMC were used as a proxy. In DWR's review of the GSP, they provided the following recommended corrective actions (RCAs) to address in the 2027 Periodic Evaluation and Plan amendments as necessary:

1. Consider utilizing the interconnected surface water guidance when issued by the Department to establish MTs/MOs/etc. (note: as of March 2026, the Department has not yet released guidance)
2. 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.
3. 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.
4. Clarify the groundwater level monitoring sites that will be used for the evaluation of depletions of interconnected surface water and provide site-specific information.
5. Review the model inputs/outputs and provide consistent information regarding stream loss and gains throughout the GSP. Clarify whether these values simply represent the overall interaction between the surface water and groundwater system or the quantity of depletion due to groundwater pumping.

The Subbasin is bounded on the north by the Butte-Tehama County line, the west by the Butte-Glenn County line, the south by a combination of the property boundaries owned by the M&T Ranch, the service area boundaries of RD 2106 and Western Canal Water District, and the eastern boundary is the edge of the alluvium as defined by DWR Bulletin 118 Update 2003. The Sacramento River lies along the western boundary from the Butte-Tehama County line on the north to 21 miles south to the confluence of Big Chico Creek with the Sacramento River. The U.S. Bureau of Reclamation controls Sacramento River flows through releases from Shasta Lake. Butte and Big Chico Creeks are perennial streams that flow from the foothills / Sierras through the central portion of the Subbasin. The Butte Creek watershed provides valuable habitat for wild spring run Chinook salmon, listed as threatened under the California and federal Endangered Species Acts. Pine, Rock, Mud, Little Chico, Dry, Little Dry Creeks flow through the central portion of the Subbasin and are ephemeral. These streams only flow after storm events and are dry in the summer months. The potential for depletions from ephemeral streams is limited to times when streams are flowing and groundwater levels are high (i.e. interconnected). Other waterways within the Subbasin, including Lindo Channel and Comanche Creek, are critical for flood protection and irrigation conveyance. Available streamflow data for the Sacramento River, Mud Creek, Big Chico Creek, Butte Creek, Lindo Channel are provided in Appendix A. The GSA is installing up to twelve additional stream gages to better characterize stream flows across the Subbasin. A map active and new stream gages are shown in Appendix A.

The LWA team addressed the DWR's RCAs listed above by assembling a robust monitoring network for ISW, incorporating new data in preparation for the Periodic Evaluation, and utilizing updated stream depletion estimates from the Butte Basin Groundwater Model (BBGM v.1.3). The remainder of this report describes ISW interactions and presents preliminary results identifying where ISW exist, using multiple lines of evidence (model results, groundwater elevations, water quality isotopes); the location, timing, and quantity of depletions; remaining data gaps; and provides recommendations to develop sustainable management criteria for managing depletions of ISW. ISW were identified using the BBGM, measured groundwater elevation data representative of the shallow aquifer, and an isotope study. Results from each method are presented in the following sections.

2.1 Streamflow Depletion and Accretion

The term interconnected surface water describes surface water features that are hydraulically connected by a continuous saturated zone to an underlying aquifer such that changes in elevations of either the aquifer or the surface water features propagate throughout the interconnected system. Within the Vina Subbasin, it is likely that certain surface water features are interconnected with the shallow zone of the groundwater system.

Interconnected surface waters are classified as either gaining or losing with respect to the condition of the surface water feature with gaining reaches gaining through accretion of groundwater and losing reaches losing through depletion to groundwater. It is important to recognize that these interconnections are dynamic and are affected by factors including variations in local geology, hydrology and water use. Thus, at a single point in time, a stream may have both gaining and losing reaches and reaches that are gaining under certain seasonal, or long-term hydrologic and water use conditions, or may become losing under others. Moreover, changes in water use or hydrology may cause interconnected surface water features to decouple from the groundwater system (i.e become disconnected).

Direct measurement of interactions between groundwater systems and surface water features is difficult because of the need for a monitoring system that tracks both stream stage and groundwater elevations at nearby locations. The interaction between groundwater systems and surface water features within the Vina Subbasin is analyzed through use of the integrated groundwater-surface water model, BBGM, which integrates information from groundwater monitoring wells and stream stages to model gradients that control flow between surface water and groundwater. Additionally, gaining and losing streams were classified using observed groundwater levels measured at existing shallow monitoring wells.

The difference between gaining and losing reaches is illustrated in Figure 1. For gaining reaches, the water table adjacent to the stream is above the elevation of water in the stream, resulting in flow of water from the groundwater system to the stream (gains or accretions). For losing reaches, the water table adjacent to the stream is below the elevation of water in the stream, resulting in flow of water from the stream to the groundwater system (losses, depletions, or seepage). In both cases, flows in the stream are directly connected to the groundwater system, with no unsaturated zone present beneath the streambed.

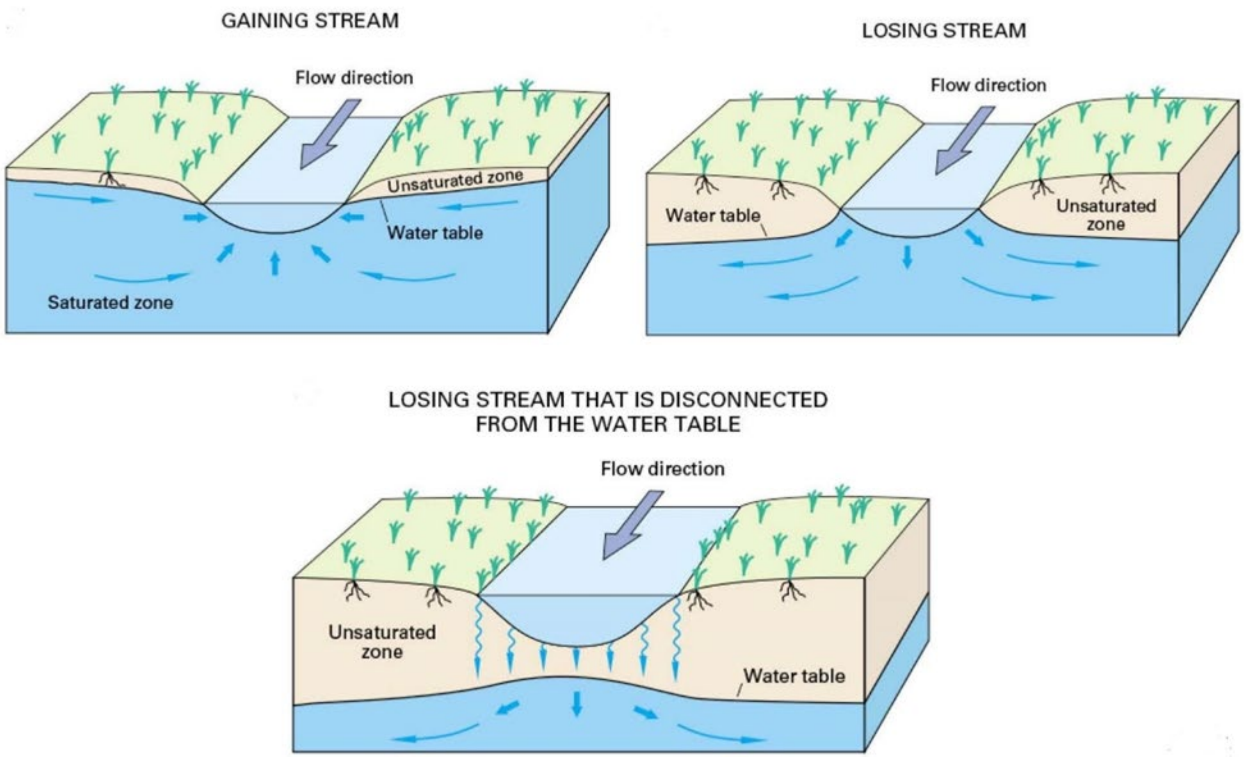

Figure 1: Illustration of Gaining and Losing Interconnected and Disconnected Stream Reaches (Source: USGS)

2.1.1 Butte Basin Groundwater Model

BBGM version 1.3 was utilized to evaluate and classify 32 stream segments, totaling to 115 miles in length, either traversing or bounding the subbasin as being primarily gaining or losing over the historical period from water year 2000 to 2024. A total of seven stream segments traversing or bounding the Subbasin with a total length of approximately 115 miles were defined. Characteristics of the stream segments (cross section, parameters etc.) are described in Butte Basin Groundwater Model Documentation v 1.0 (Butte County, 2021). The segments range in length from 1 to 9 miles with an average length of 3.6 miles and are shown in Figure 2. The results of this analysis are shown in Figure 3. The figure shows the percentage of months for the period from water year 2000 to 2024 with gaining conditions and classifies streams as primarily gaining (gaining conditions more than 80% of the time), primarily losing (losing conditions more than 80% of the time), or mixed. As indicated in Figure 3, stream segments representing the Sacramento River and the lower segments of Pine, Rock, and Mud Creeks are gaining more than 80% of the time while streams in the central and southeastern portions of the subbasin are largely losing.

Based on consideration of the frequency with which stream segments are gaining based on BBGM results and on consideration of the spring depth to groundwater below the estimated streambed depth along each primary stream, it is likely that northwestern stream segments are mostly connected to groundwater, while other stream segments remain disconnected.

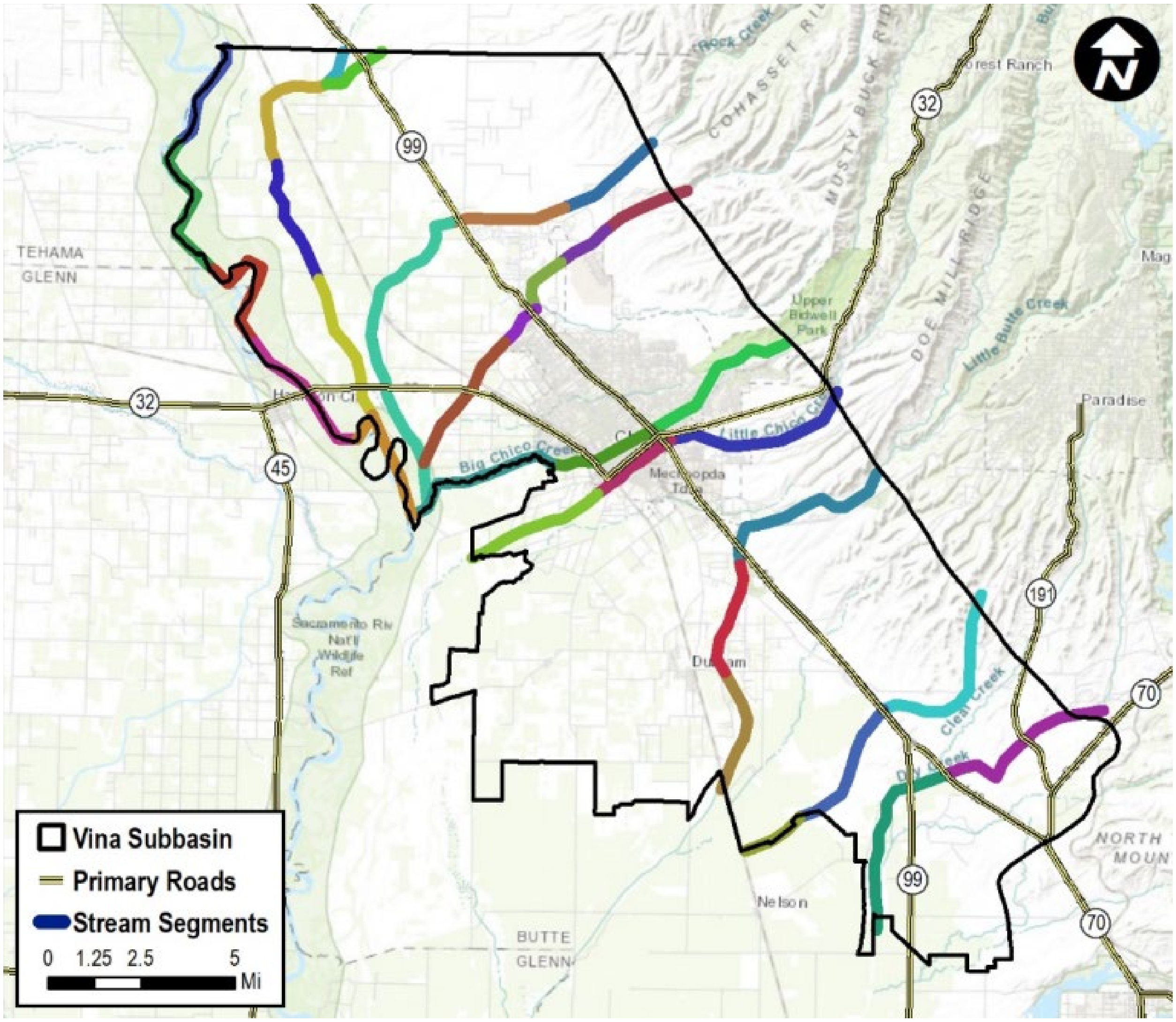

Figure 2: Vina Subbasin Stream Segments as defined in the BBGM.

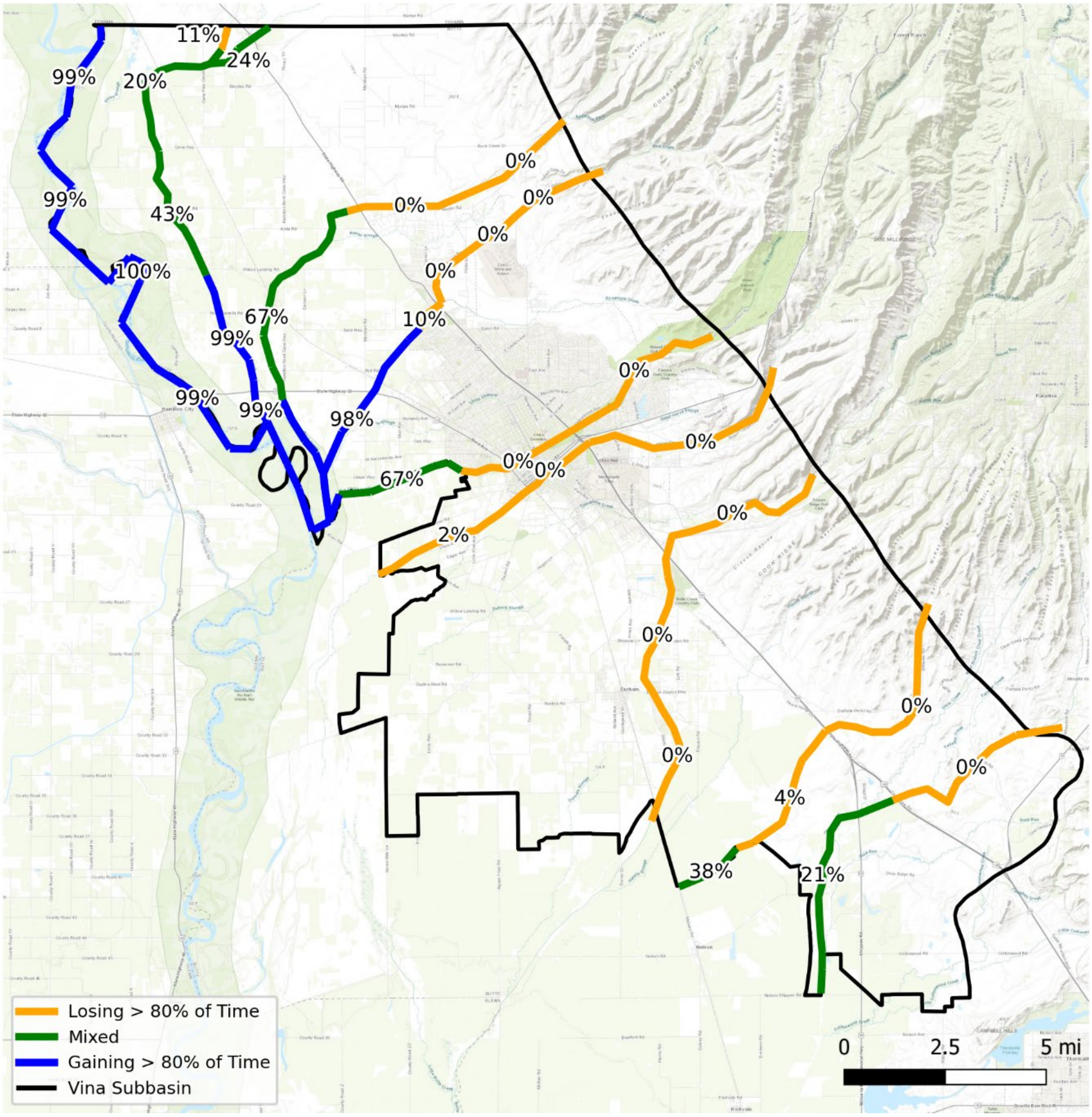

Figure 3: Vina Subbasin Gaining and Losing Stream Reaches Based on the BBGM v1.3, Water Years 2000 to 2024.

2.1.1.1 Timing and Amount of Surface Water – Groundwater Interaction

The timing and amount of surface water–groundwater interaction was estimated using the BBGM v.1.3 for the primary streams in the Subbasin shown in Figures 2 and 3. Monthly net gains to streamflow from groundwater were estimated monthly for the historical period from water year 2000 to 2024 and are summarized in Tables 1 and 2. Average monthly gains to streamflow are expressed in cubic feet per second (cfs) and thousand acre-feet, respectively. Negative values denote average losses from streamflow to groundwater (i.e., seepage).

Table 1: Average Monthly Gains to Streamflow from Groundwater, Water Years 2000 to 2024 (cfs)

Stream	Month												Average
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Angel Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Chico Creek	-1	-2	-5	-5	-5	-6	-3	-2	-1	-1	-1	-1	-3
Butte Creek	-8	-11	-18	-19	-19	-22	-20	-17	-12	-9	-7	-7	-14
Dry Creek	-1	-1	-3	-2	-2	-2	-1	0	0	0	0	0	-1
Little Chico Creek	-1	-1	-3	-2	-2	-2	-2	-1	-1	-1	-1	-1	-2
Little Dry Creek	-3	-4	-7	-7	-7	-7	-5	-4	-3	-3	-3	-3	-5
Mud Creek	2	2	1	3	3	5	5	5	3	2	2	2	3
Pine Creek	2	3	3	9	11	16	16	12	7	4	3	2	7
Rock Creek	-1	-1	-1	1	1	3	3	2	1	0	0	0	1
Sac. River	128	132	125	164	136	182	175	166	137	125	124	118	143
Singer Creek	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	116	116	93	141	117	167	169	161	131	118	116	110	130

Table 2: Average Monthly Gains to Streamflow from Groundwater, Water Years 2000 to 2024 (TAF)

Stream	Month												Annual Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Angel Slough	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Big Chico Creek	-0.1	-0.1	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-2.0
Butte Creek	-0.5	-0.6	-1.1	-1.1	-1.2	-1.4	-1.2	-1.0	-0.7	-0.5	-0.4	-0.4	-10.1
Dry Creek	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.8
Little Chico Creek	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-1.2
Little Dry Creek	-0.2	-0.2	-0.4	-0.4	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-3.4
Mud Creek	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.1	0.1	2.1
Pine Creek	0.1	0.2	0.2	0.5	0.7	0.9	0.9	0.8	0.4	0.3	0.2	0.1	5.4
Rock Creek	0.0	0.0	-0.1	0.0	0.1	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.5
Sac. River	7.7	8.0	7.6	9.9	8.2	11.0	10.6	10.0	8.3	7.6	7.5	7.1	103.4
Singer Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Total	7.0	7.0	5.6	8.5	7.0	10.1	10.2	9.7	7.9	7.1	7.0	6.7	94.0

On average, streams traversing or bounding the subbasin are currently estimated to gain approximately 130 cfs on average, or approximately 94 TAF annually. Average monthly gains from groundwater are greatest for the Sacramento River, at approximately 143 cfs. Gains are least between June and December (~127 CFS), due to relatively low groundwater elevations resulting from summer pumping. Gains tend to be greatest between late winter and spring (~165 CFS between January to May), due to higher groundwater elevations relative to river stage and reduced groundwater pumping. It is estimated by difference that the Sacramento River gains approximately 38 CFS (or 16 TAF per year) less between June through December on average due to pumping within Vina and adjacent subbasins. This represents the groundwater that would have entered the stream if groundwater pumping in the summer (primarily for irrigation) did not occur. This additional depletion is less than 1% of the total flow of approximately 7,500,000 AFY on the Sacramento River. Based on the relatively small volume of additional depletions, the relatively low level of depletions as a percentage of the total streamflow, and based on the managed nature of the Sacramento River, the risk of additional depletions from the Sacramento River are not currently considered to have the potential to have significant and unreasonable impacts on beneficial uses of the river.

2.1.2 ISW Identification using Groundwater Elevation Data

To identify the location of ISW reaches within the basin and ground truth BBGM modeled results we used seasonally interpolated shallow groundwater elevations, created from monitoring well data, in conjunction with LiDAR extracted surface water elevations. There are 28 existing shallow groundwater monitoring wells within the Subbasin. A map of well locations and hydrographs are provided in Appendix B. Additional shallow monitoring wells were used from Corning (two wells) and Butte (twenty-six wells) Subbasins to improve the interpolation across the basin boundaries. Groundwater elevations were interpolated between monitoring wells to develop spatial datasets across the entire Subbasin. Groundwater elevation rasters were developed for the spring and fall from 2000 through 2025. LiDAR, or Light Detection and Ranging, is a technology that allows for precise measuring of ground surface elevations by using laser light pulses from aircraft. Longer pulse return times indicate distances farther from the aircraft, and thus lower elevations. Due to the wavelength of light used for LiDAR surveys in the Vina Subbasin, water penetration was limited and it is assumed that the returned elevations of surface water bodies reflect their stage rather than their bottom elevations. To account for this uncertainty as well as uncertainty related to capillary effects below losing streams, a conservative threshold of 20 feet was used to determine connectivity (DWR, 2024). Whether inaccuracies in LiDAR measurements would change connectivity determinations is then done by comparing results generated by manual survey measurement at select locations on Pine Creek, Butte Creek, Mud Creek, Dry Creek, and Little Chico Creek. Manual survey results are provided in appendix C. Streams, with the exception of the Sacramento River, were classified as either likely disconnected or connected based on the following criteria:

1. Likely Disconnected: Interpolated groundwater levels are greater than 20 feet below the extracted surface water elevation
2. Likely Connected: Interpolated groundwater levels are less than 20 feet below the extracted surface water elevation

A threshold of 10 feet, instead of 20 feet, was used for the Sacramento River to be conservative due to uncertainties with the LiDAR data. We then use this classification in a similar way to the BBGM model results, and define three categories of Gaining, Mixed, and Losing based on the percentage of time connected and disconnected:

1. Gaining: Reach is likely gaining greater than 80% of the time
2. Mixed: Reach is likely gaining between 80 and 20% of the time
3. Losing: Reach is likely losing greater than 80% of the time

Results indicate that streams in the northwest of the subbasin have groundwater elevations within 20 feet of extracted surface water elevations, while most of the other stream reaches do not. For visualization of this result - years 2000, 2015, and 2025 were selected as being reflective of the start of the modeled period (2000), two drought years (2015 and 2022), and current conditions (2025) as shown on Figures 4 through 7, respectively. Of these, the modeled low points in groundwater storage (i.e., 2015 and 2022) correlate to the smallest extent of interconnected reaches. By 2025, the extent of interconnected reaches rebounds following several above normal and wet years. It should be noted that there are a limited number of wells available in the southeast with sufficient data to be used in the interpolation. As a result, there may be inaccuracies in this region on Little Dry Creek, Dry Creek, Clear Creek, and Cottonwood Creek. However, this method produces results that align with isotope tracers explained further in the next section.

Expanding the LiDAR analysis to all spring and fall measurements between 2000 and 2025 and applying the BBGM categories as detailed in the methods section, the Sacramento River is identified as gaining, with the lower reaches of Pine Creek, Rock Creek, and Mud Creek considered mixed (Figure 8). The upper reaches of these mixed streams are considered losing along with nearly all other stream reaches. Furthermore, surveyed results indicate that while LiDAR elevations can be up to 5 feet higher at channel bottom, indicating erosive action since LiDAR acquisition, classification into connected and disconnected categories would remain unchanged due to both our use of wide bin intervals and groundwater elevations that remain far below streambeds (Appendix C).

Overall, the categorization of interconnected surface waters and their status as gaining or losing by use of both LiDAR extracted surface water elevations and interpolated groundwater elevations match the general spatial pattern of the BBGM v1.3 results. Due to this, despite Lindo Channel, Sycamore Creek, Comanche Creek, Hamlin Slough, and Cottonwood Creek not being simulated in BBGM, estimates on these reaches are reasonable. In general, we conclude that aside from the Sacramento River, the likelihood of streams gaining within the Subbasin increases as they traverse westward towards the Sacramento River, with reaches towards the outer margins often disconnected and losing.

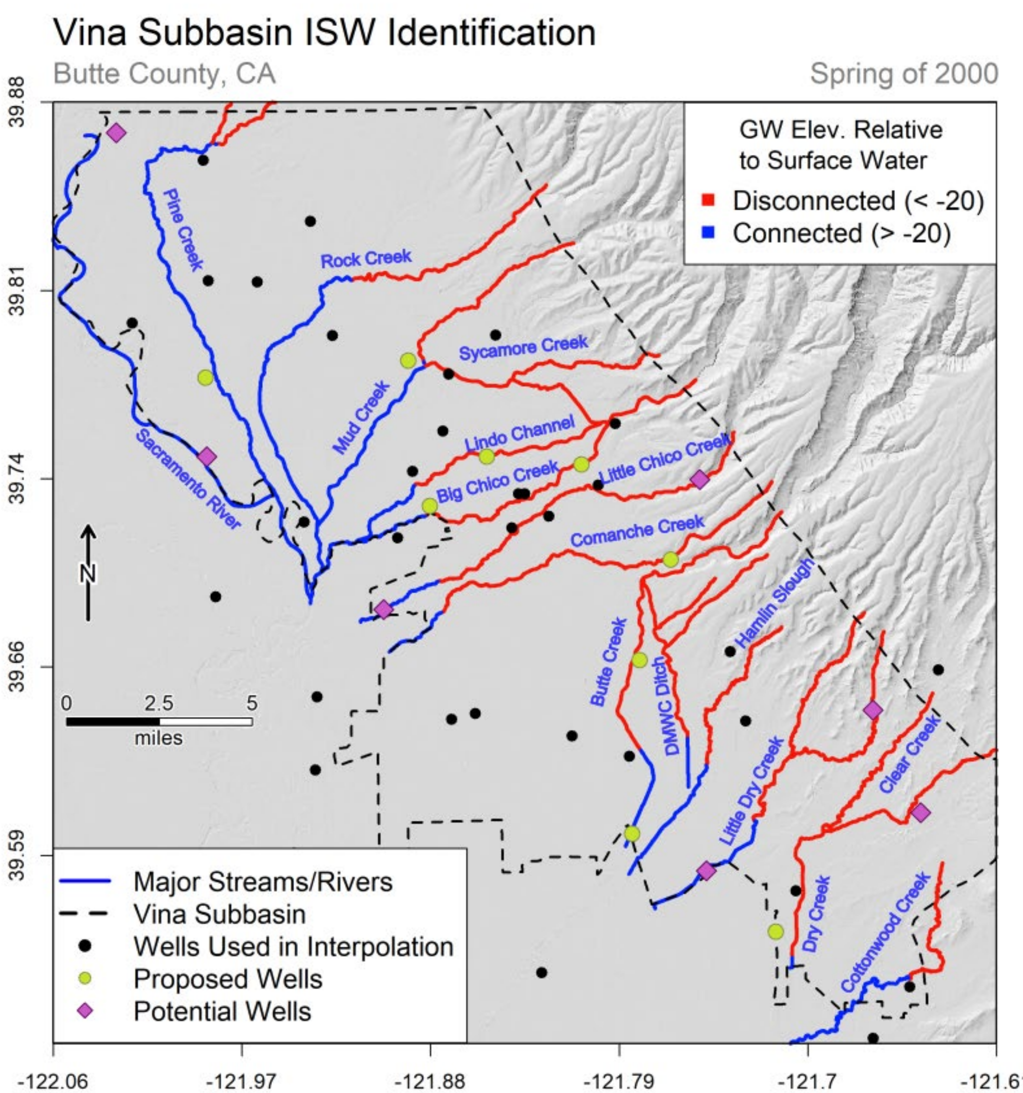

Figure 4: Comparison between shallow interpolated water surface elevations and LiDAR extracted streambed elevations in the spring of 2000.

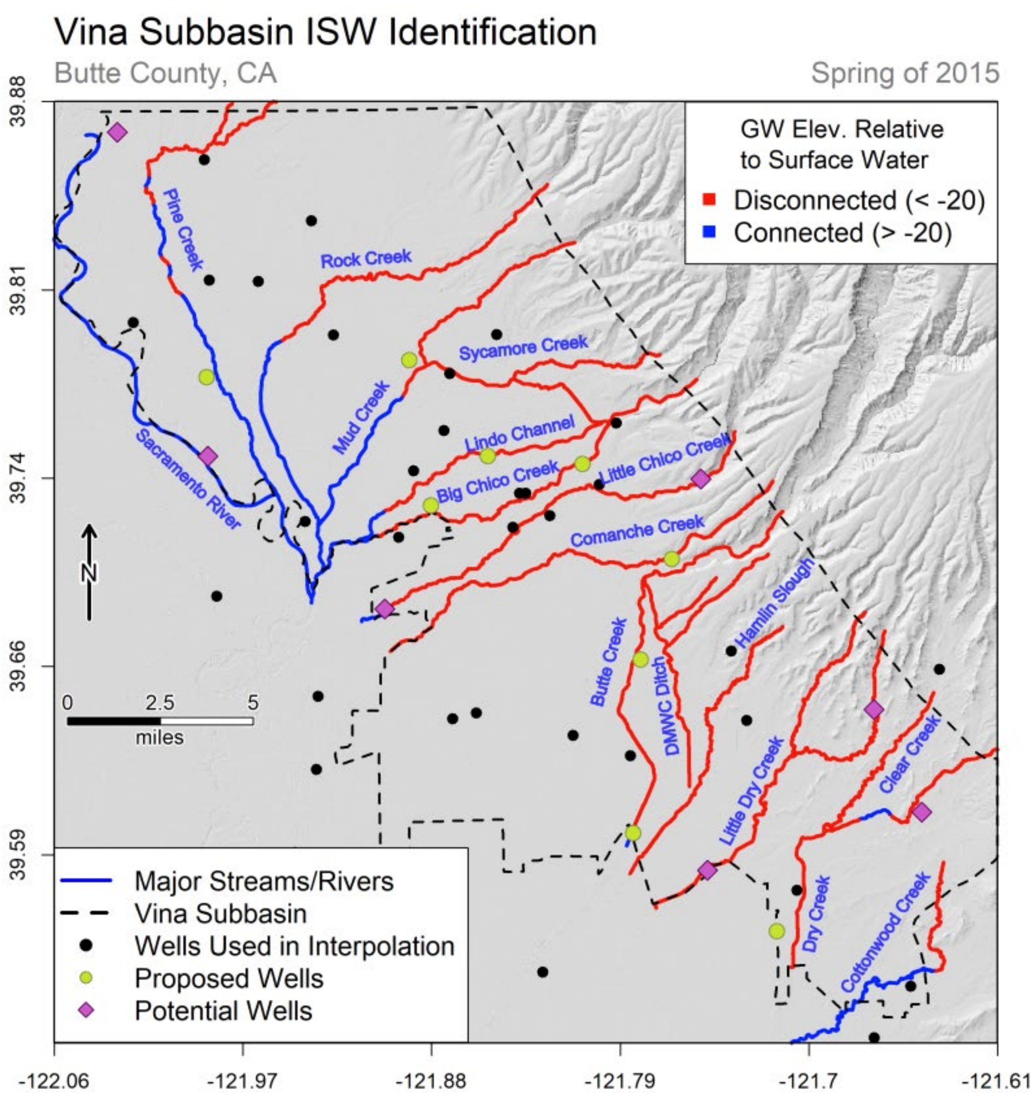

Figure 5: Comparison between shallow interpolated water surface elevations and LiDAR extracted streambed elevations in the spring of 2015.

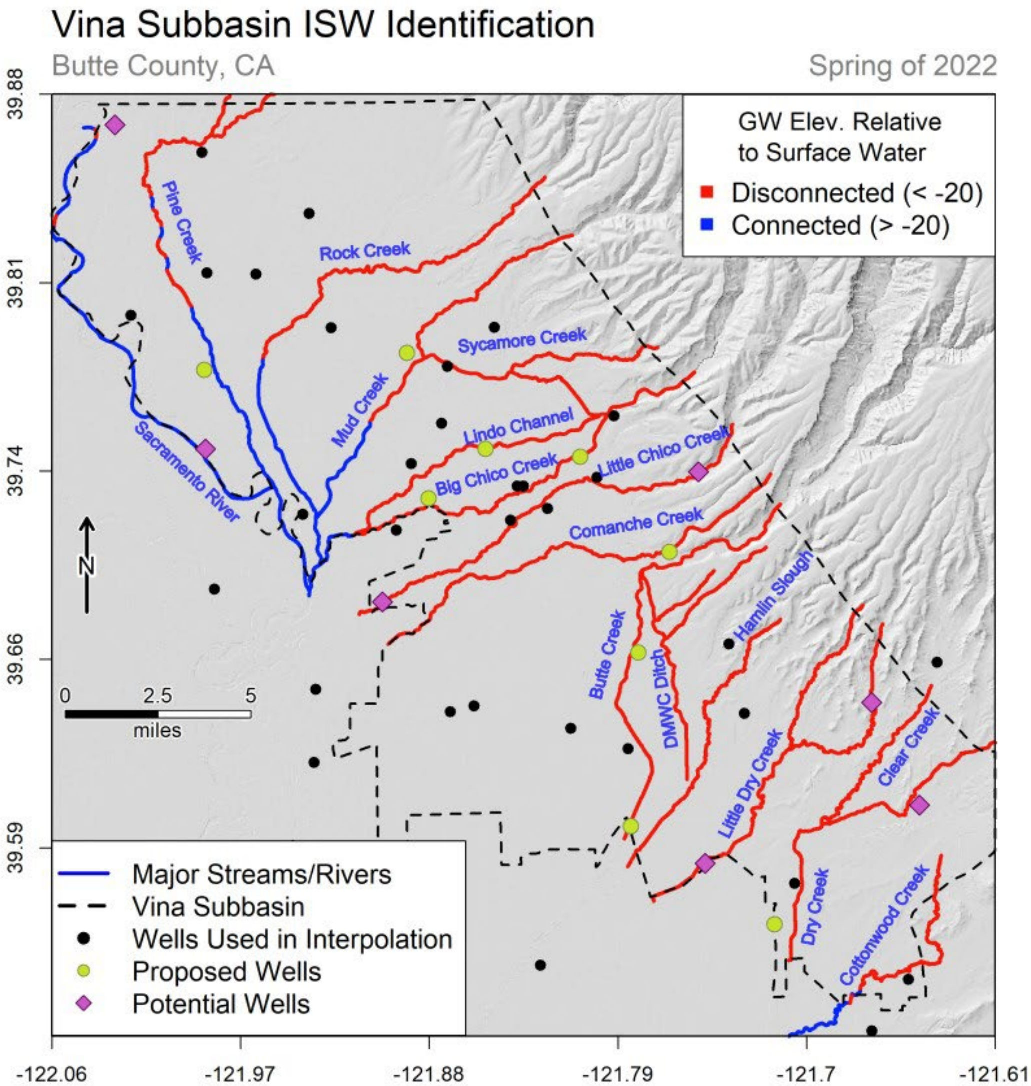

Figure 6: Comparison between shallow interpolated water surface elevations and LiDAR extracted streambed elevations in the spring of 2022.

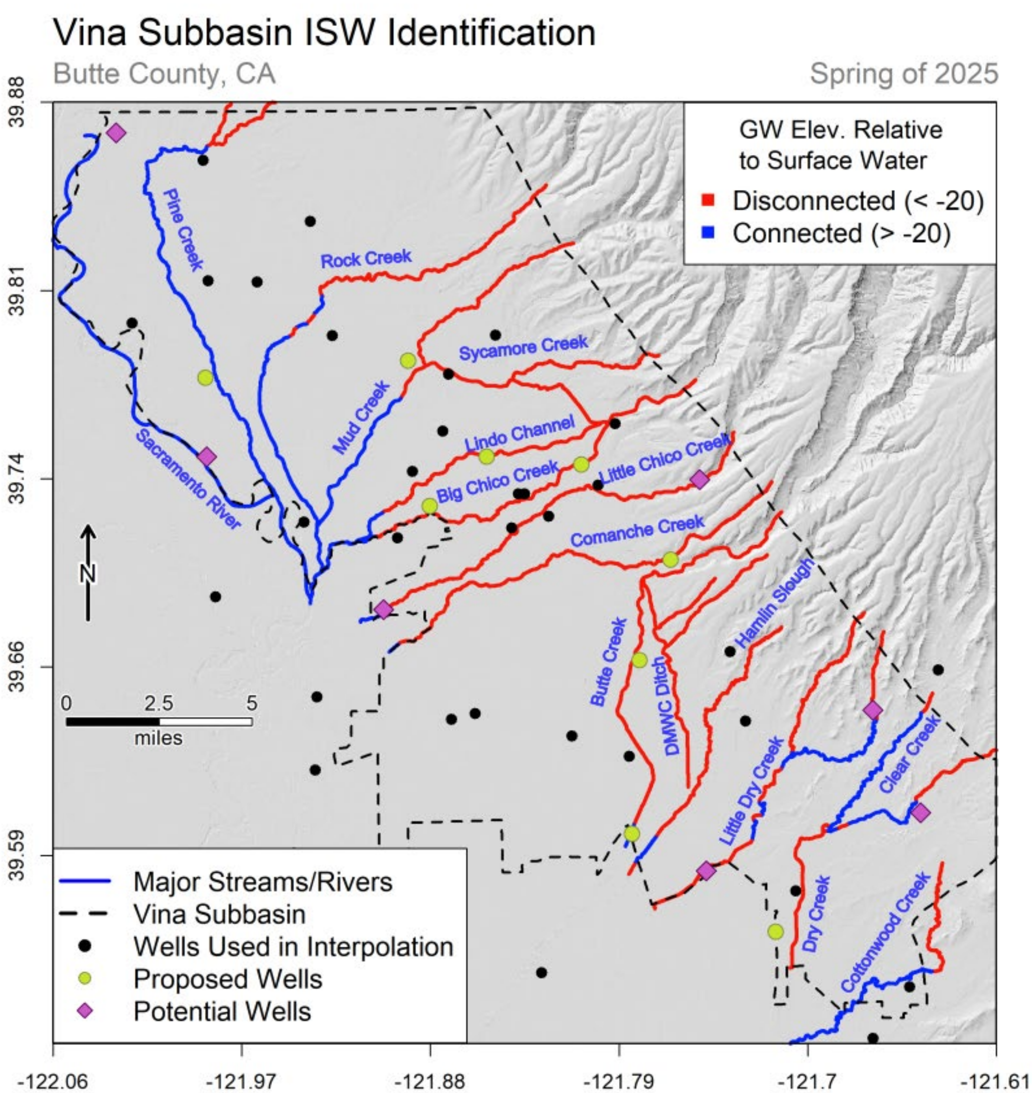

Figure 7: Comparison between shallow interpolated water surface elevations and LiDAR extracted streambed elevations in the spring of 2025.

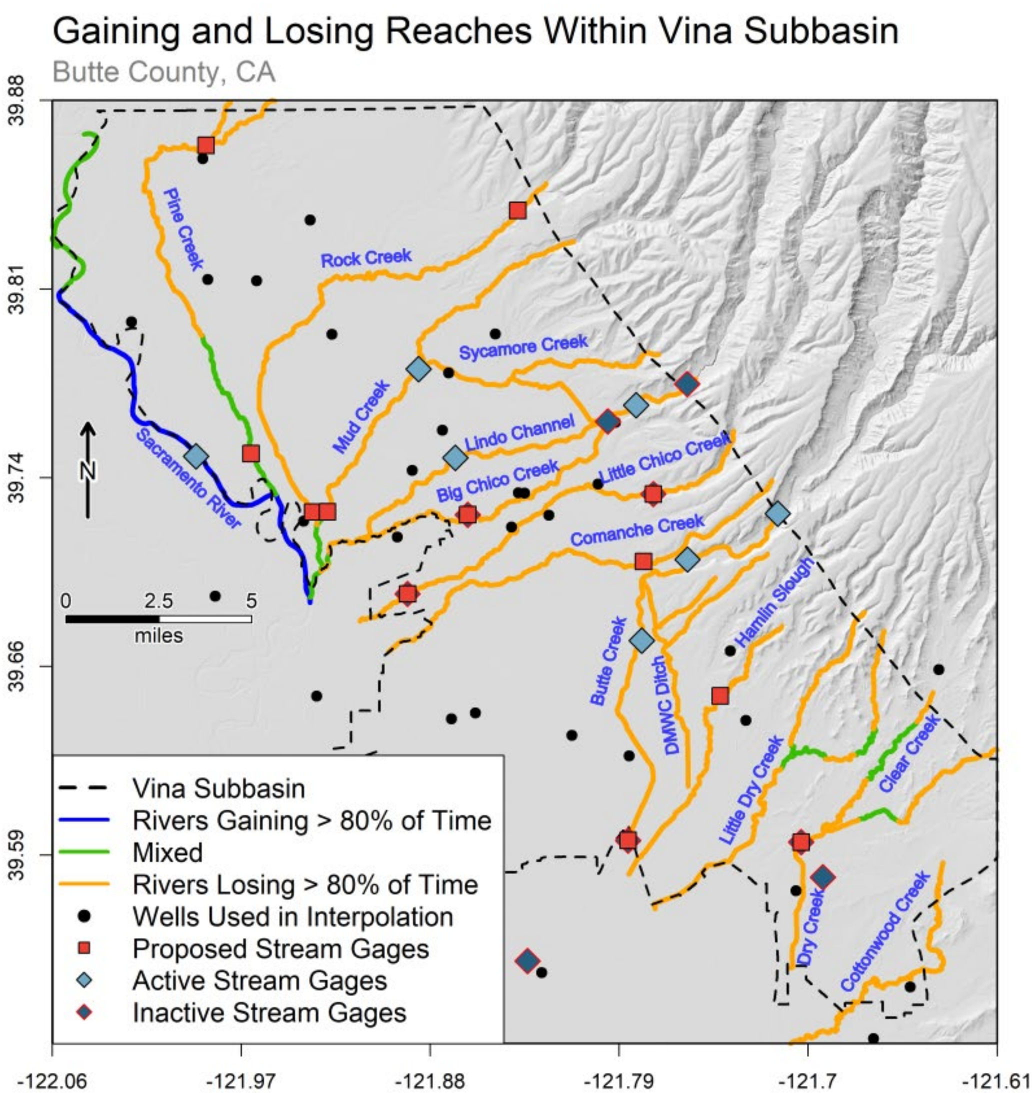

Figure 8: Use of Interpolated water surface elevations and LiDAR extracted water surface elevations over the period from 2000 through 2025 to determine the percentage of time in which a given reach is gaining.

2.1.3 ISW Identification through Isotope Sampling

To understand ISW interactions on a finer timescale than seasonal groundwater interpolations can provide, radon-222 and stable isotopes of the water molecule along Big Chico and Butte Creeks were sampled monthly June through October of 2025. Samples were taken from six locations along Big Chico Creek and four locations along Butte Creek as shown on Figure 9.

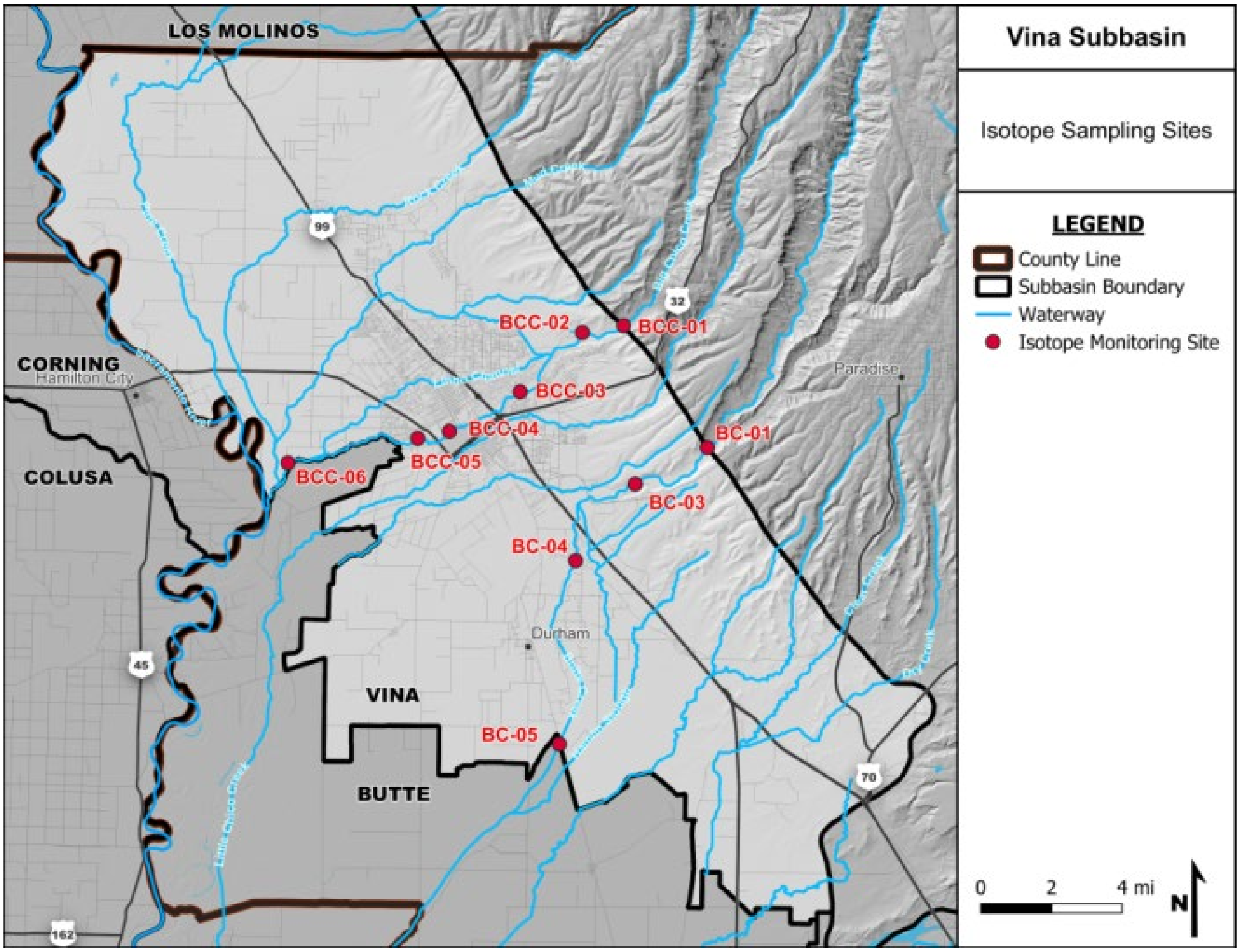

Figure 9: Isotope Sampling Locations along Big Chico and Butte Creeks.

Firstly, radon-222 is a naturally occurring short-lived radioactive noble gas that is produced in geologic material and accumulates in groundwater. As groundwater discharges to the surface, radon-222 quickly degasses, and its presence therefore indicates a localized groundwater contribution to surface water flows. In a 2005 USGS study of the South Sacramento Valley, groundwater radon-222 was measured at between 200-700 pCi/L (USGS, 2005). Therefore, it would be expected that surface water in the Vina Subbasin receiving groundwater inputs (i.e. gaining) should contain elevated levels of radon-222. Secondly, as the ratio of stable isotopes of the water molecule (^{16}O,^{18}O,^{1}H,^{2}H) varies due to natural hydrologic processes such as evaporative fractionation and precipitation altitude, sampled water bodies with different source areas should be detected as having distinct isotopic fingerprints (Jameel et al., 2019; Visser et al., 2016). The combination of radon-222 and isotopes of the water molecule allow us to detect seasonal and local groundwater inputs, source area elevation, and evaporative signatures (Castaldo et al., 2021).

In terms of radon-222, low activities (< 4 pCi/L) were observed compared to the 200-700 pCi/L expected from a groundwater signal in all samples (Figures 10 & 11). When combined with the results discussed in the previous section, it is confirmed that the Big Chico and Butte Creeks are losing, which matches BBGM modeled results and groundwater level approach as shown in Figures 3 and 8; respectively. In terms of stable water isotopes, samples taken on Butte Creek from a distinct group and are more depleted in heavy isotopes when compared to those taken on Big Chico Creek, signaling a higher elevation source area for Butte Creek (Figure 12, Castaldo et al., 2021). Samples on both Butte and Big Chico Creek are furthermore close to the Global Meteoric Water Line (GMWL), implying limited impact of evaporative fractionation (Figure 13). This indicates that the streams act as a source of recharge to the local aquifer system without significant water loss through evaporation during transit.

Given the general agreement between the results of groundwater elevations, radon, and stable water isotopes we can conclude that neither Butte Creek nor Big Chico Creek receive groundwater inputs and are disconnected from groundwater a majority of the time. This result has slight disagreement in the far lower reaches of Big Chico Creek when compared to BBGM modeled results. However, it should be noted that the isotope portion of this study represents a snapshot in time and may not capture transitions from gaining to losing or vice versa that occur over time. The isotope study may be continued as funding allows to assess seasonal trends and impacts from groundwater level fluctuations.

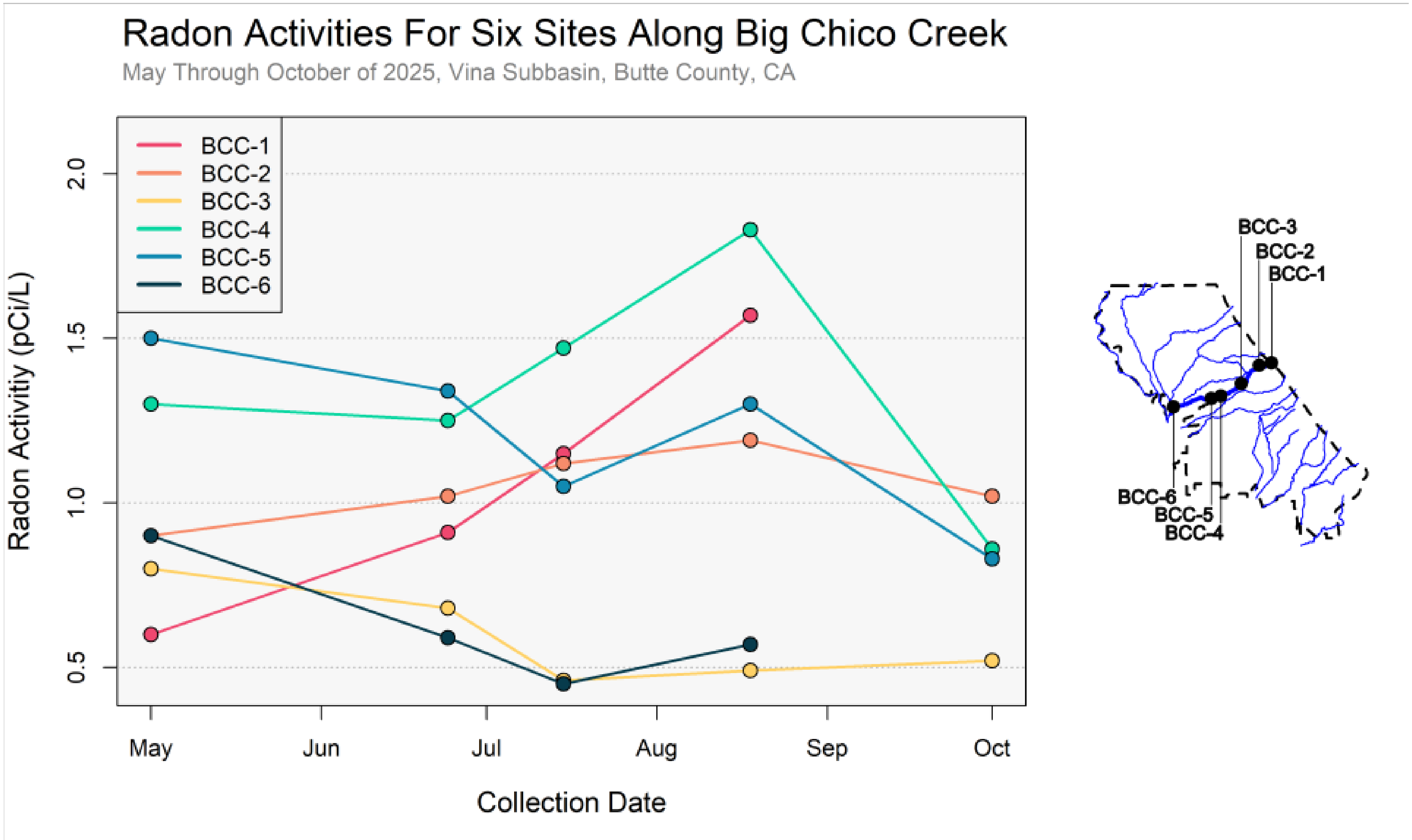

Figure 10: Radon activity for sampled sites along Big Chico Creek in May through October of 2025

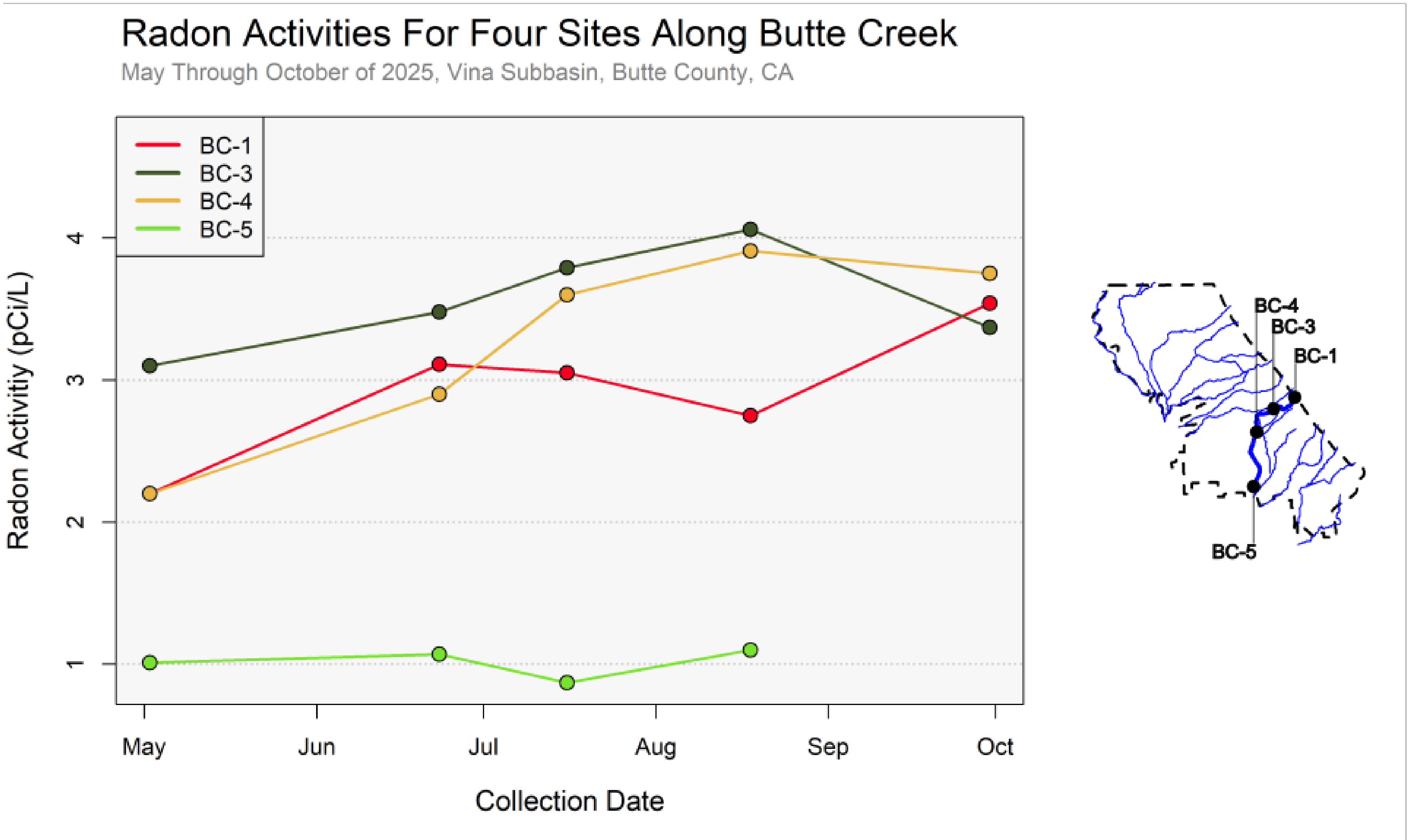

Figure 11: Radon activity for sampled sites along Butte Creek in May through October of 2025

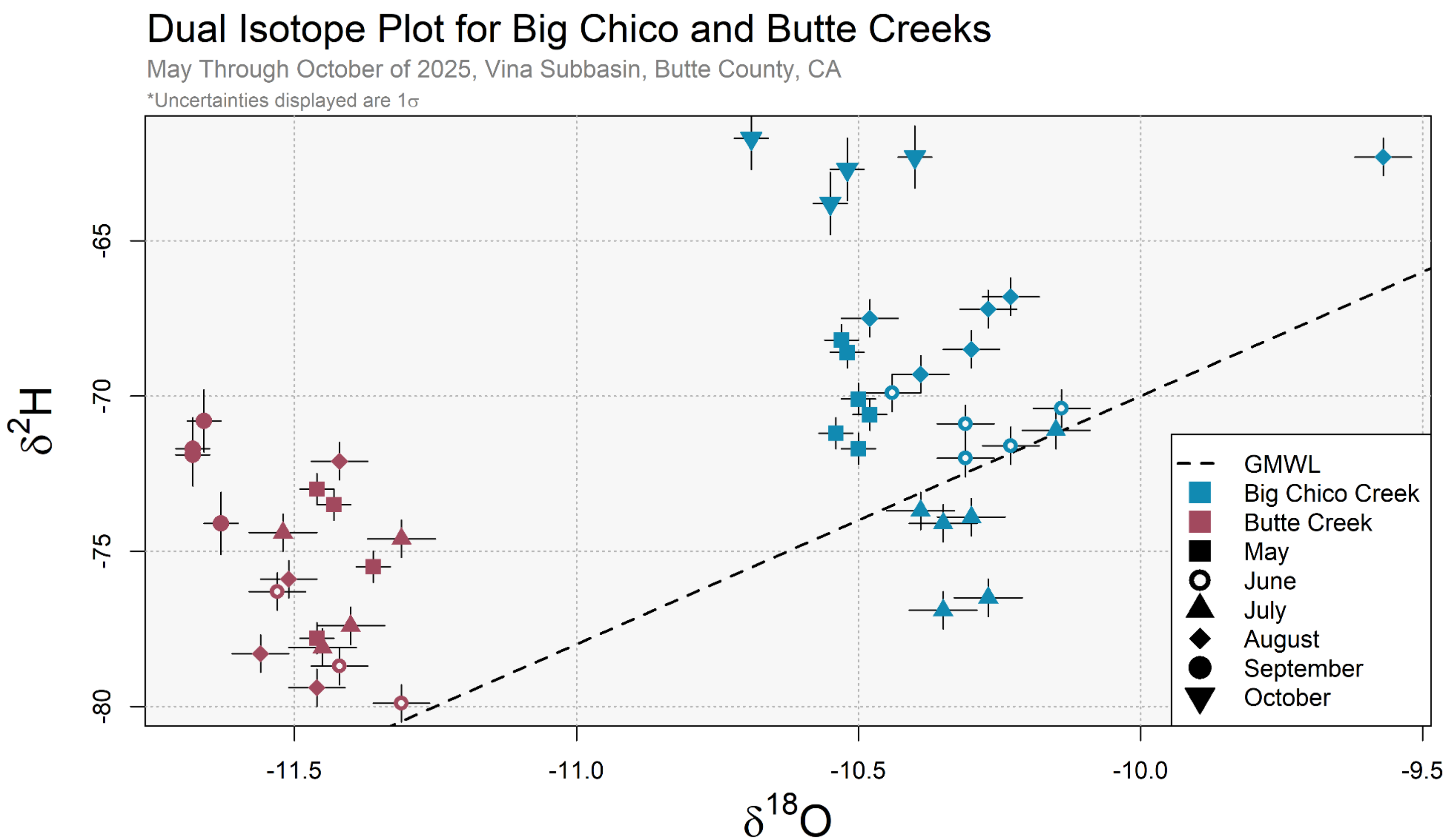

Figure 12: Dual isotope plot for isotopes of the water molecule at sampled sites along Big Chico and Butte Creeks in May through October of 2025. Delta notation is relative to Vienna Standard Mean Ocean Water (VSMOW). Global Meteoric Water Line (GMWL) is defined by the equation $\delta D = (8 * \delta^{18}O) + 10$ ‰.

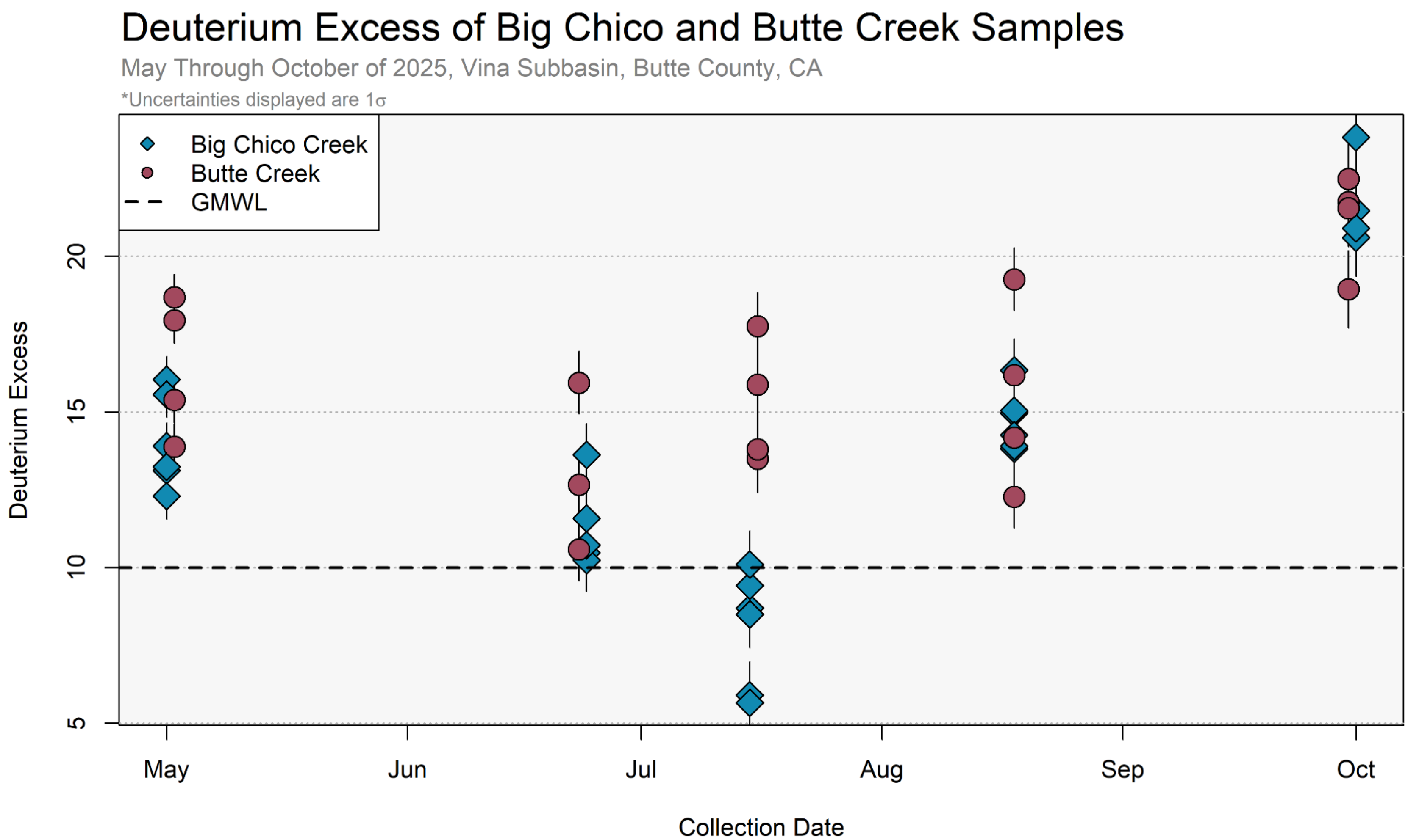

Figure 13: Deuterium excess of Big Chico and Butte Creek samples. Samples taken in June through October of 2025. Deuterium excess defined by the equation Excess = $\delta D - 8 * \delta^{18}O$.

SECTION 3: SUMMARY AND CONCLUSIONS

This document details efforts in the Vina Subbasin to identify ISW locations using the updated BBGM, LiDAR extracted surface water elevations in conjunction with interpolated groundwater elevations, and stable and radioactive isotope tracers. Based on best available information and data (including multiple lines of evidence), streams are primarily disconnected, except for the Sacramento River and short stream segments in the most western part of the Subbasin as summarized in Table 3. Disconnected streams are not impacted by groundwater pumping; therefore, not subject to SGMA. The new shallow monitoring wells and stream gages (installed in 2026) will help fill remaining data gaps. These conclusions are subject to change as additional information becomes available.

Key preliminary findings include:

- The Sacramento River is primarily a gaining stream and is subject to depletions from groundwater pumping. Depletions from the Sacramento River are not considered to have the potential for significant and unreasonable impacts on beneficial uses and users of the river. It is estimated that the Sacramento River experiences depletions due to groundwater pumping within Vina and adjacent subbasins.on the order of 38 CFS (or 16 TAF per year) June through December.
- Perennial streams traversing the Subbasin including Big Chico and Butte Creeks are disconnected from the principal aquifer. Localized perched aquifer layers may influence stream gains / losses. Locations and extent of perched aquifers remain a data gap; however, several studies and site-specific evaluations have confirmed perched layers do exist within the Subbasin. The new shallow wells will help fill data gaps along Big Chico and Butte Creeks.
- Several streams across the Subbasin are ephemeral including Pine, Mud, Rock, Little Chico, Dry, and Little Dry Creeks. Depletions from pumping are limited to when the stream is flowing and the stream is connected to the aquifer. Stream flows typically end by June which leads to a small amount of potential gains / losses in the spring as pumping starts for the irrigation season. These streams are disconnected from the aquifer except for the lower reaches near the Sacramento River such as along Pine and Big Chico Creeks. These segments are likely influenced by the backwater effects from the Sacramento River. Therefore, depletions are not considered to have the potential for significant and unreasonable impacts on beneficial uses and users of surface water in these systems.

Table 3: Preliminary Connected and Disconnected Streams within the Vina Subbasin.

Stream	Type	Preliminary Status (Connected or Disconnected)	Length (miles)
Sacramento River	Perennial (flows controlled by USBR releases at Shasta Lake)	Connected - Gaining	23.4
Pine Creek	Ephemeral	Disconnected (except for lower ~5 miles)	12.6
Rock Creek	Ephemeral	Disconnected (except for lower ~1 miles)	13.4
Mud Creek	Ephemeral	Disconnected (except for lower ~2 miles)	13.2
Big Chico Creek	Perennial	Disconnected (except for lower ~2 miles)	10.7
Little Chico Creek	Ephemeral	Disconnected	11.9
Butte Creek	Perennial	Disconnected	11.8
Litte Dry Creek	Ephemeral	Disconnected	10.8
Dry Creek	Ephemeral	Disconnected	10.9
		Total:	118.7

SECTION 4: REFERENCES

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Appendices

APPENDIX A: DISCHARGES FROM STREAM GAGES WITHIN THE SUBBASIN

APPENDIX B: SHALLOW MONITORING WELL HYDROGRAPHS

APPENDIX C: SURVEYED TRANSECTS ACROSS STREAMS IN THE VINA SUBBASIN

Appendix A

Discharges from Stream Gages within Vina Subbasin

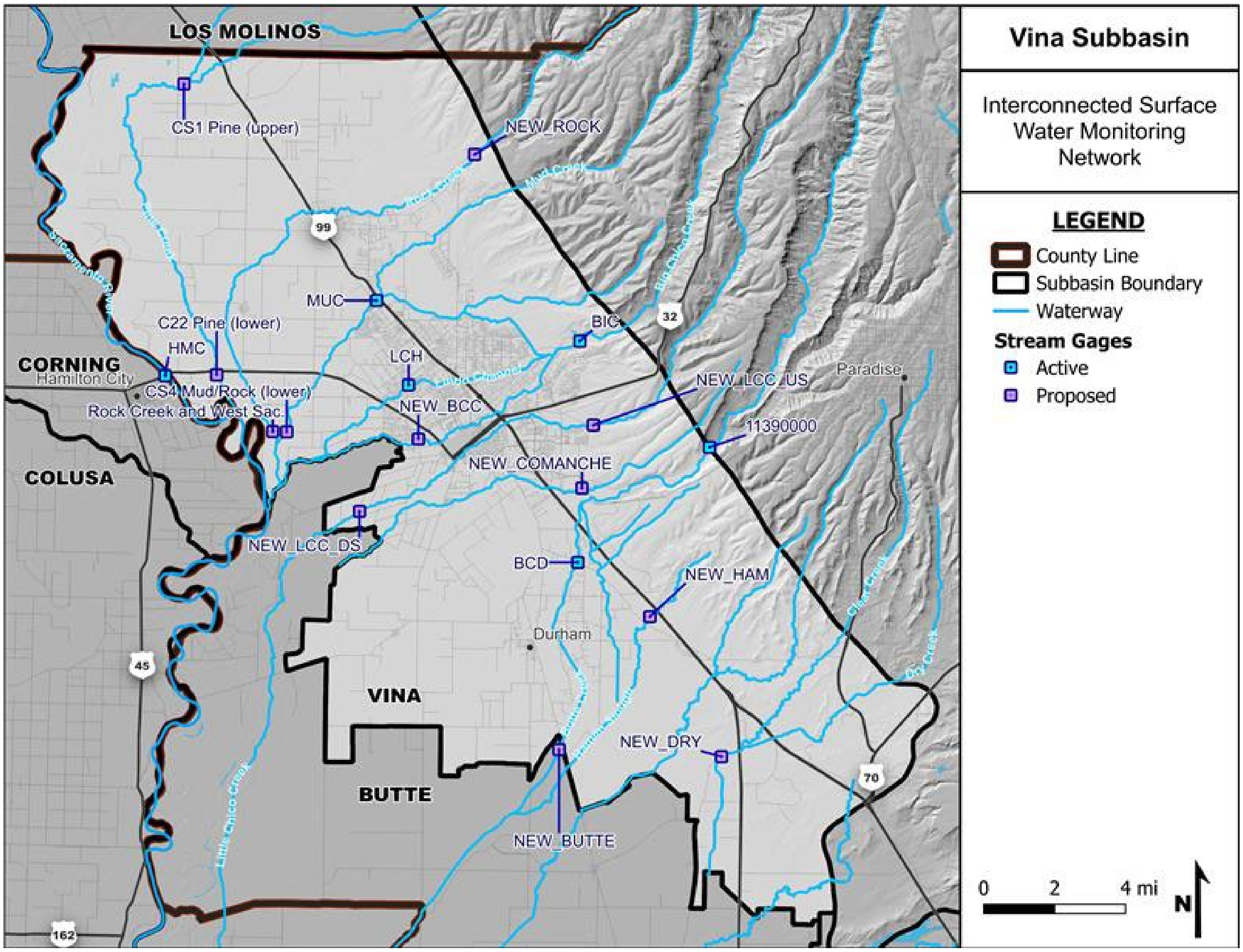
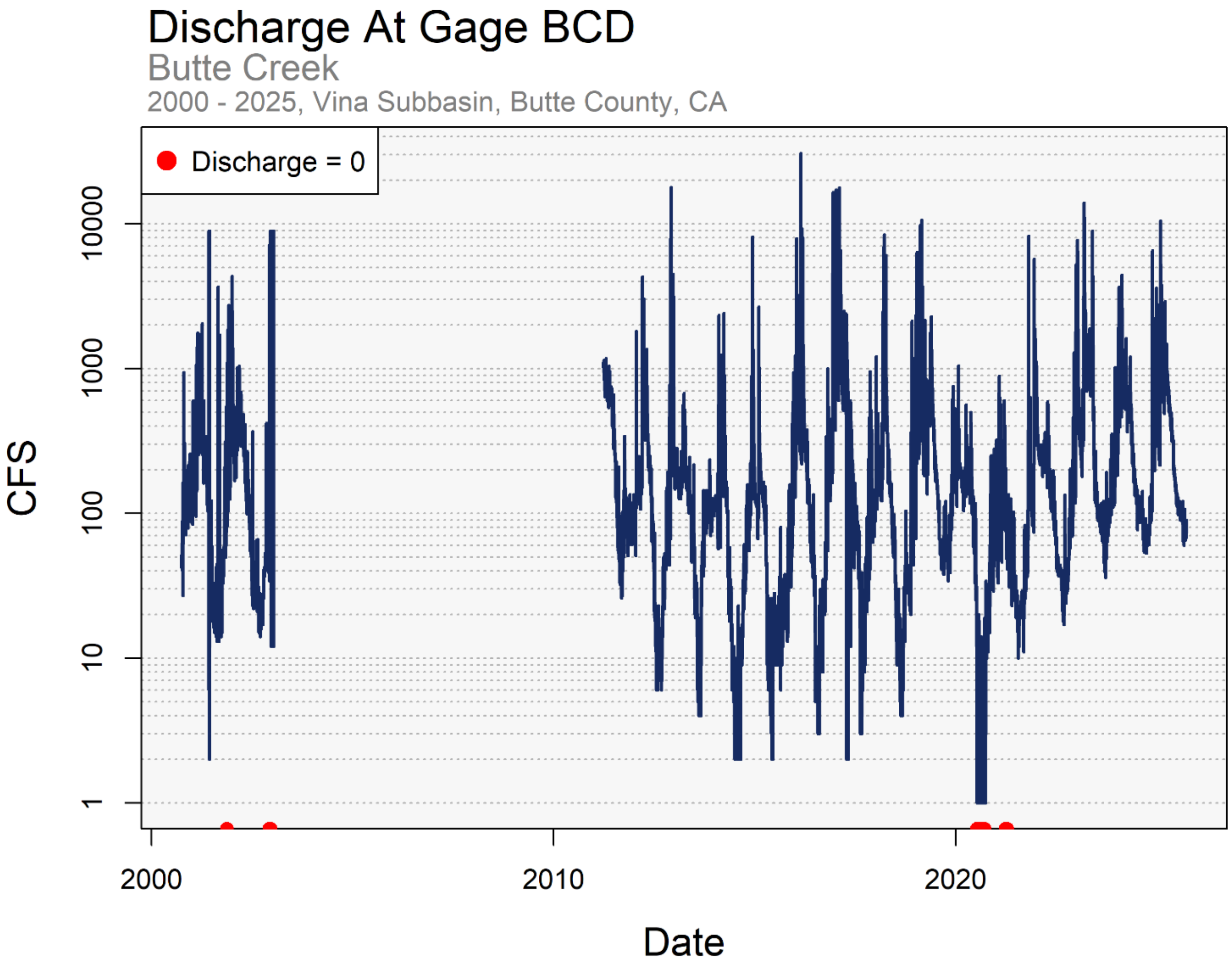


Figure A- 1: Map of active and proposed stream gages. Active gages have historical data. Proposed gages will be installed in 2026.



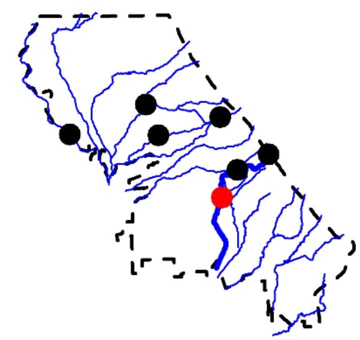


Figure A- 2: Discharge at CDEC gage BCD on Butte Creek between 2000 and 2025. For ease of visualization data has been log transformed.

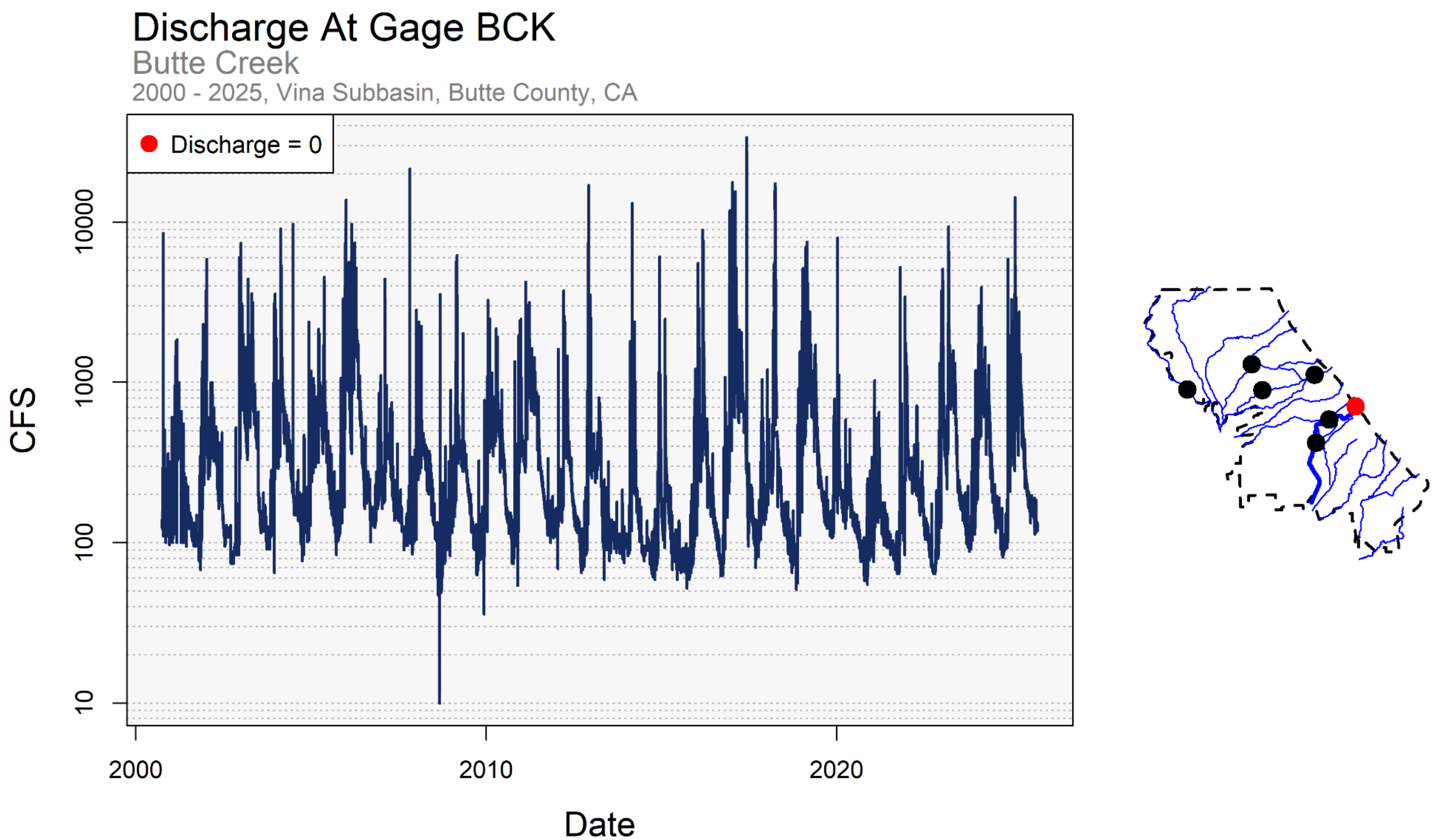


Figure A- 3: Discharge at CDEC gage BCK on Butte Creek between 2000 and 2025. For ease of visualization data has been log transformed.

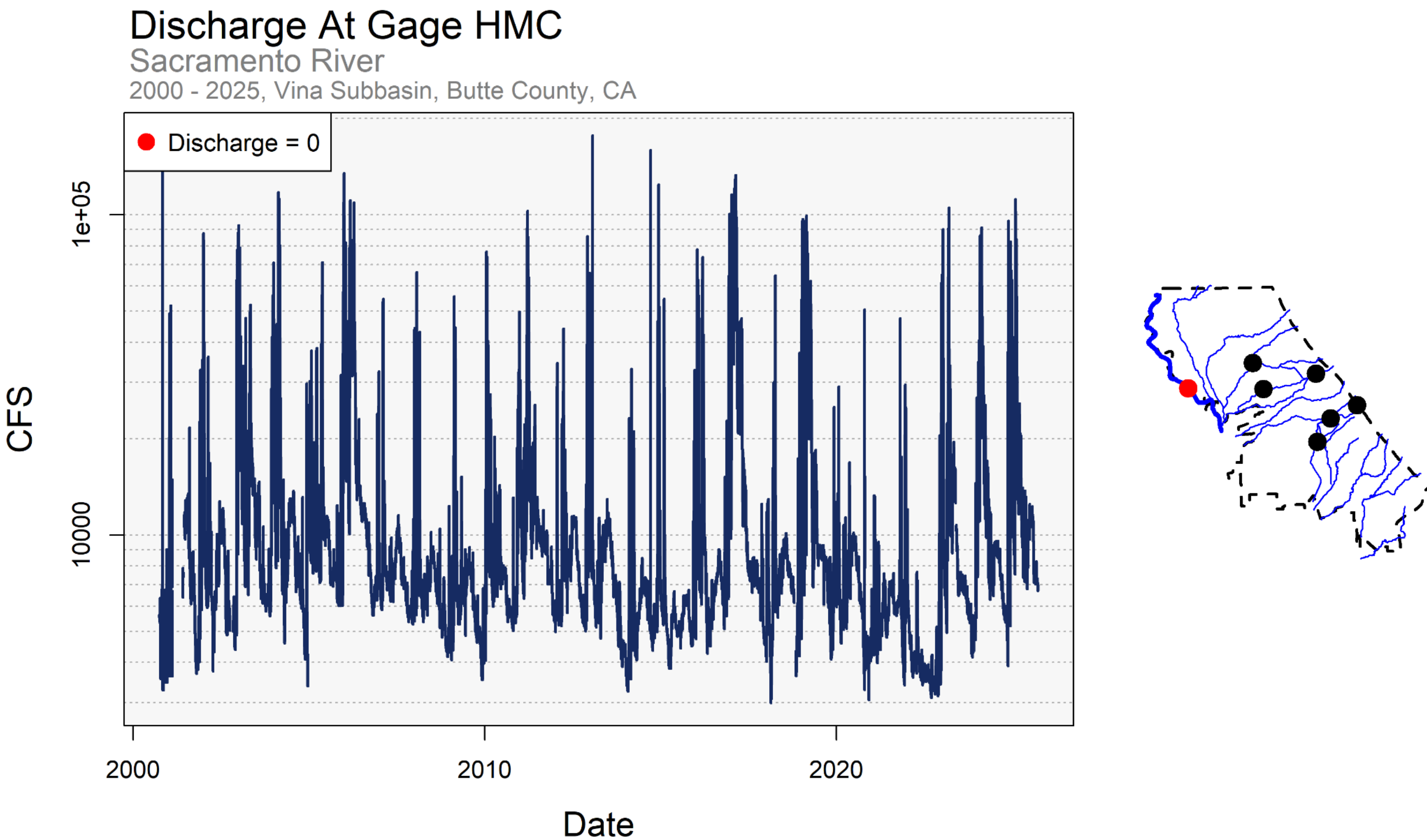
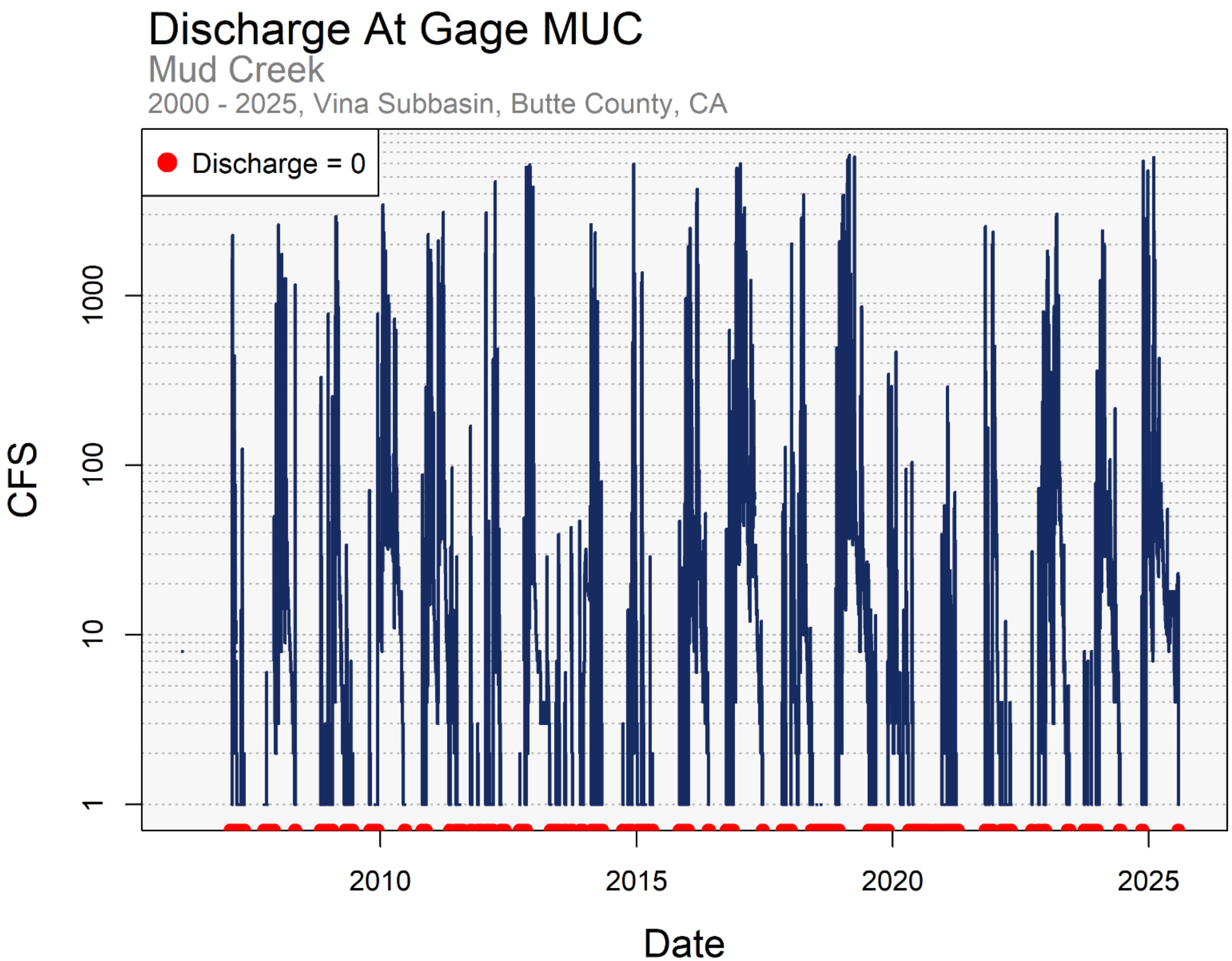


Figure A- 4: Discharge at CDEC gage HMC on the Sacramento River between 2000 and 2025.For ease of visualization data has been log transformed.



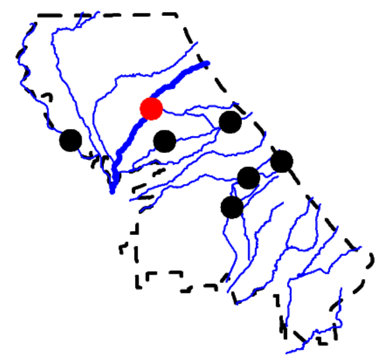


Figure A- 5: Discharge at CDEC gage MUC on Mud Creek between 2000 and 2025.For ease of visualization data has been log transformed.

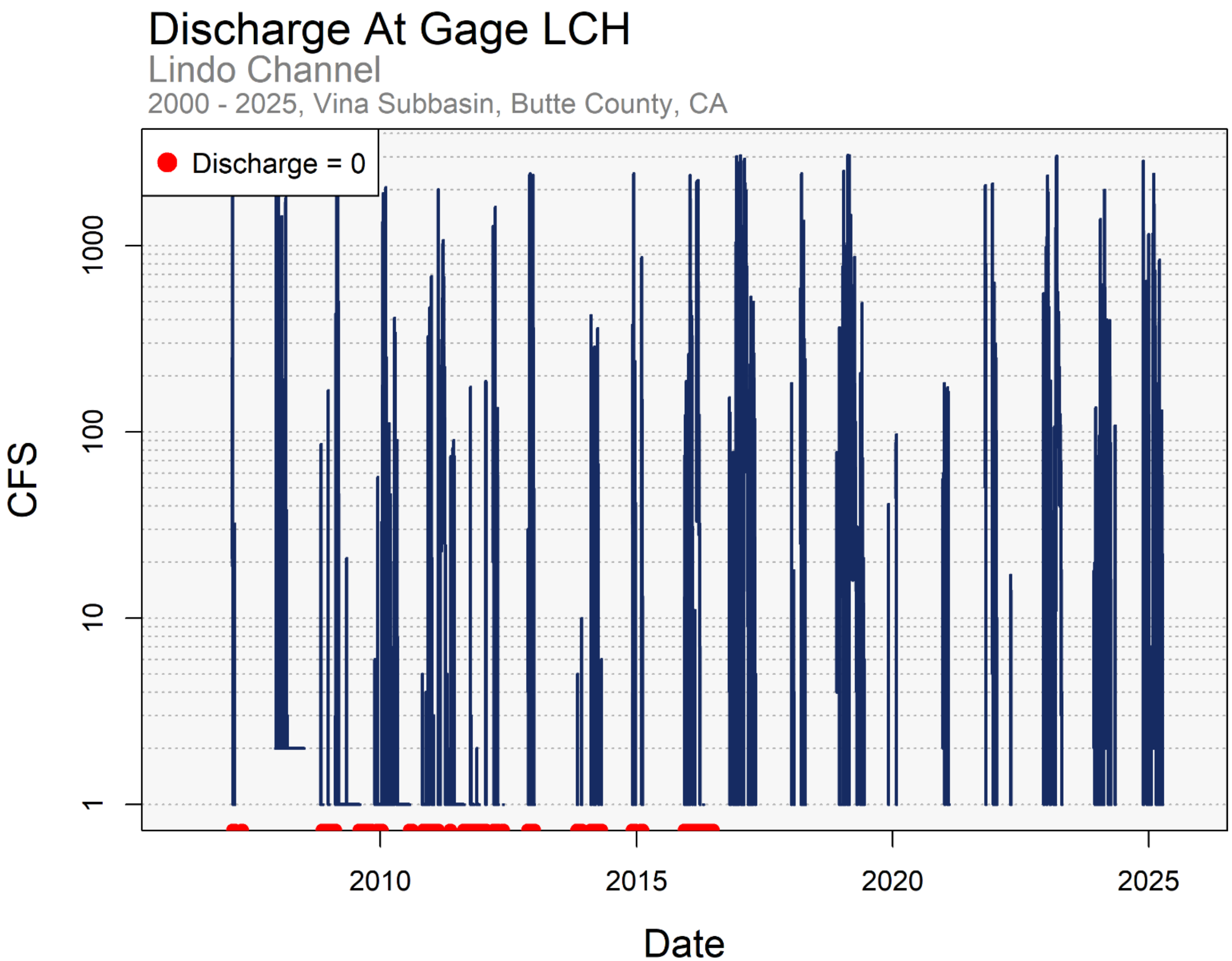


Figure A- 6: Discharge at CDEC gage LCH on Lindo Channel between 2000 and 2025.For ease of visualization data has been log transformed.

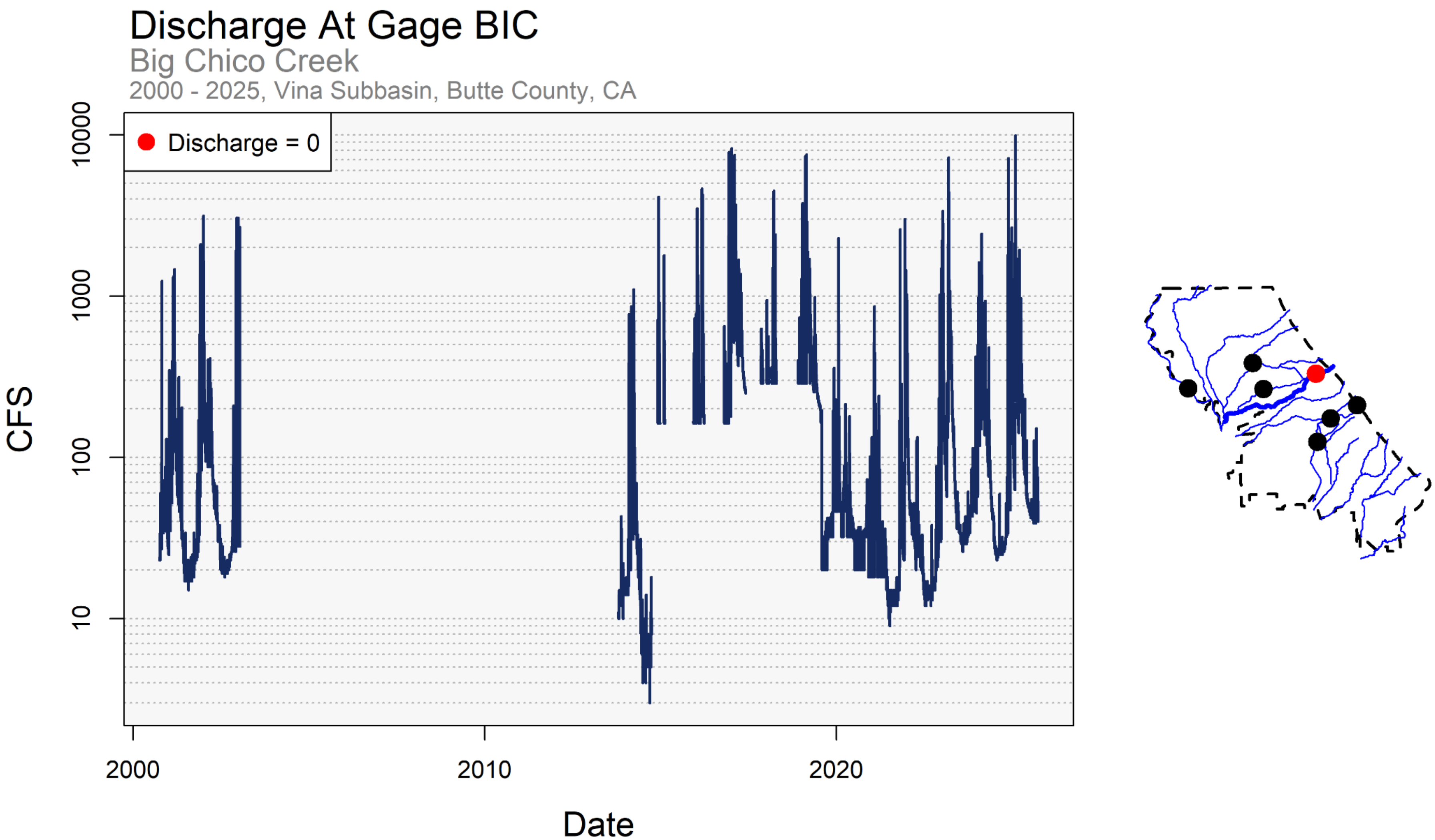


Figure A- 7: Discharge at CDEC gage BIC Big Chico Creek between 2000 and 2025.For ease of visualization data has been log transformed.

Shallow Monitoring Well Hydrographs

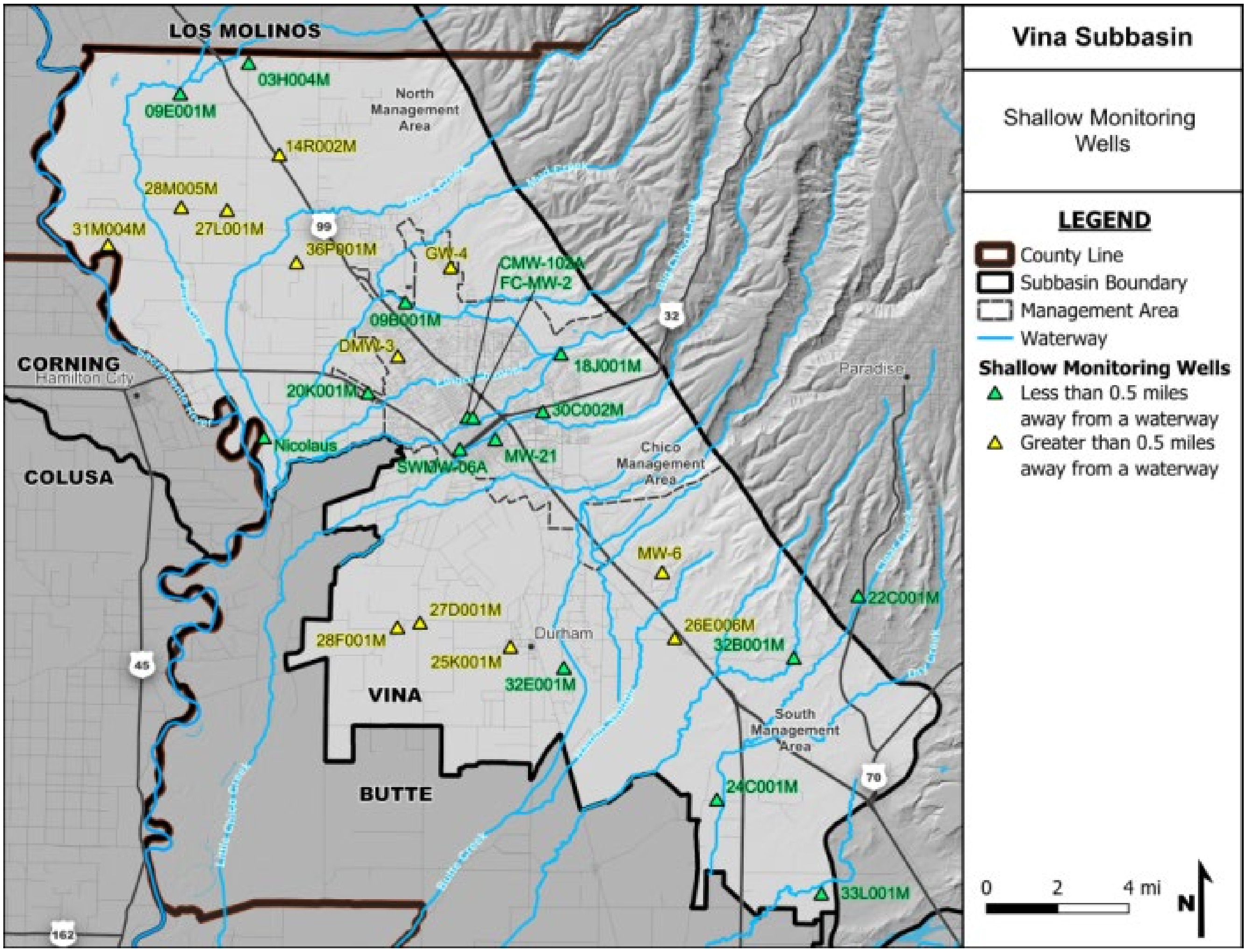
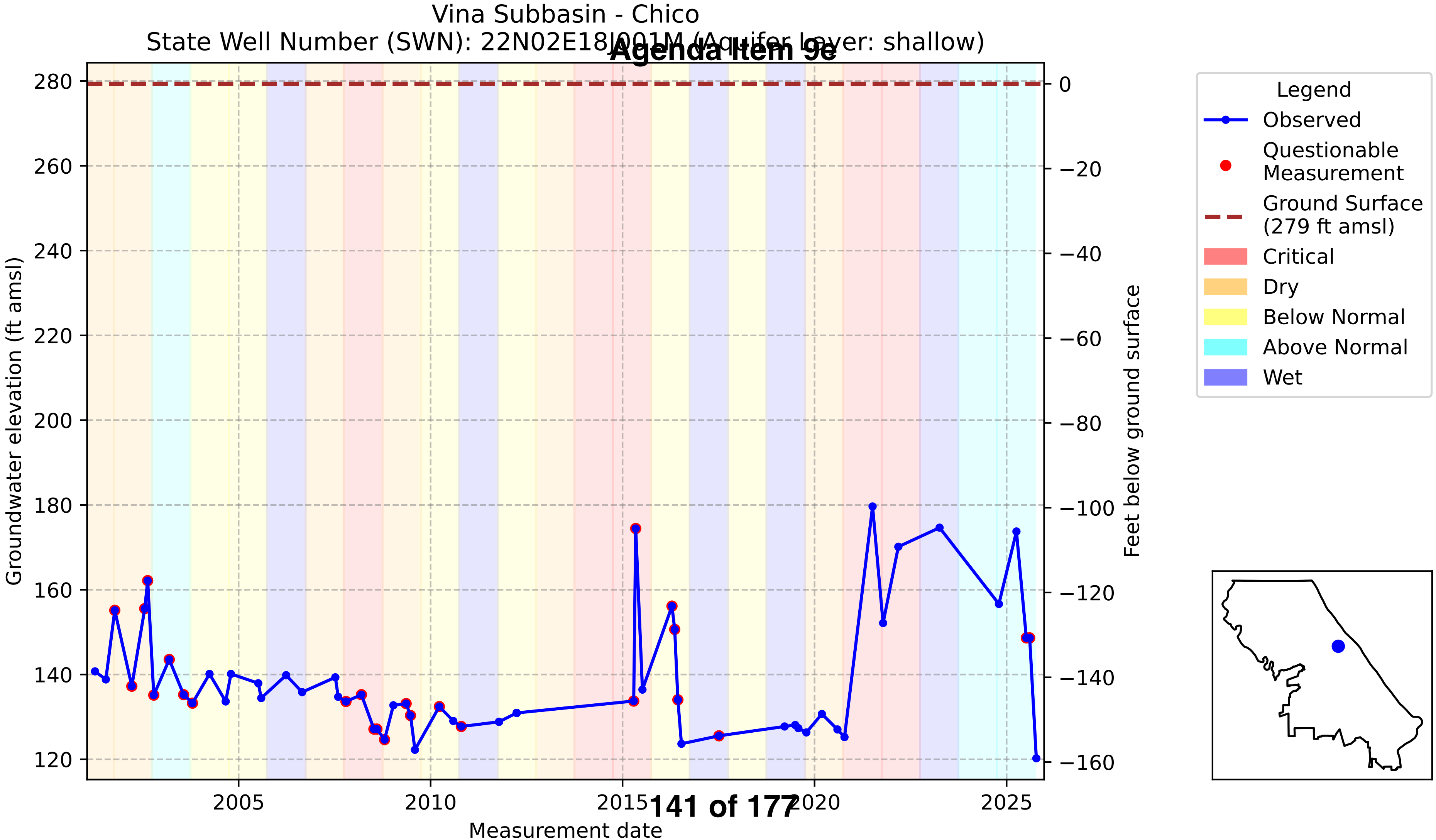
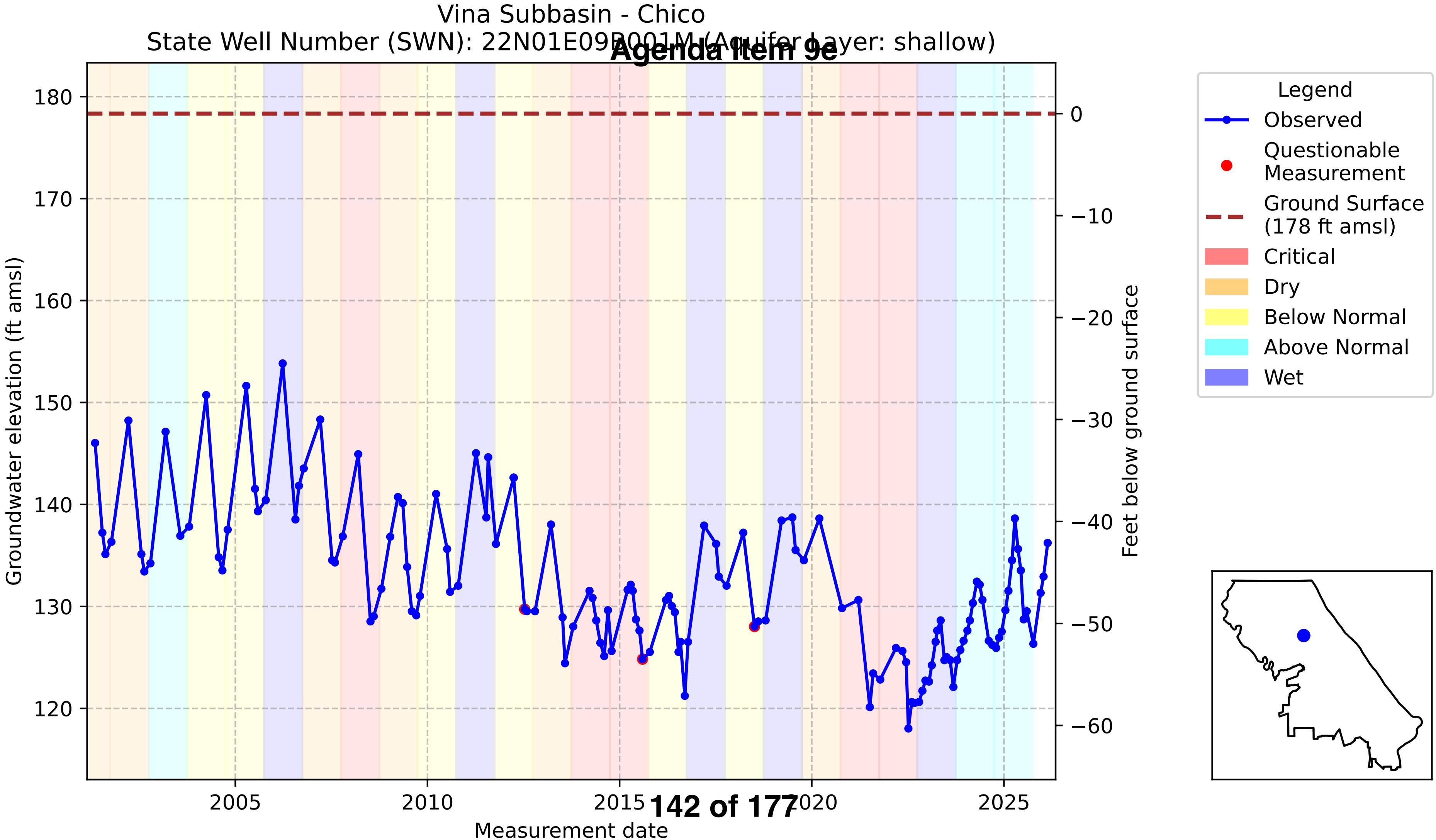
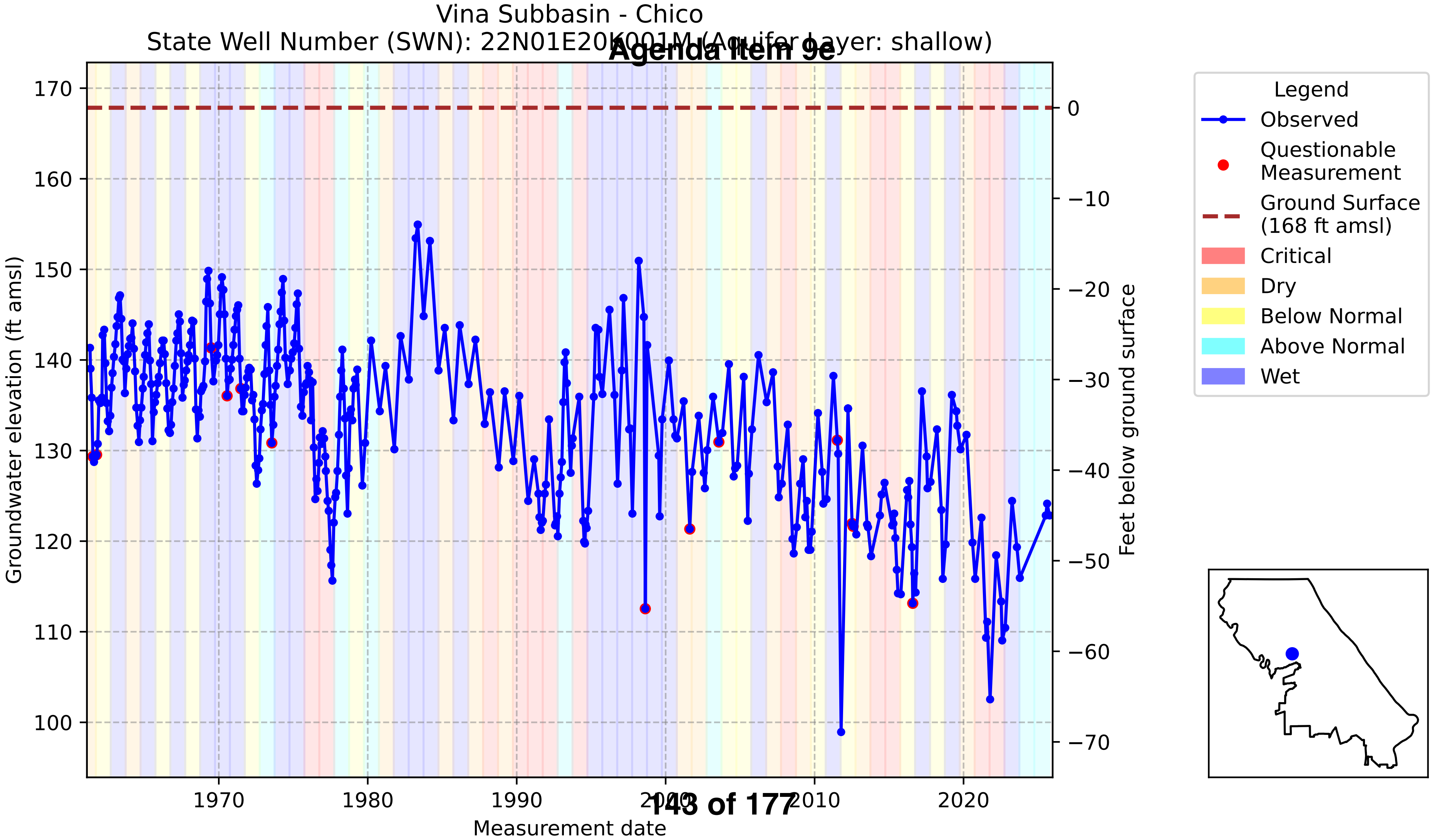


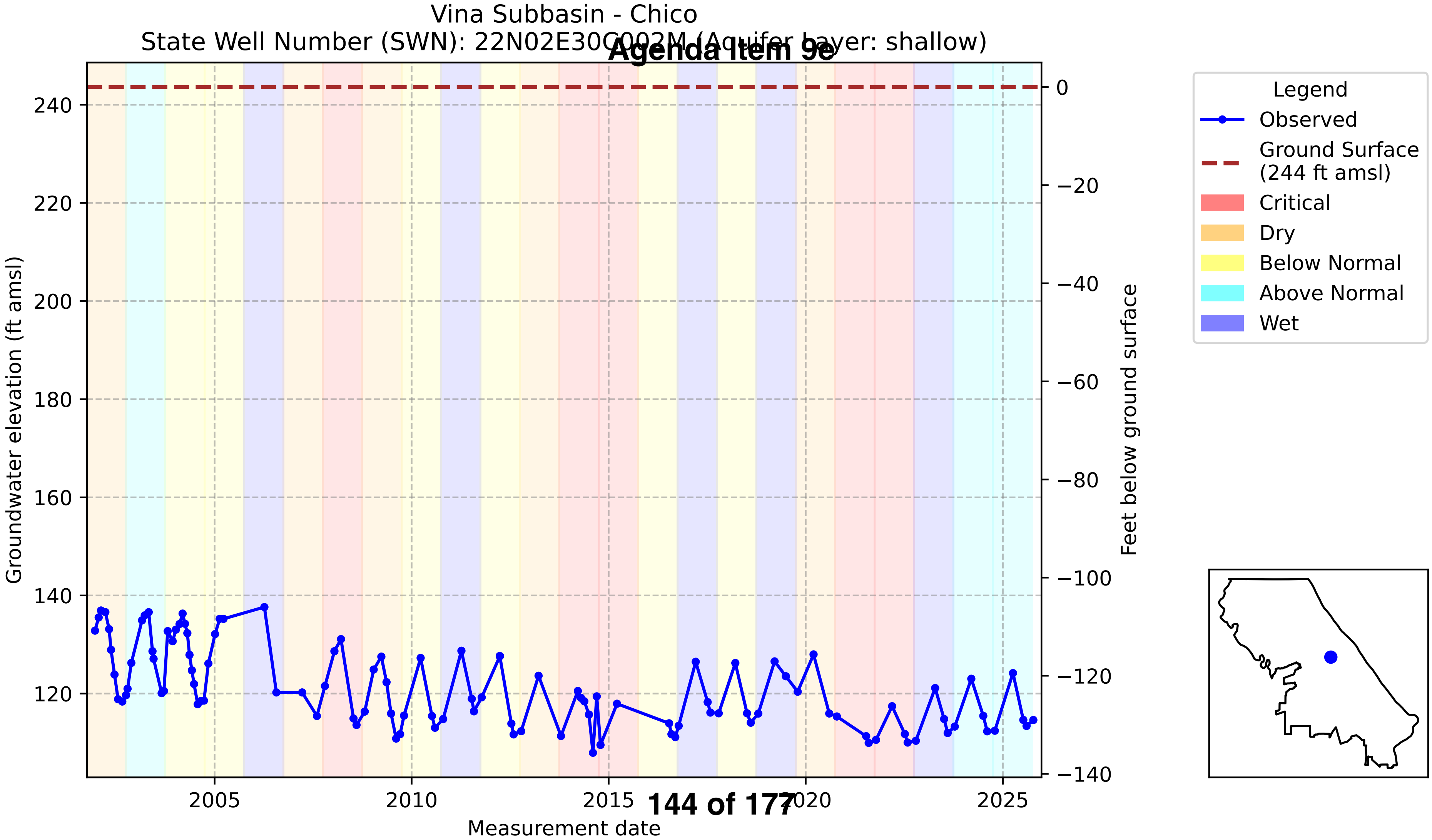
Figure B- 1: Shallow Monitoring Well Locations.

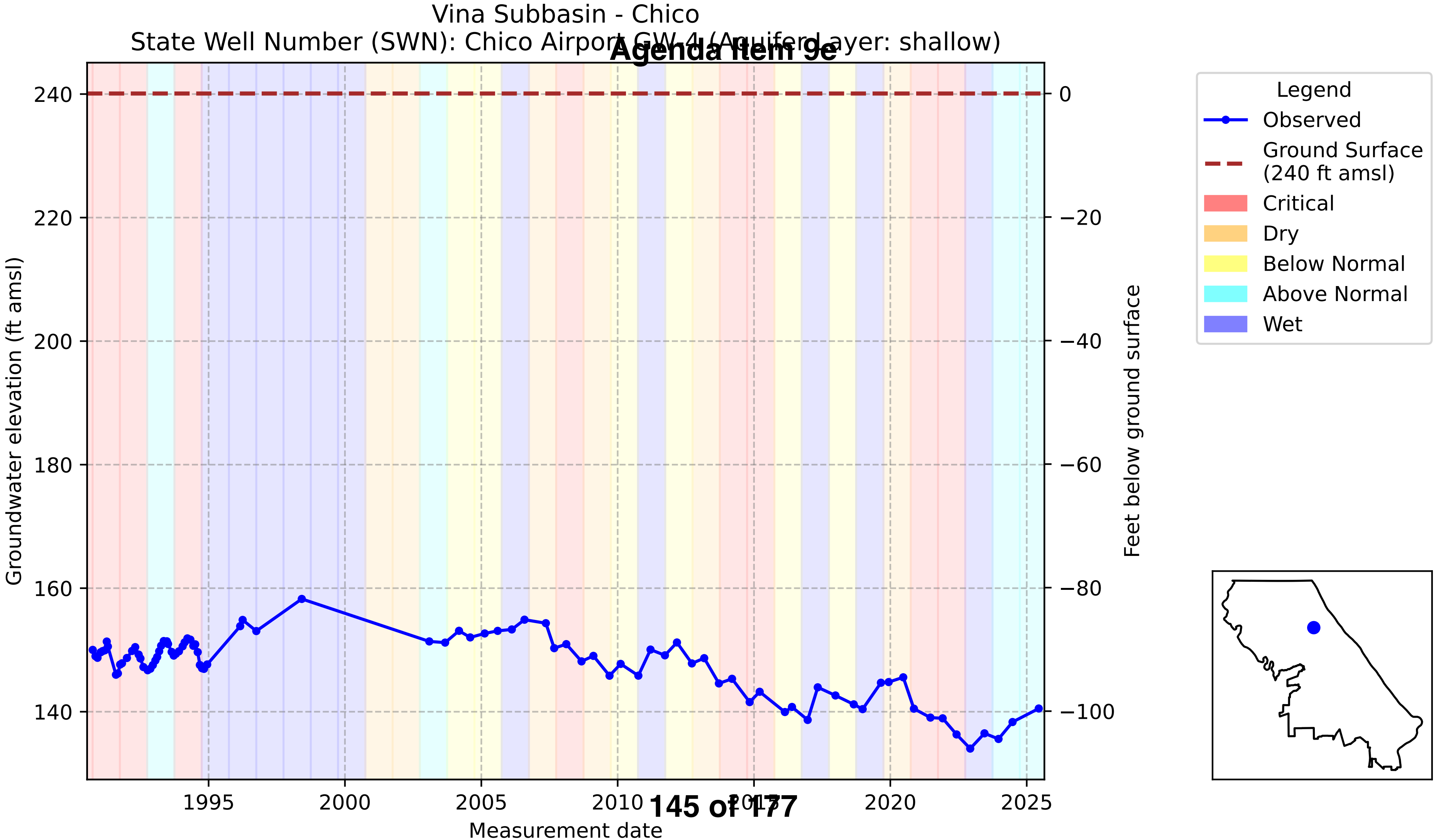

Vina Subbasin - Chico
State Well Number (SWN): 22N02E18J001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
280
260
240
220
200
180
160
140
120
0
−20
−40
−60
−80
−100
−120
−140
−160
2005
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (279 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

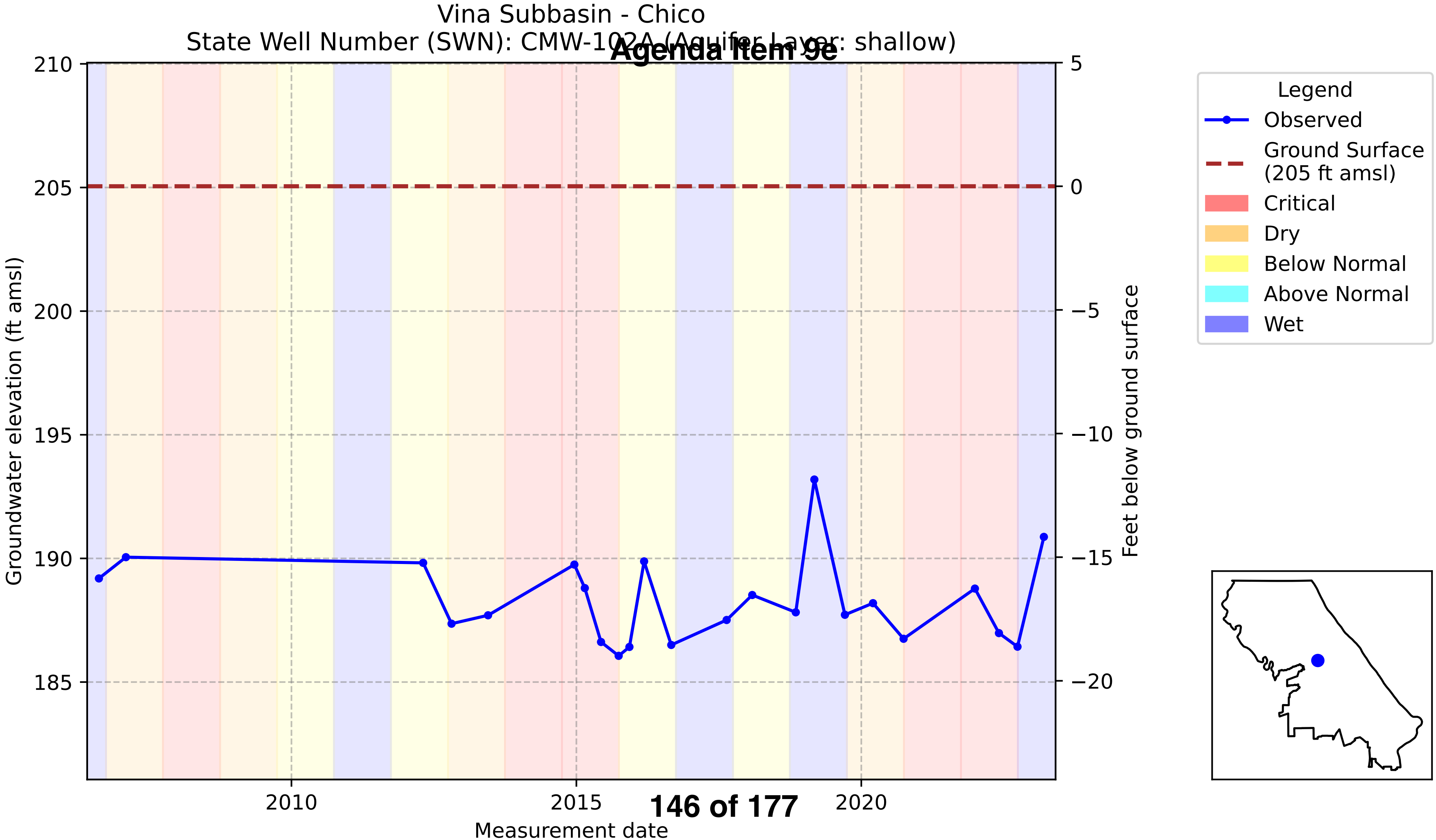

Vina Subbasin - Chico
State Well Number (SWN): 22N01E09B001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
180
170
160
150
140
130
120
0
−10
−20
−30
−40
−50
−60
2005
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (178 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

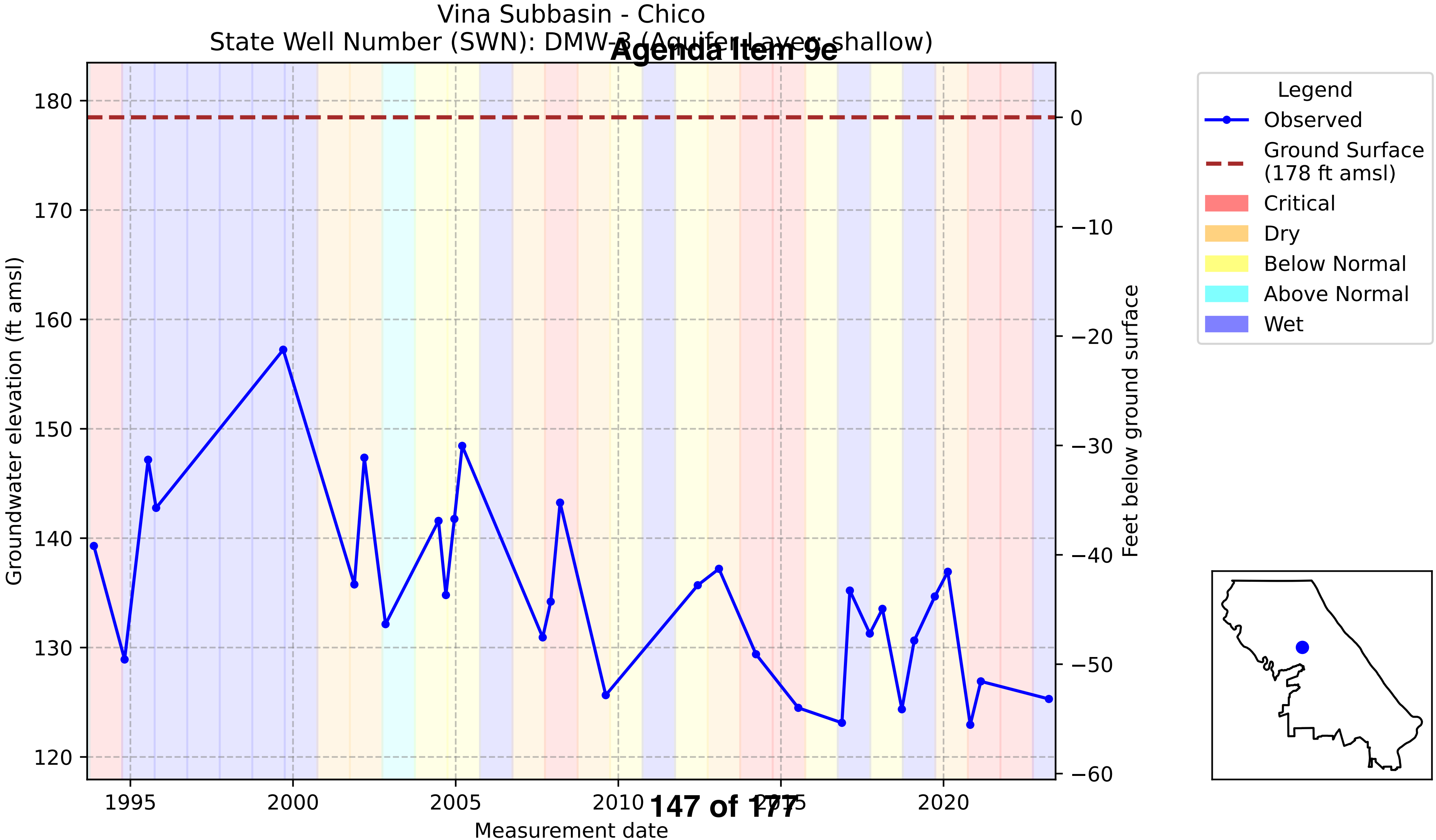


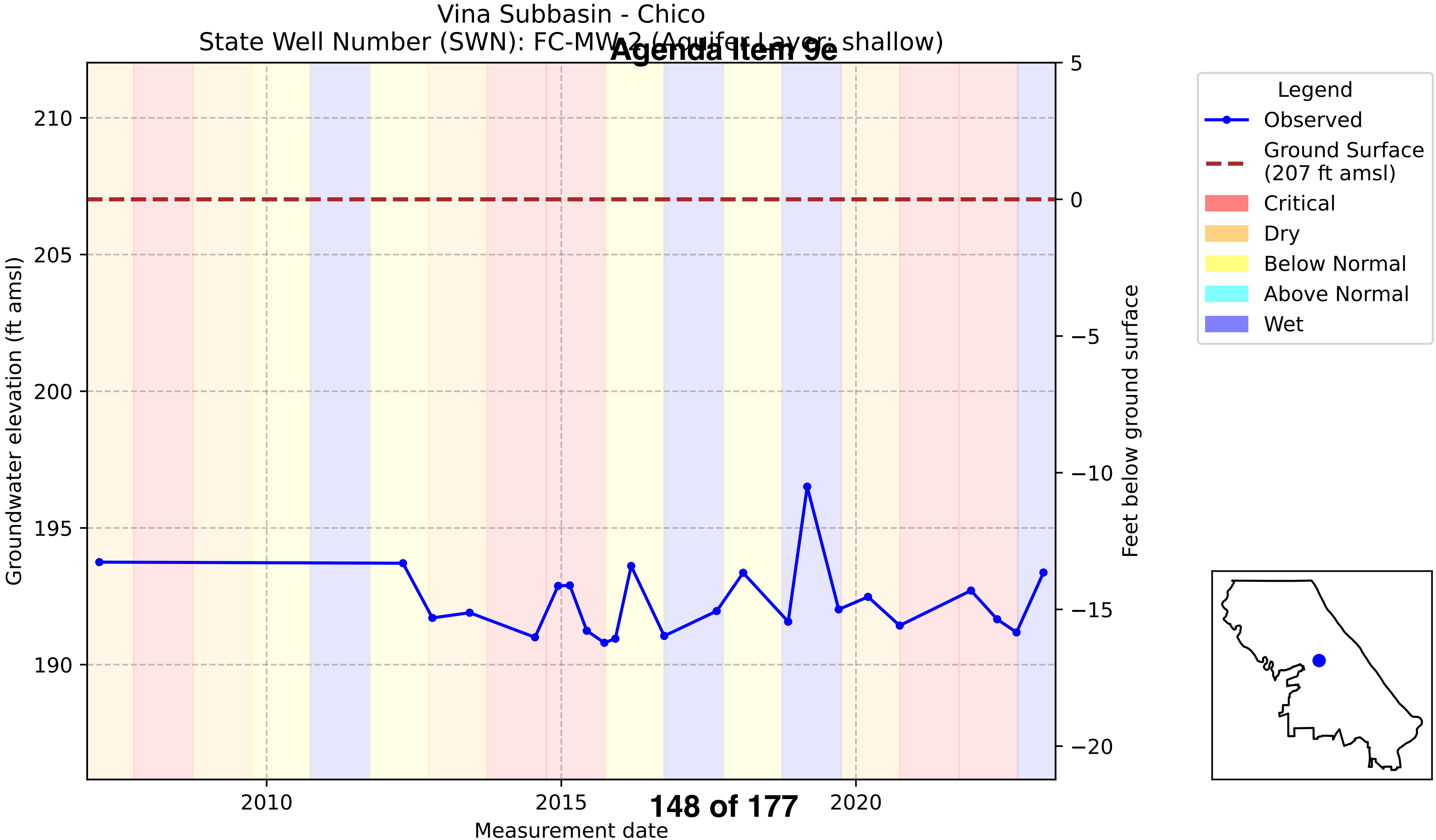
Vina Subbasin - Chico
State Well Number (SWN): 22N01E20K001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Observed
Questionable Measurement
Ground Surface (168 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

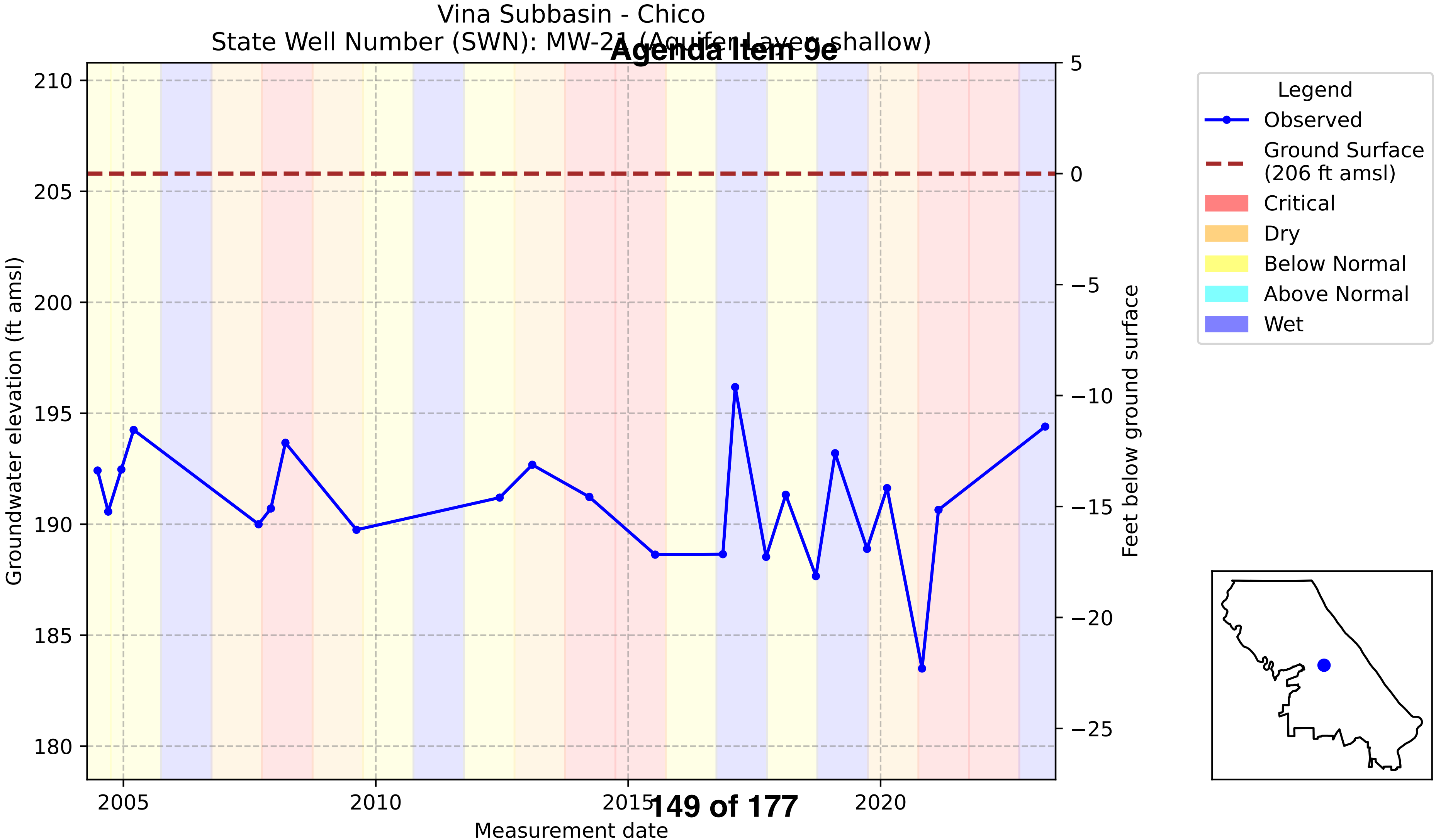

Vina Subbasin - Chico
State Well Number (SWN): 22N02E30C002M (Aquifer layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
240
220
200
180
160
140
120
0
−20
−40
−60
−80
−100
−120
−140
2005
2010
2015
2020
2025
Legend
Observed
Ground Surface (244 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

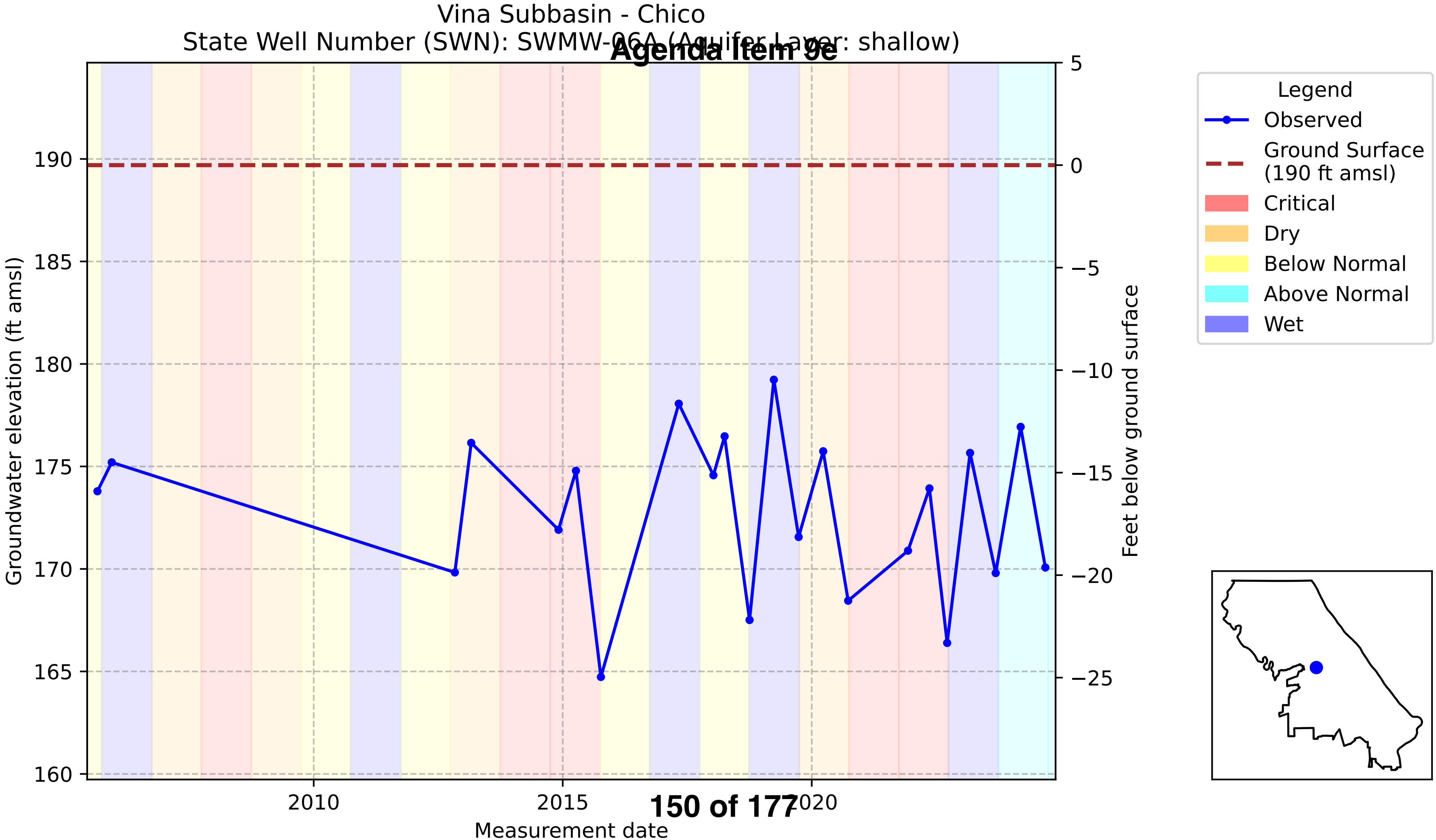

Vina Subbasin - Chico
State Well Number (SWN): Chico Airport GW-4 (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
240
220
200
180
160
140
0
−20
−40
−60
−80
−100
1995
2000
2005
2010
2015
2020
2025
Legend
Observed
Ground Surface (240 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

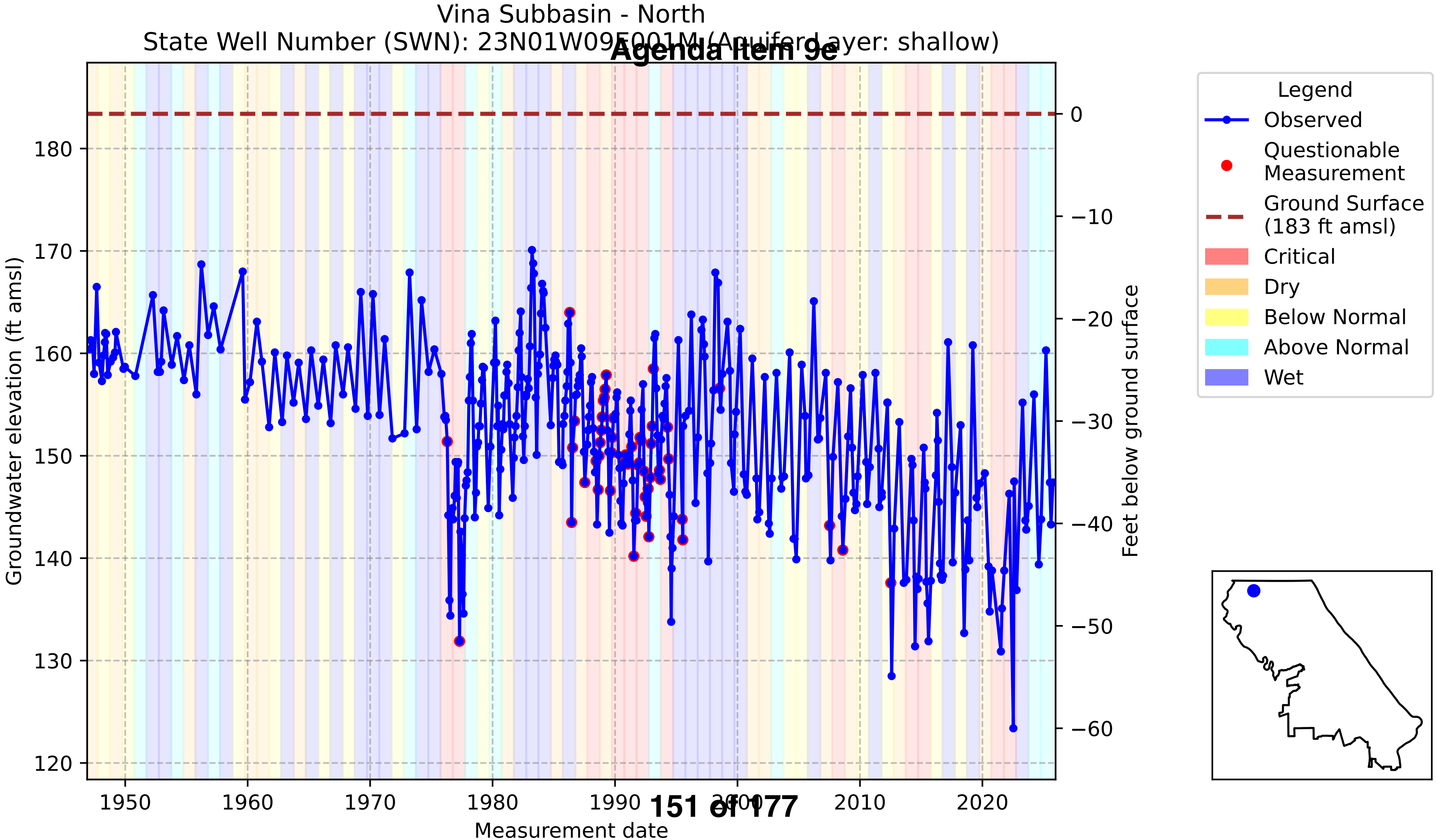

Vina Subbasin - Chico
State Well Number (SWN): CMW-102A (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
210
205
200
195
190
185
5
0
−5
−10
−15
−20
2010
2015
2020
Legend
Observed
Ground Surface (205 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

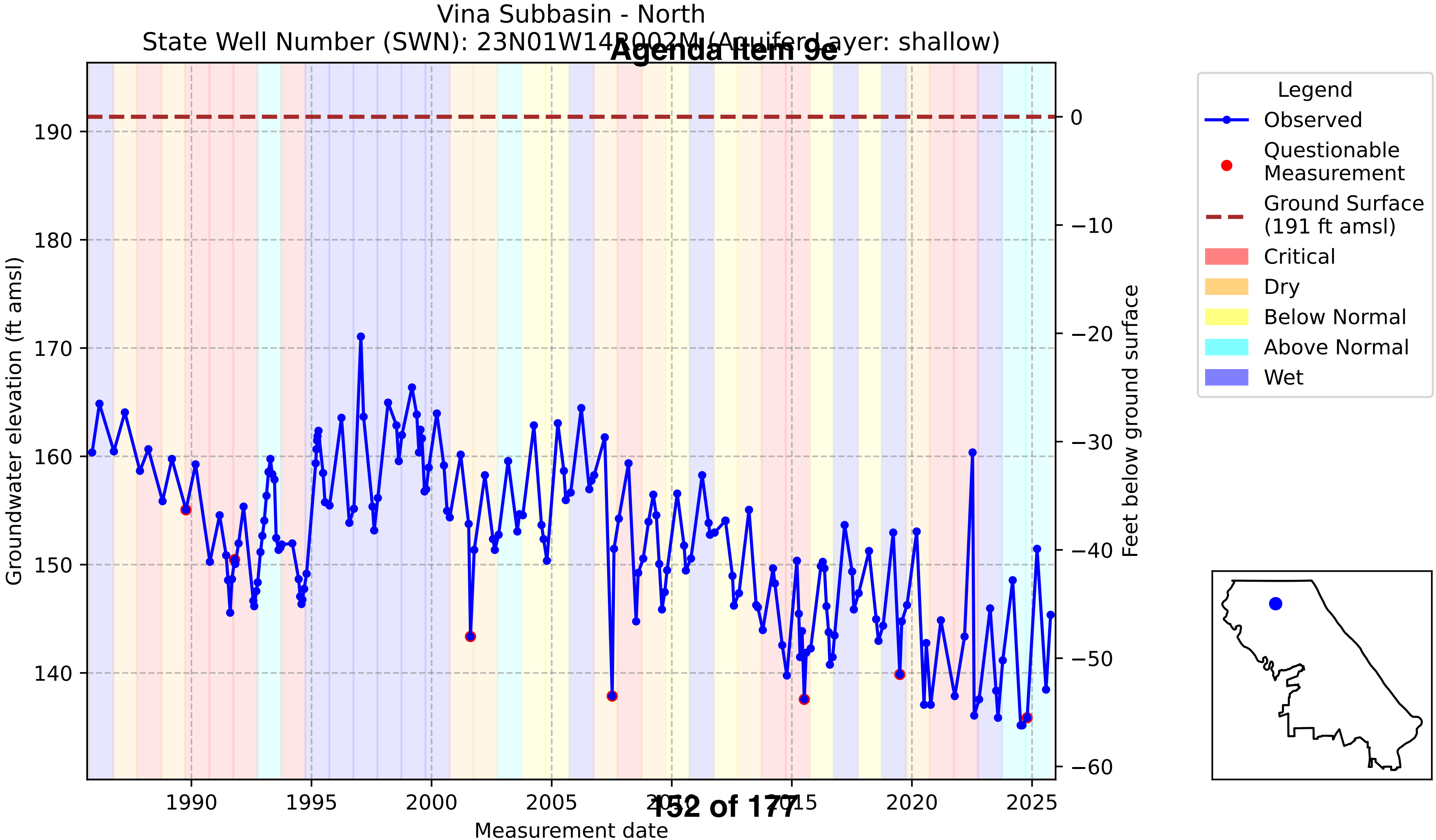

Vina Subbasin - Chico
State Well Number (SWN): DMW-3 (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
180
170
160
150
140
130
120
0
−10
−20
−30
−40
−50
−60
1995
2000
2005
2010
2015
2020
Legend
Observed
Ground Surface (178 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

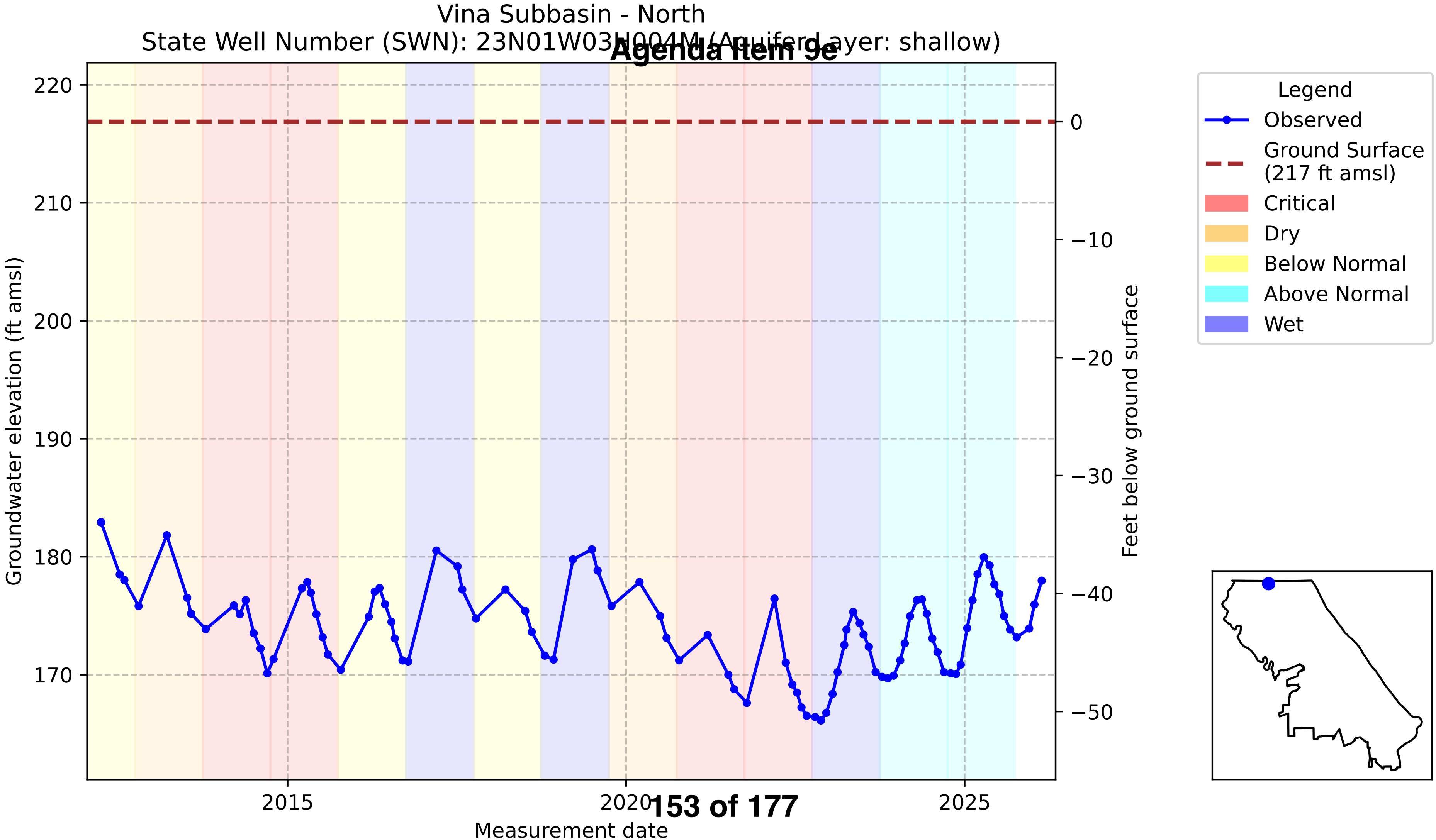

Vina Subbasin - Chico
State Well Number (SWN): FC-MW-2 (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
210
205
200
195
190
5
0
−5
−10
−15
−20
2010
2015
2020
Legend
Observed
Ground Surface (207 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

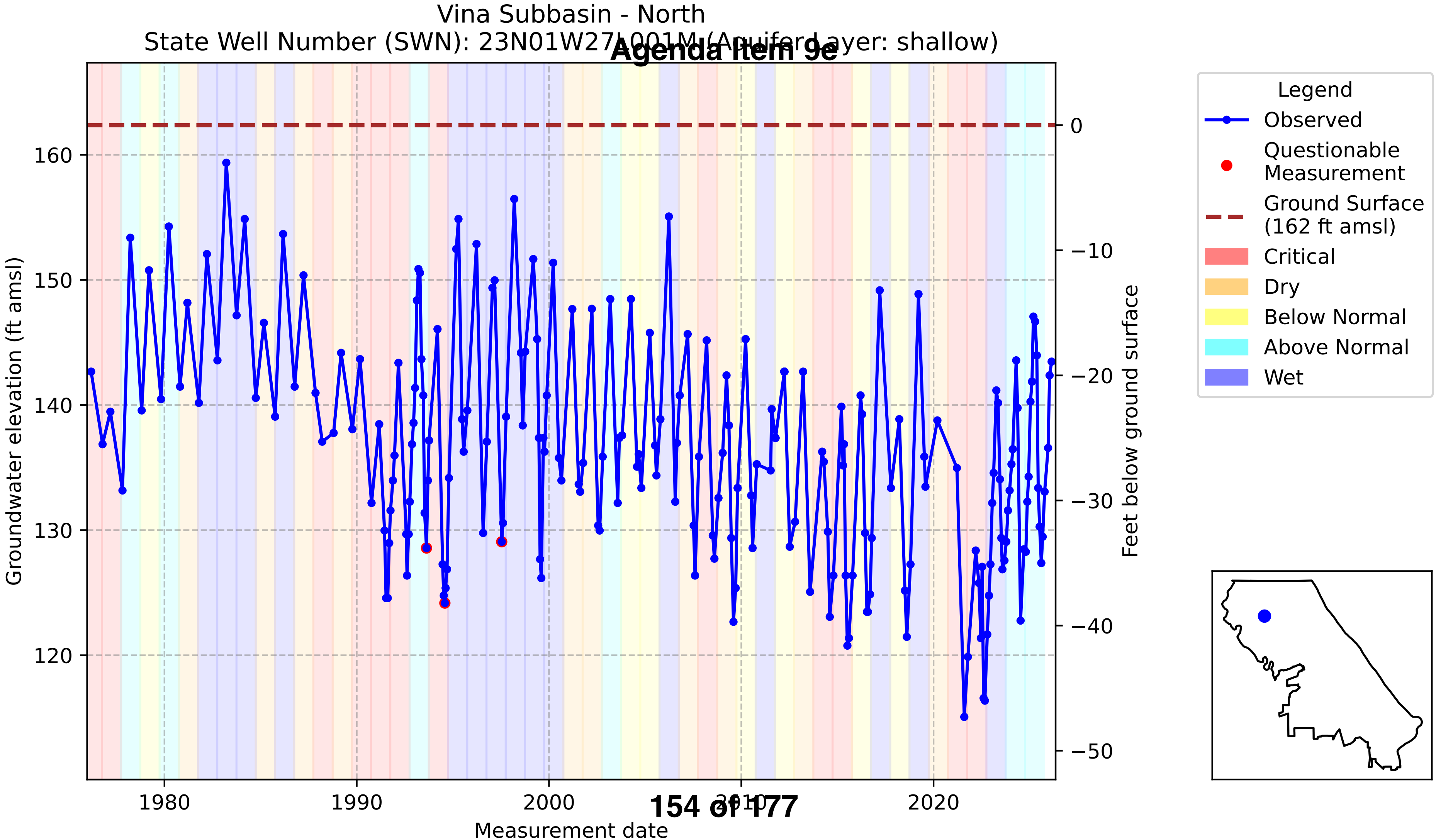

Vina Subbasin - Chico
State Well Number (SWN): MW-21 (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
210
205
200
195
190
185
180
5
0
−5
−10
−15
−20
−25
2005
2010
2015
2020
Legend
Observed
Ground Surface (206 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - Chico
State Well Number (SWN): SWMW-06A (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
190
185
180
175
170
165
160
5
0
−5
−10
−15
−20
−25
2010
2015
2020
Legend
Observed
Ground Surface (190 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

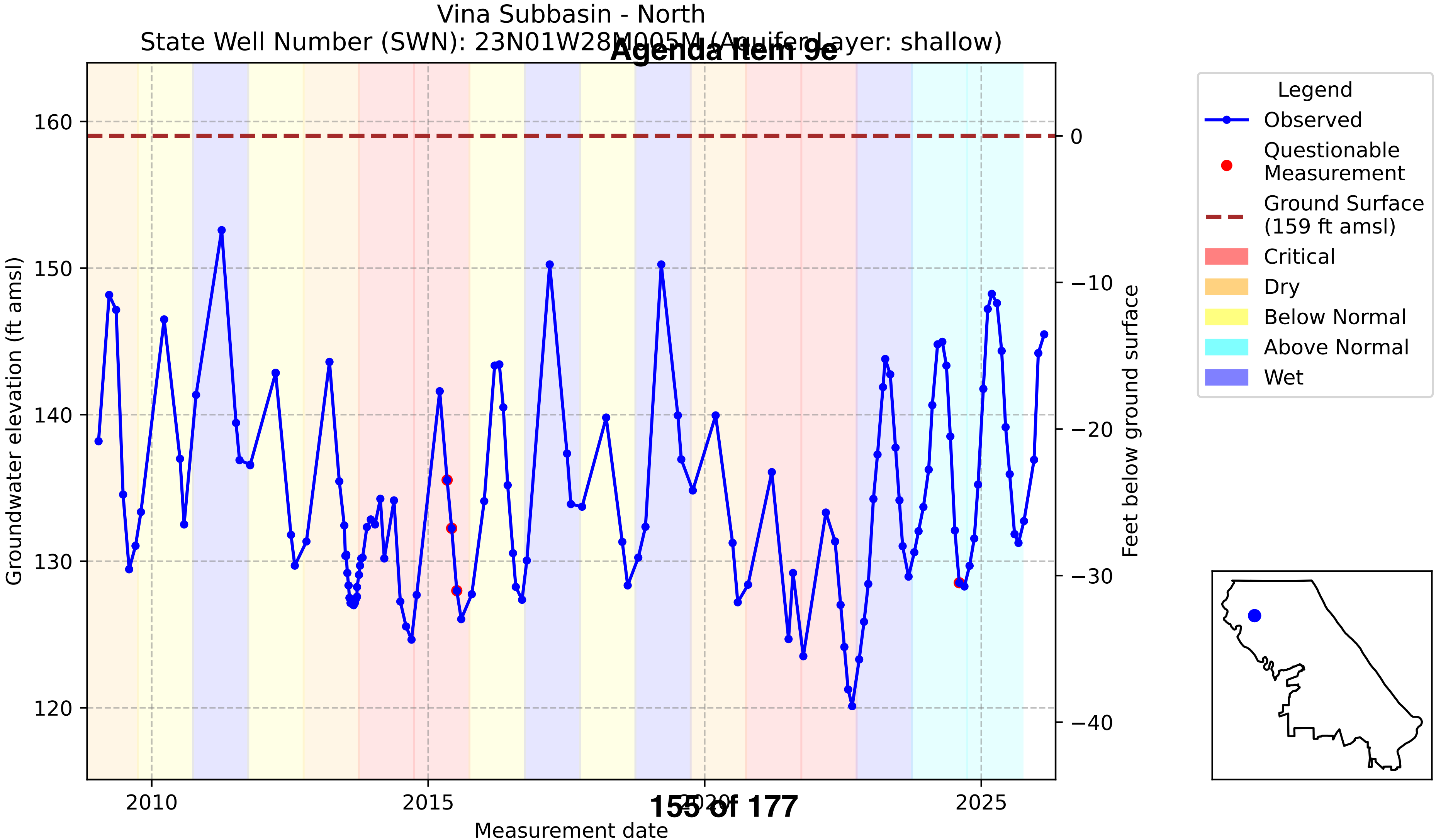

Vina Subbasin - North
State Well Number (SWN): 23N01W09E001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Observed
Questionable Measurement
Ground Surface (183 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - North
State Well Number (SWN): 23N01W14R002M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
1990
1995
2000
2005
2010
2015
2020
2025
140
150
160
170
180
190
0
−10
−20
−30
−40
−50
−60
Legend
Observed
Questionable Measurement
Ground Surface (191 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

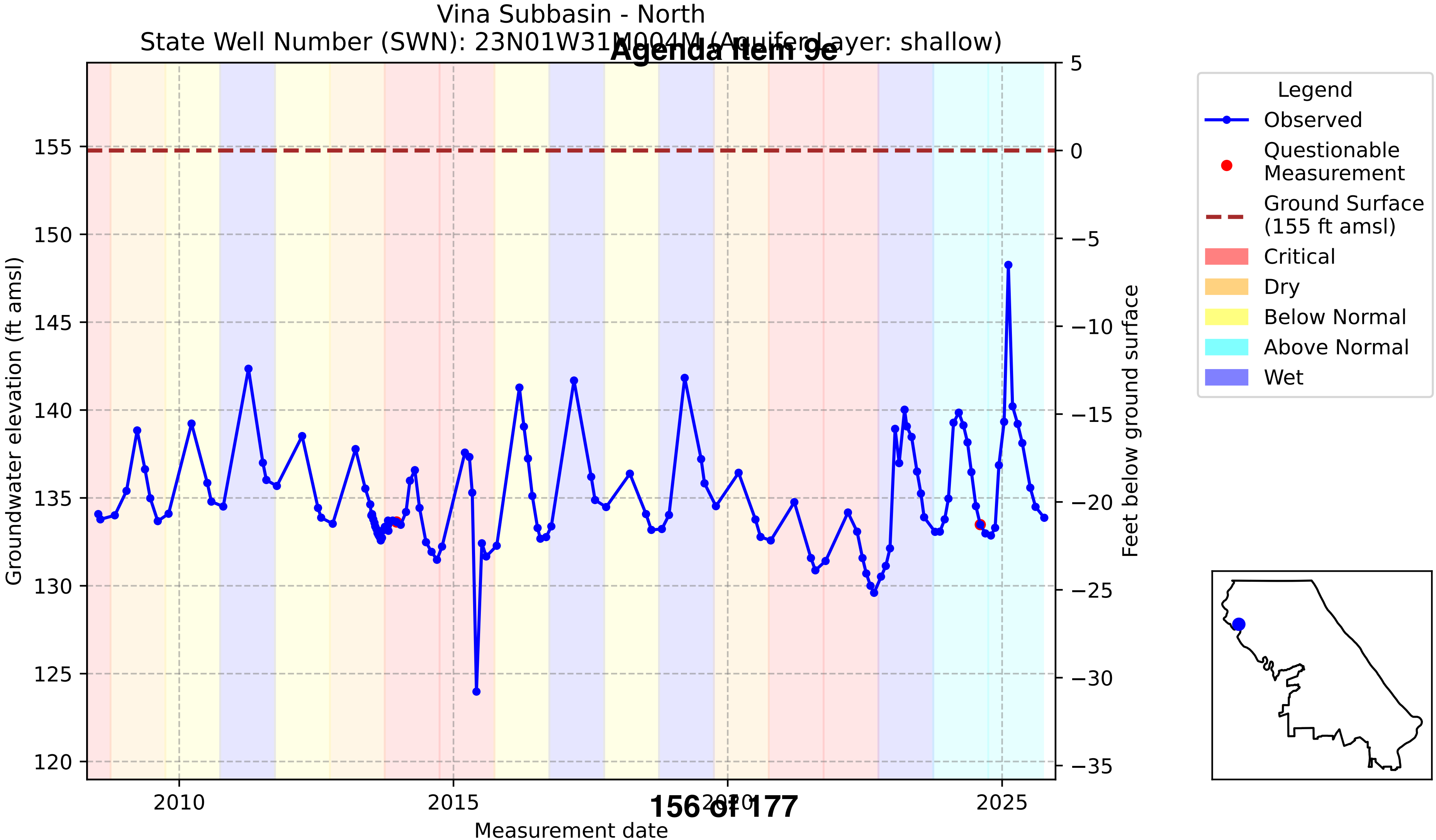

Vina Subbasin - North
State Well Number (SWN): 23N01W03H004M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
220
210
200
190
180
170
0
−10
−20
−30
−40
−50
2015
2020
2025
Legend
Observed
Ground Surface (217 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

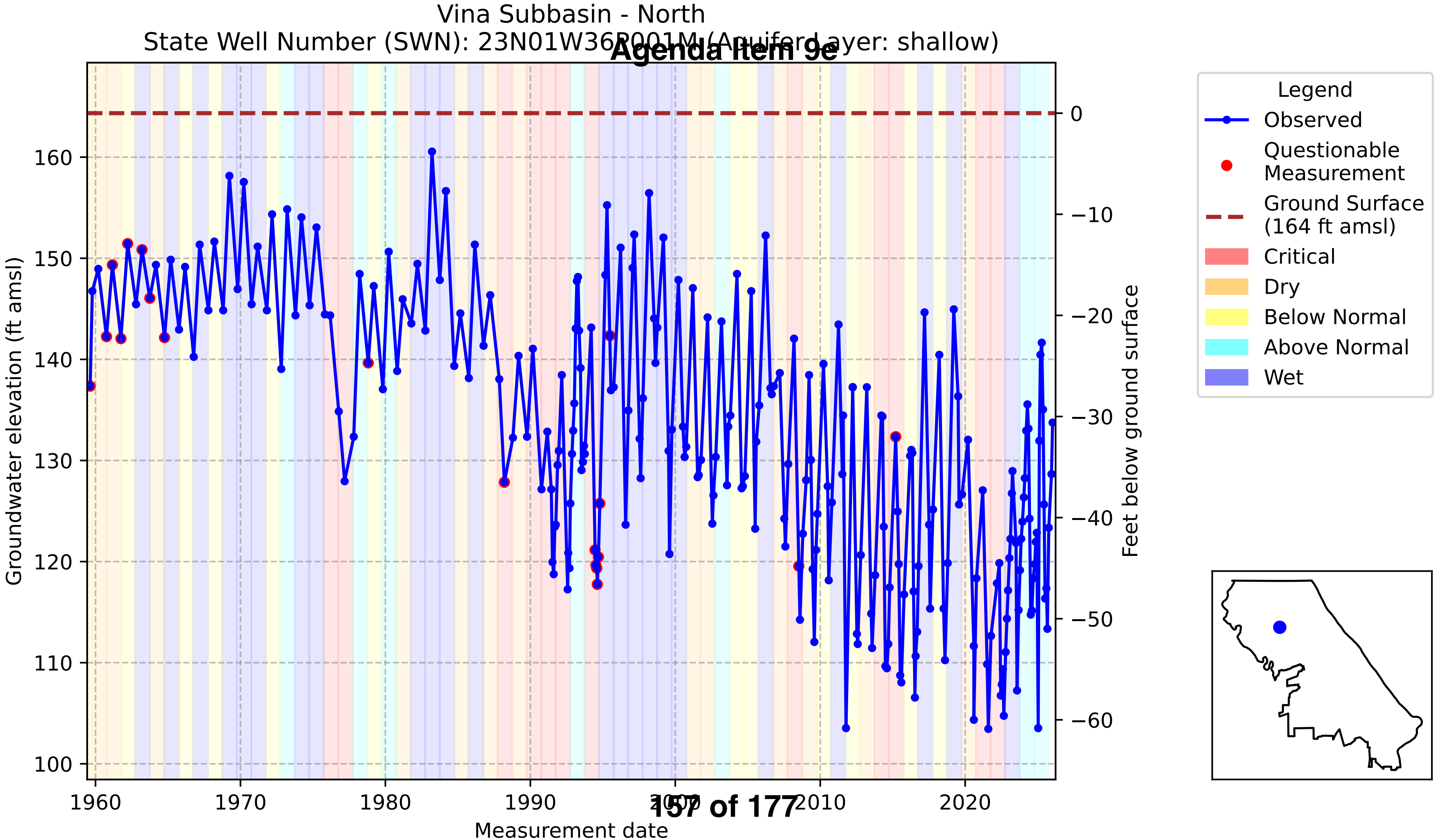


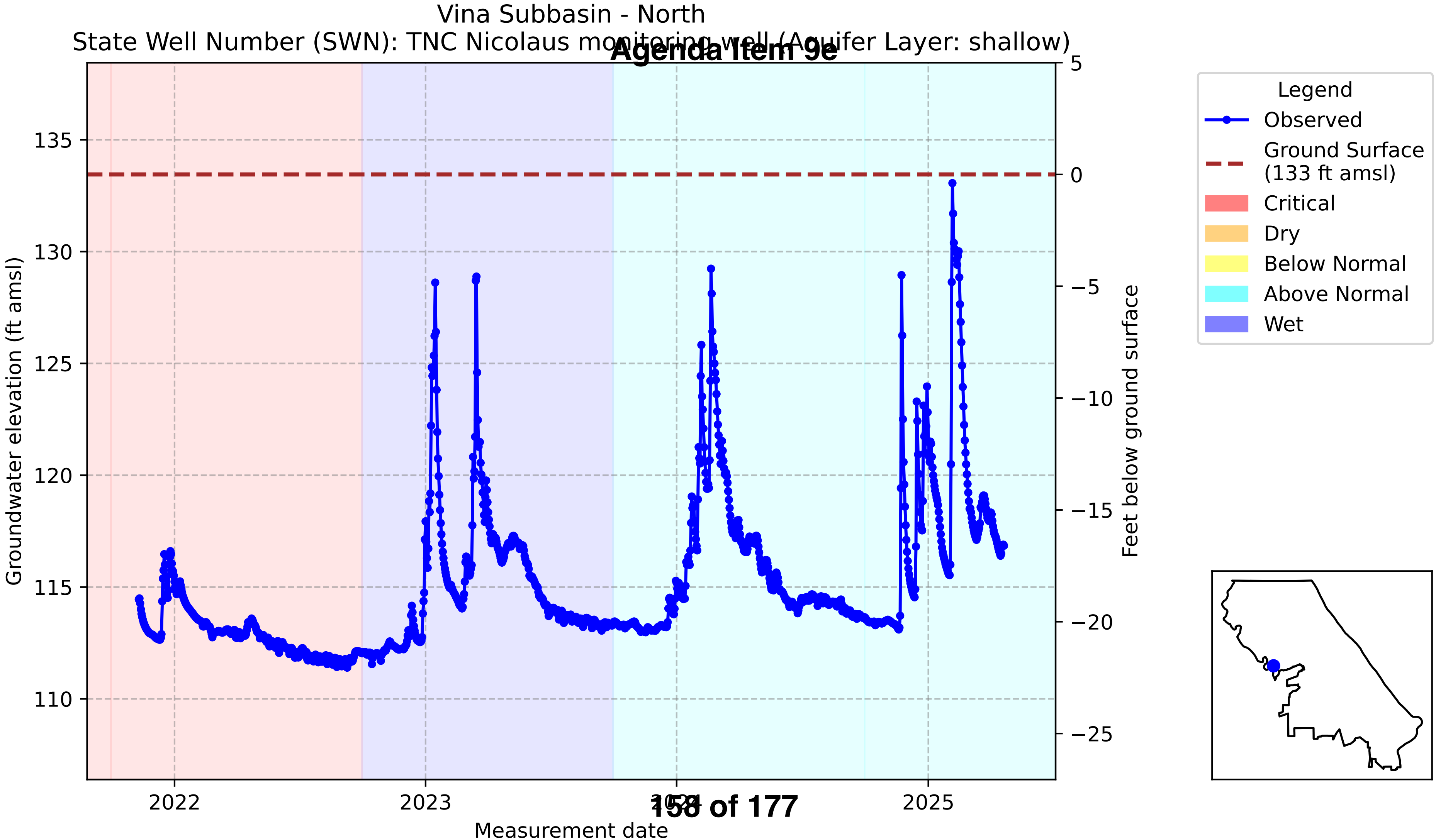
Vina Subbasin - North
State Well Number (SWN): 23N01W27L001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
150
140
130
120
0
−10
−20
−30
−40
−50
1980
1990
2000
2010
2020
Legend
Observed
Questionable Measurement
Ground Surface (162 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

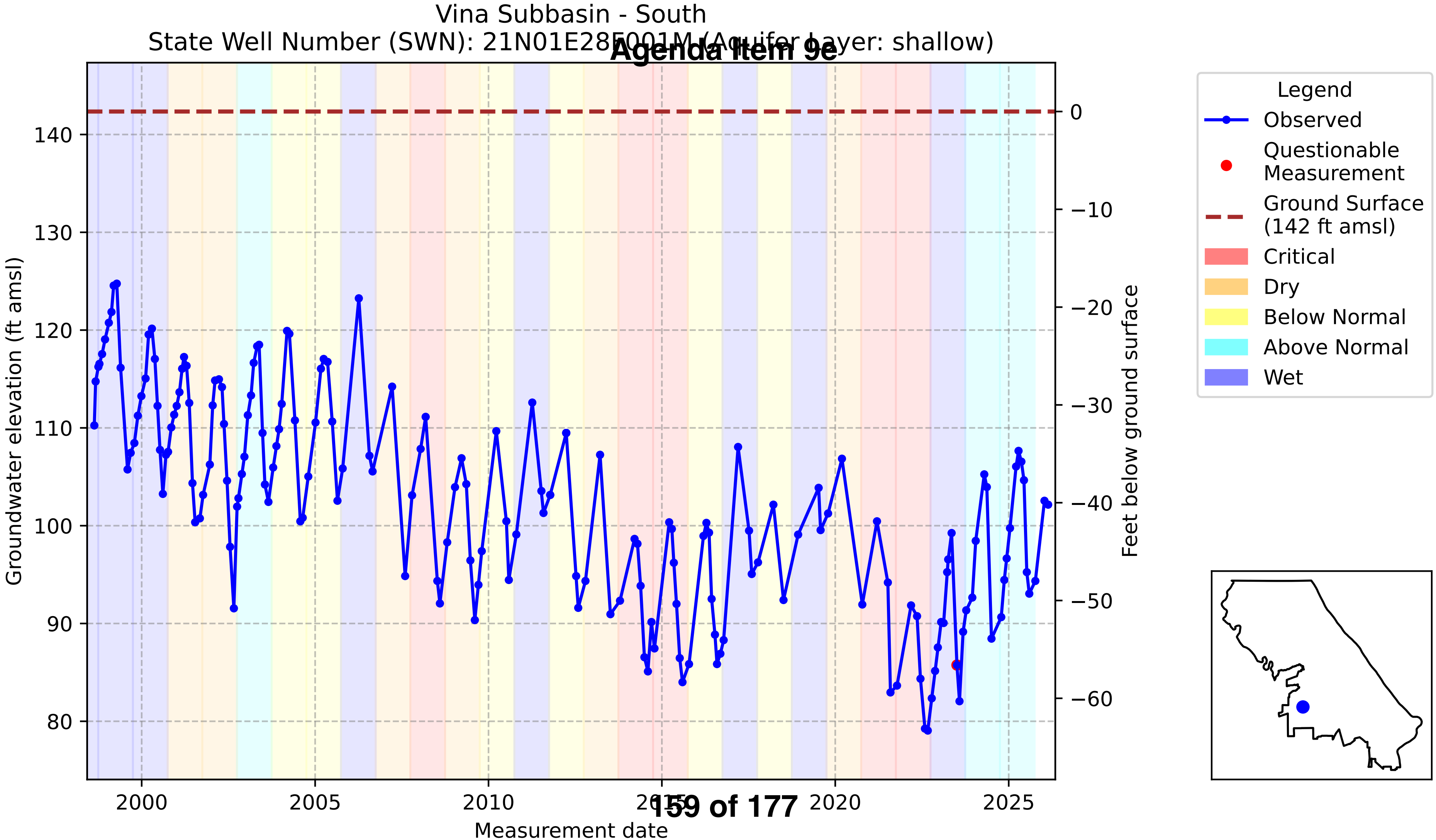


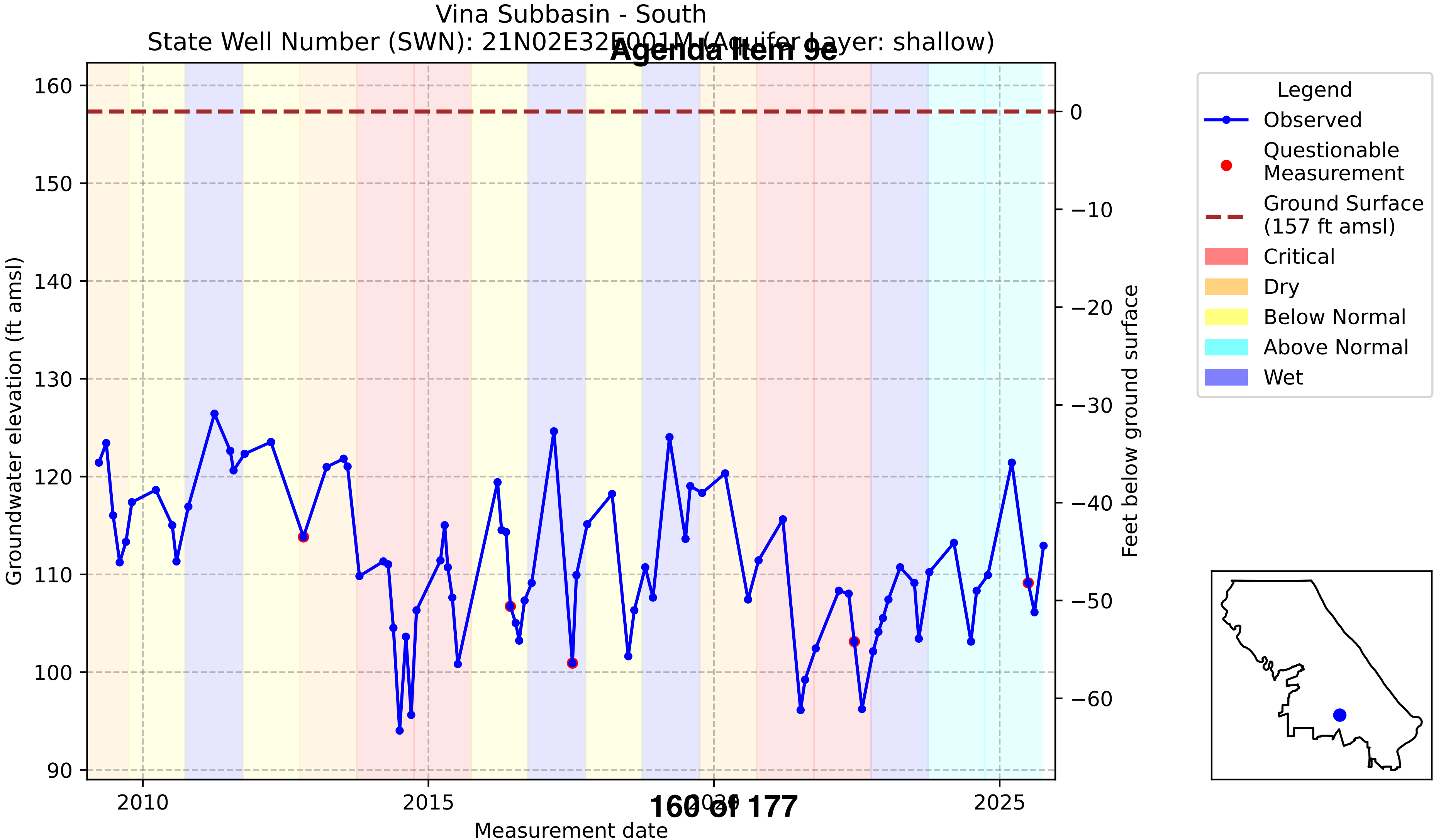
Vina Subbasin - North
State Well Number (SWN): 23N01W28M005M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
150
140
130
120
0
−10
−20
−30
−40
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (159 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - North
State Well Number (SWN): 23N01W31M004M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
155
150
145
140
135
130
125
120
5
0
−5
−10
−15
−20
−25
−30
−35
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (155 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

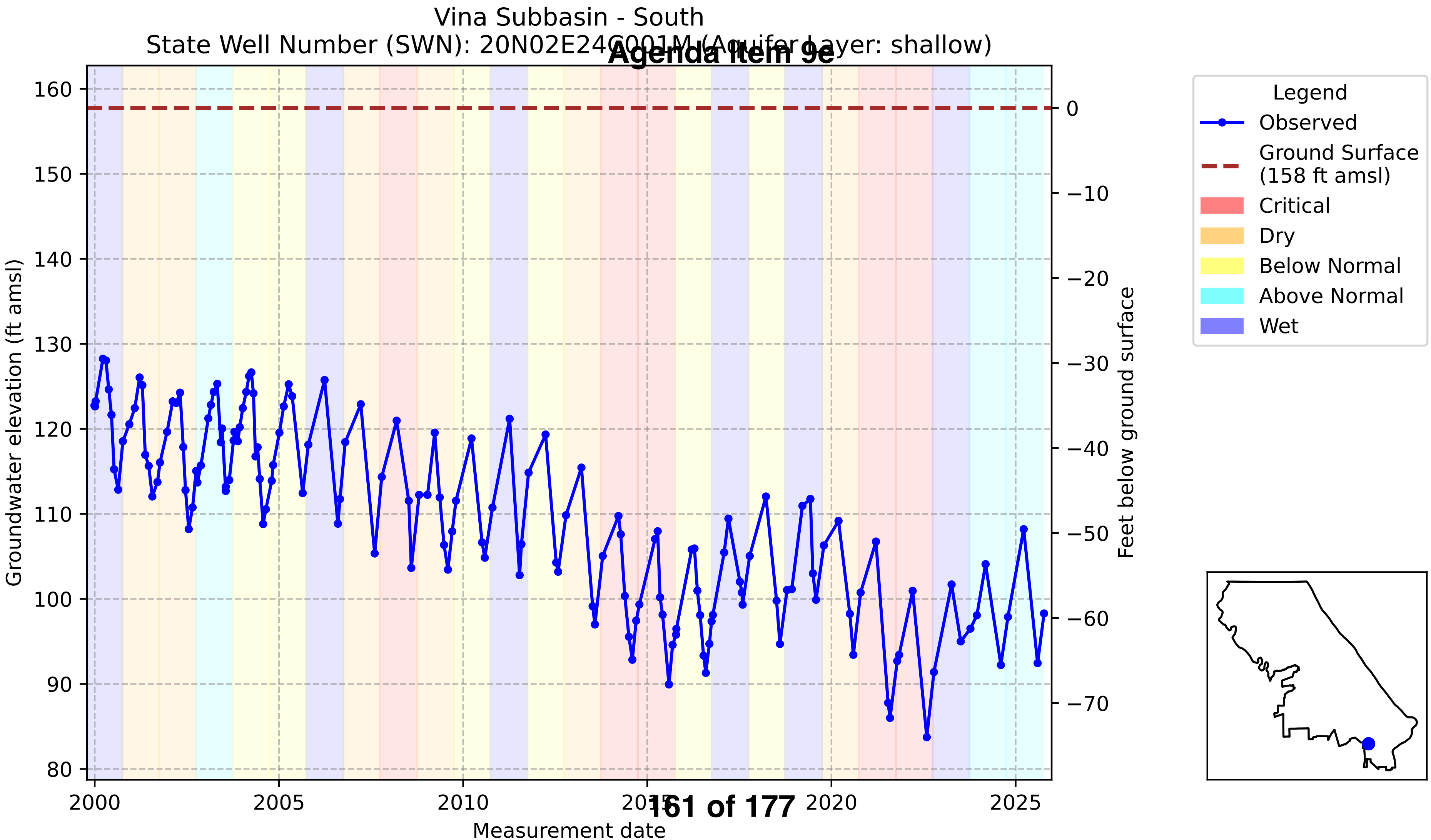

Vina Subbasin - North
State Well Number (SWN): 23N01W36R001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Observed
Questionable Measurement
Ground Surface (164 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

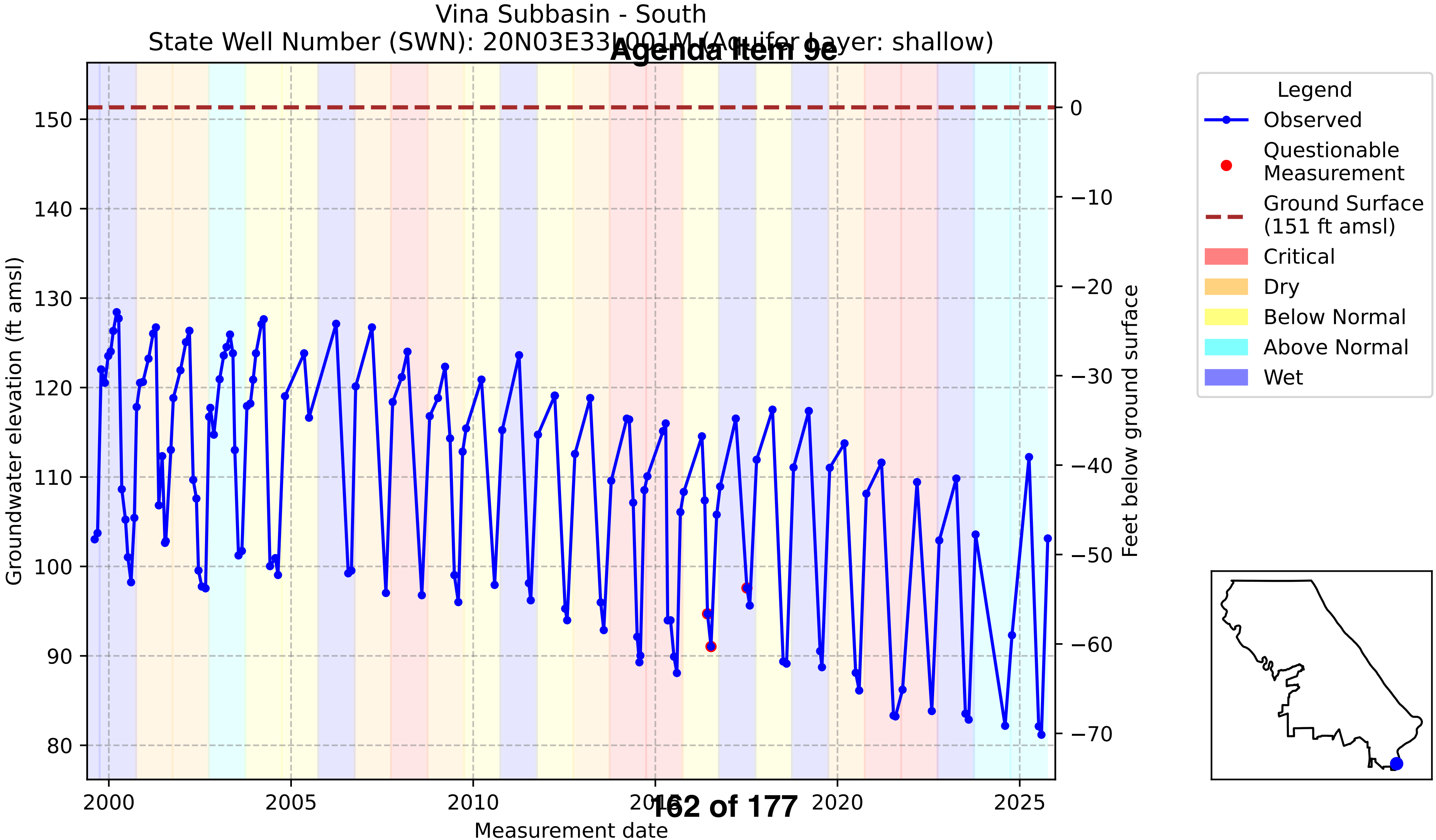

Vina Subbasin - North
State Well Number (SWN): TNC Nicolaus monitoring well (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
135
130
125
120
115
110
5
0
−5
−10
−15
−20
−25
2022
2023
2024
2025
Legend
Observed
Ground Surface (133 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

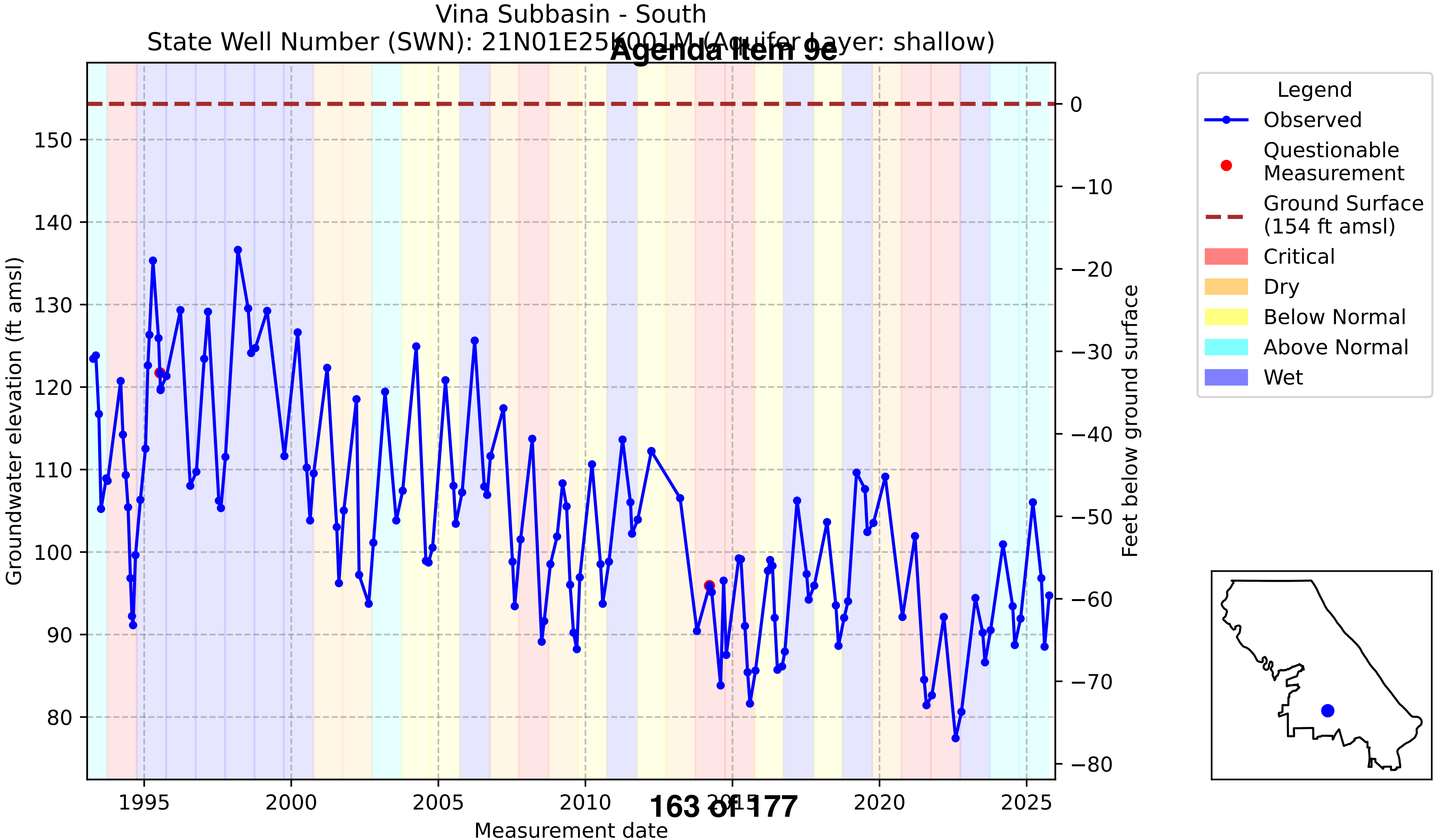

Vina Subbasin - South
State Well Number (SWN): 21N01E28F001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
140
130
120
110
100
90
80
0
−10
−20
−30
−40
−50
−60
2000
2005
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (142 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

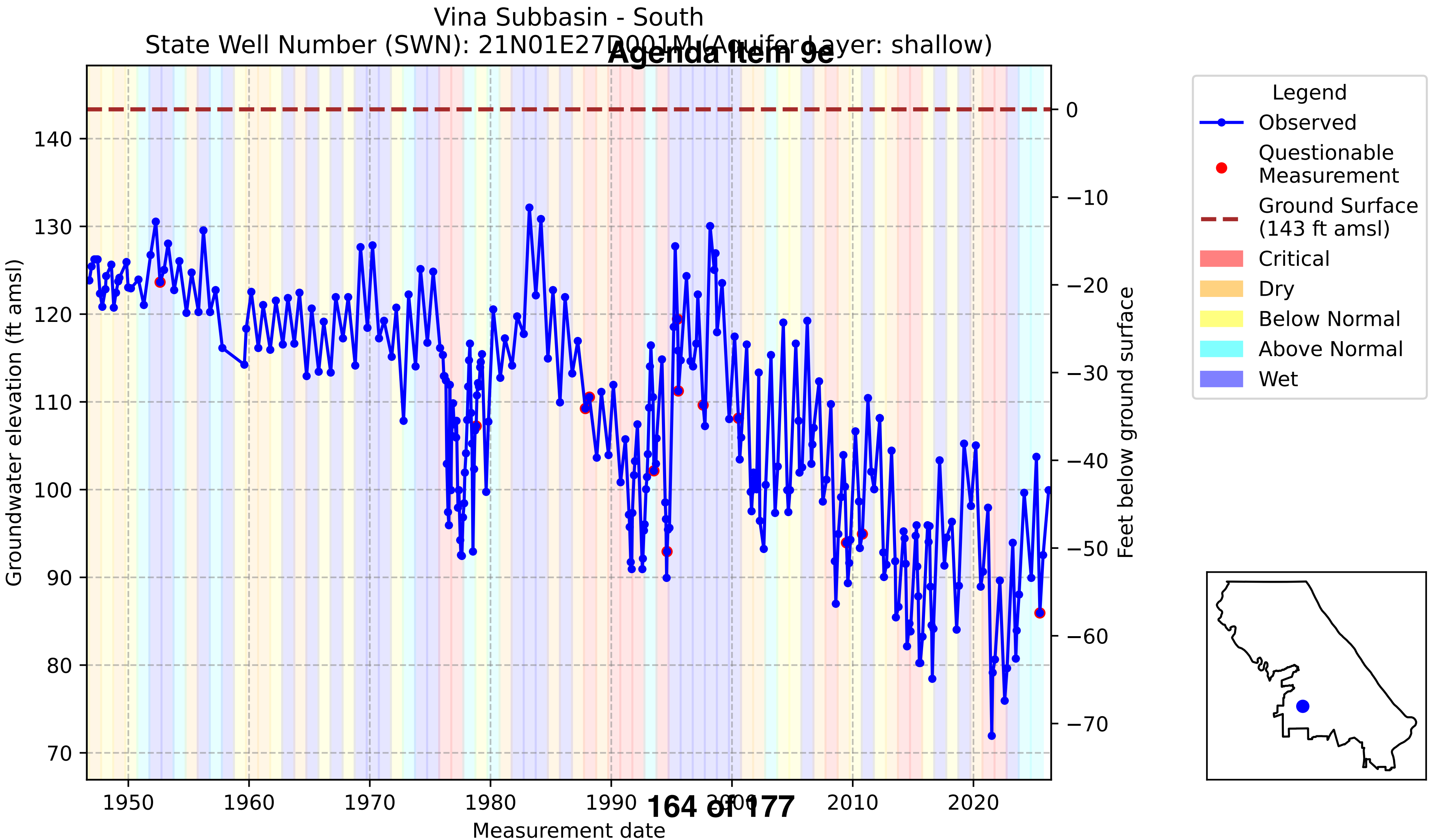


Vina Subbasin - South
State Well Number (SWN): 21N02E32F001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
150
140
130
120
110
100
90
0
−10
−20
−30
−40
−50
−60
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (157 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

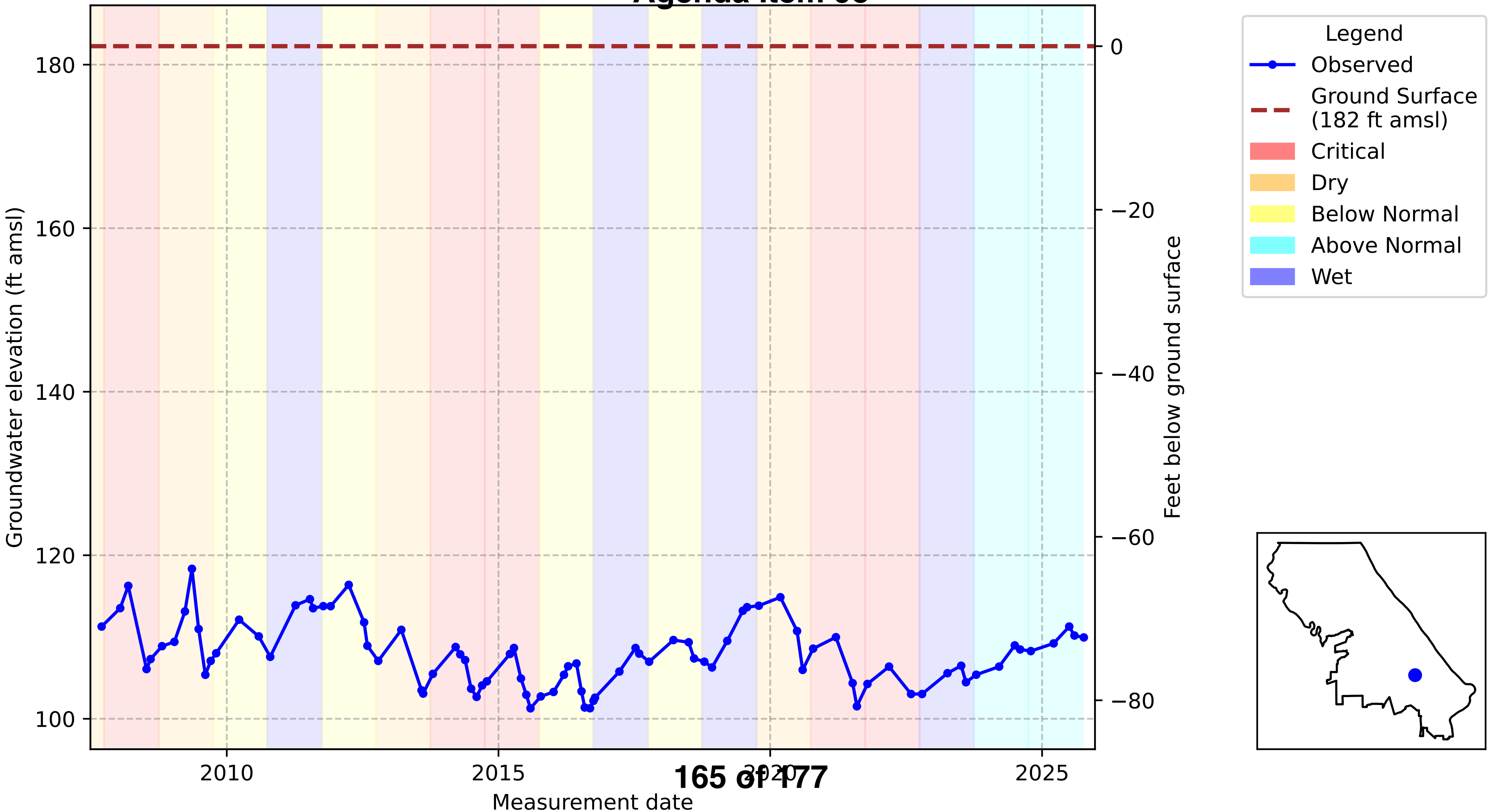

Vina Subbasin - South
State Well Number (SWN): 20N02E24C001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
160
150
140
130
120
110
100
90
80
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
2020
2025
Legend
Observed
Ground Surface
(158 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

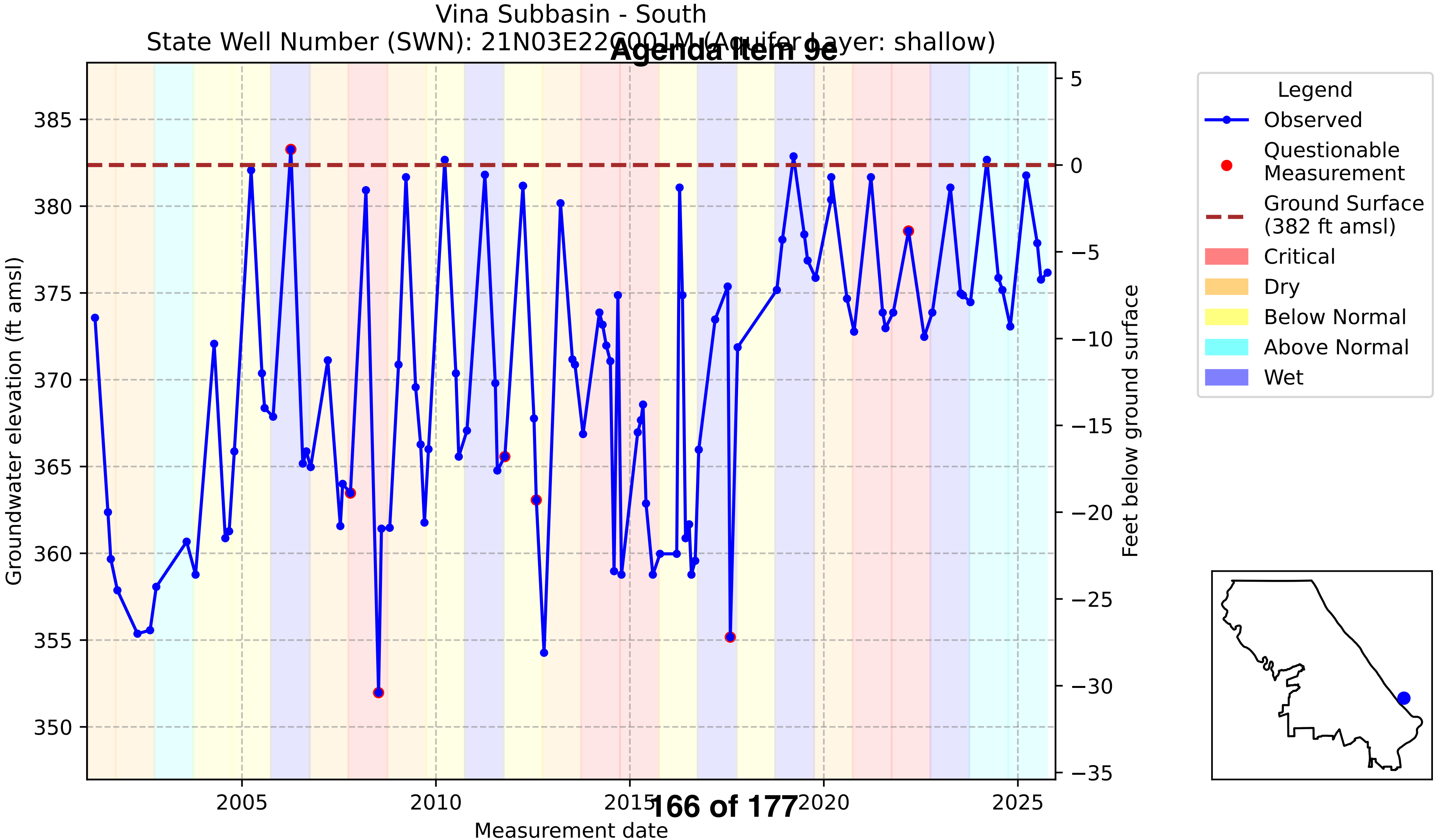

Vina Subbasin - South
State Well Number (SWN): 20N03E33L001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
150
140
130
120
110
100
90
80
0
−10
−20
−30
−40
−50
−60
−70
2000
2005
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (151 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

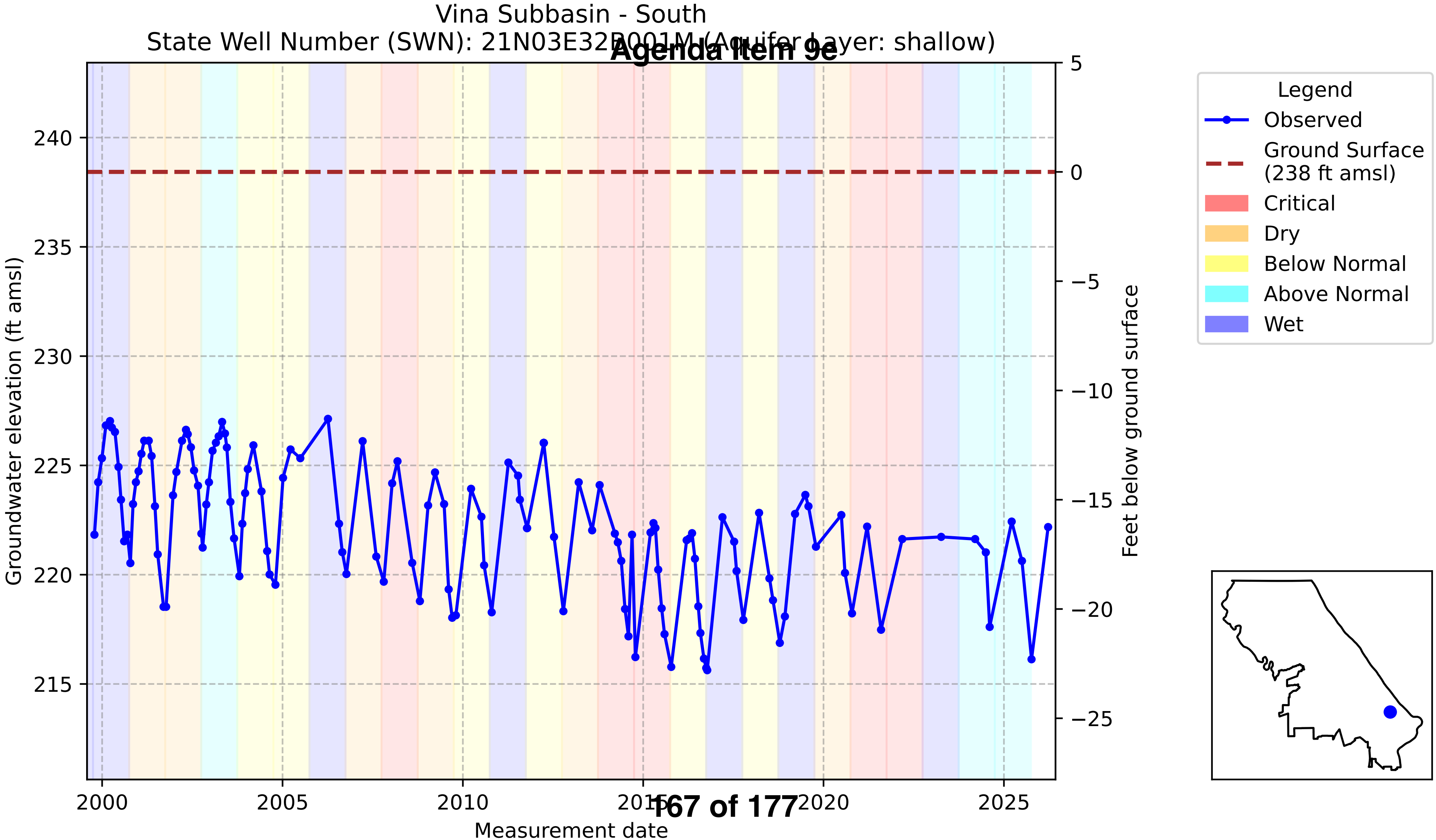

Vina Subbasin - South
State Well Number (SWN): 21N01E25K001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
Legend
Observed
Questionable Measurement
Ground Surface (154 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

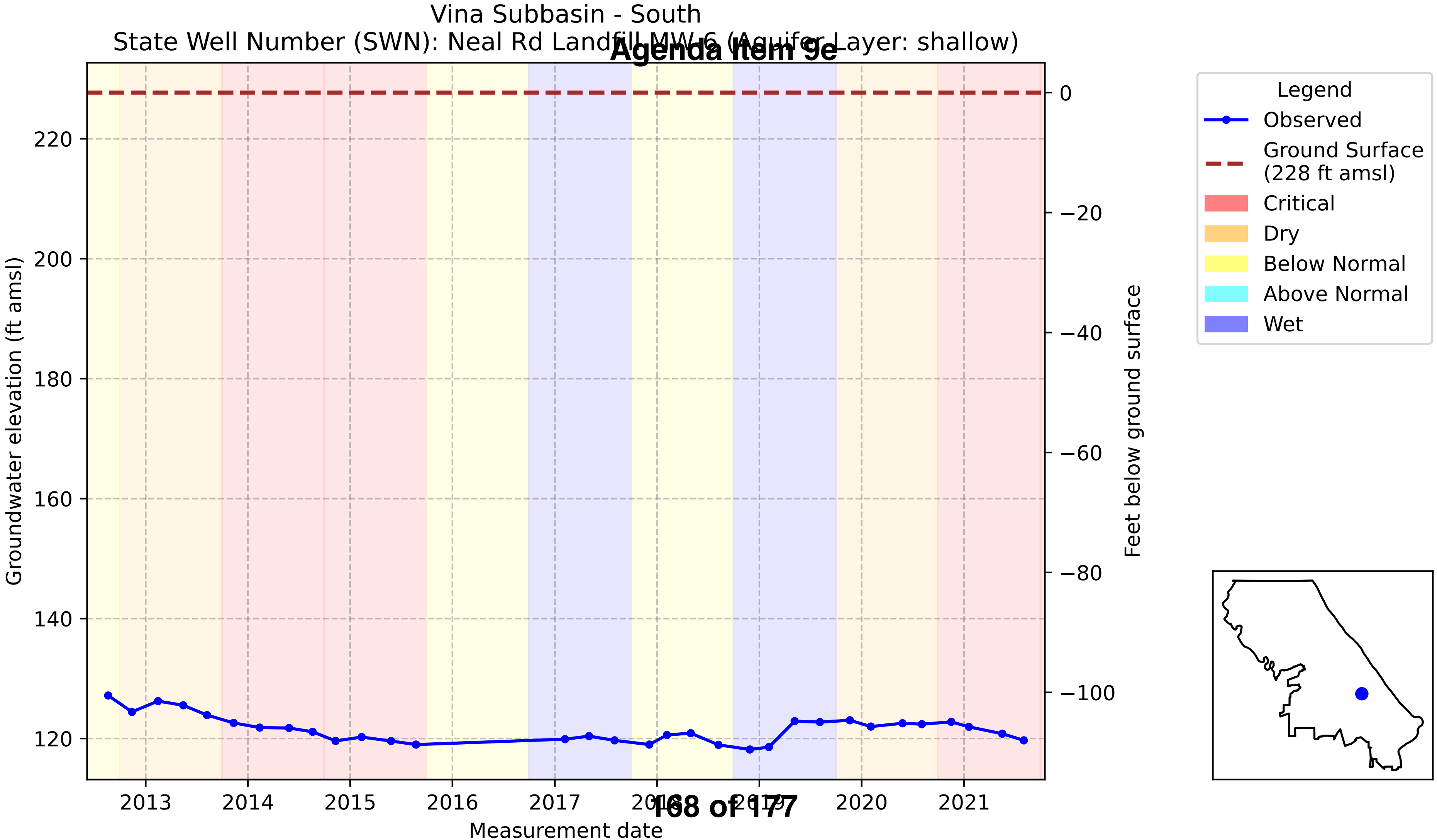

Vina Subbasin - South
State Well Number (SWN): 21N01E27D001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
1950
1960
1970
1980
1990
2000
2010
2020
70
80
90
100
110
120
130
140
0
−10
−20
−30
−40
−50
−60
−70
Legend
Observed
Questionable Measurement
Ground Surface (143 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

Vina Subbasin - South
State Well Number (SWN): 21N02E26F006M (Aquifer Layer: shallow)




Vina Subbasin - South
State Well Number (SWN): 21N03E22C001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
385
380
375
370
365
360
355
350
5
0
−5
−10
−15
−20
−25
−30
−35
2005
2010
2015
2020
2025
Legend
Observed
Questionable Measurement
Ground Surface (382 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - South
State Well Number (SWN): 21N03E32B001M (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
240
235
230
225
220
215
5
0
−5
−10
−15
−20
−25
2000
2005
2010
2015
2020
2025
Legend
Observed
Ground Surface
(238 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet


Vina Subbasin - South
State Well Number (SWN): Neal Rd Landfill MW-6 (Aquifer Layer: shallow)
Groundwater elevation (ft amsl)
Feet below ground surface
Measurement date
220
200
180
160
140
120
0
−20
−40
−60
−80
−100
2013
2014
2015
2016
2017
2018
2019
2020
2021
Legend
Observed
Ground Surface (228 ft amsl)
Critical
Dry
Below Normal
Above Normal
Wet

Appendix C

Surveyed Transects Across Streams in the Wyandotte Creek Subbasin

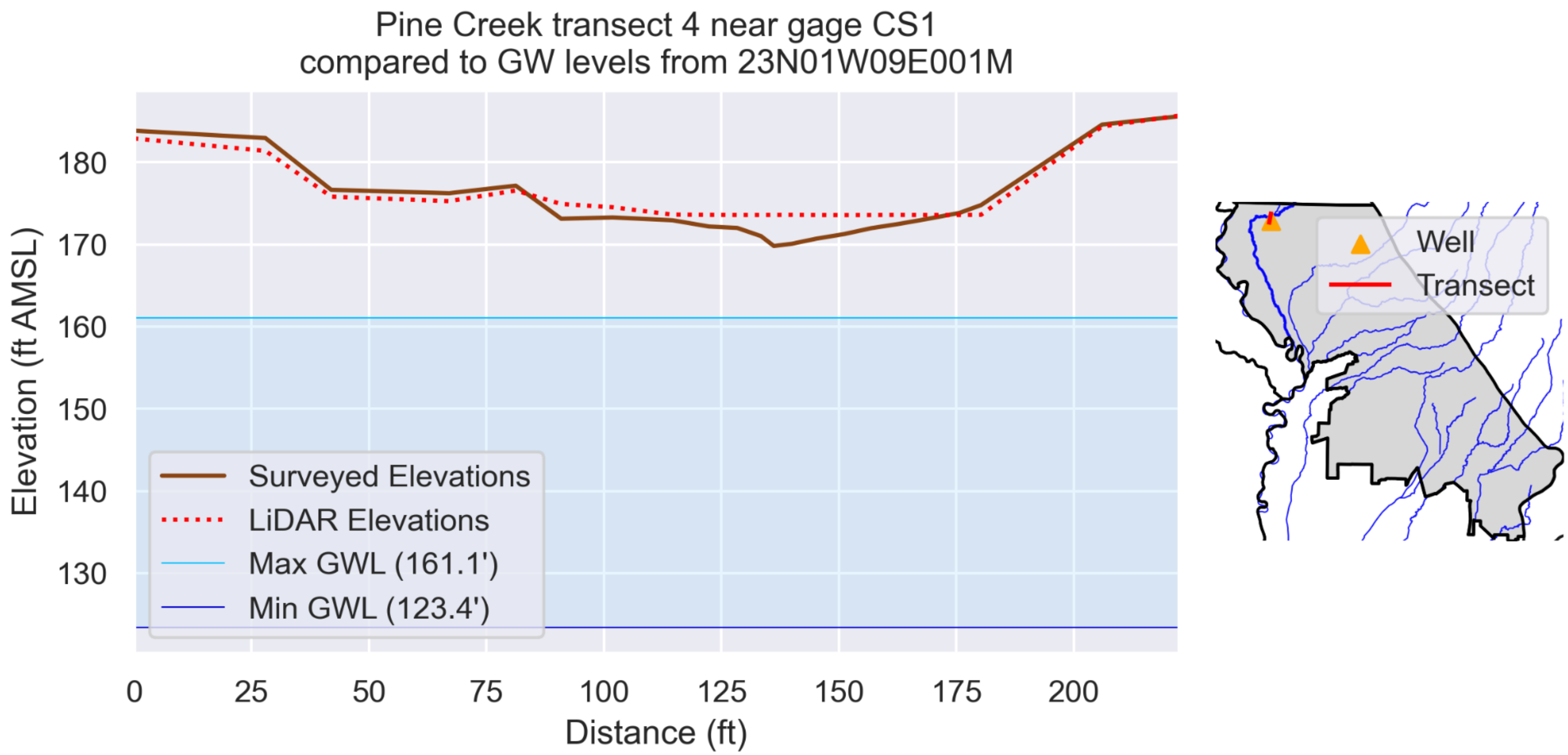


Figure C- 1: Transect Comparing Surveyed and LiDAR Extracted Elevations on Upper Reach of Pine Creek (distance from well to transect: 0.2 miles).

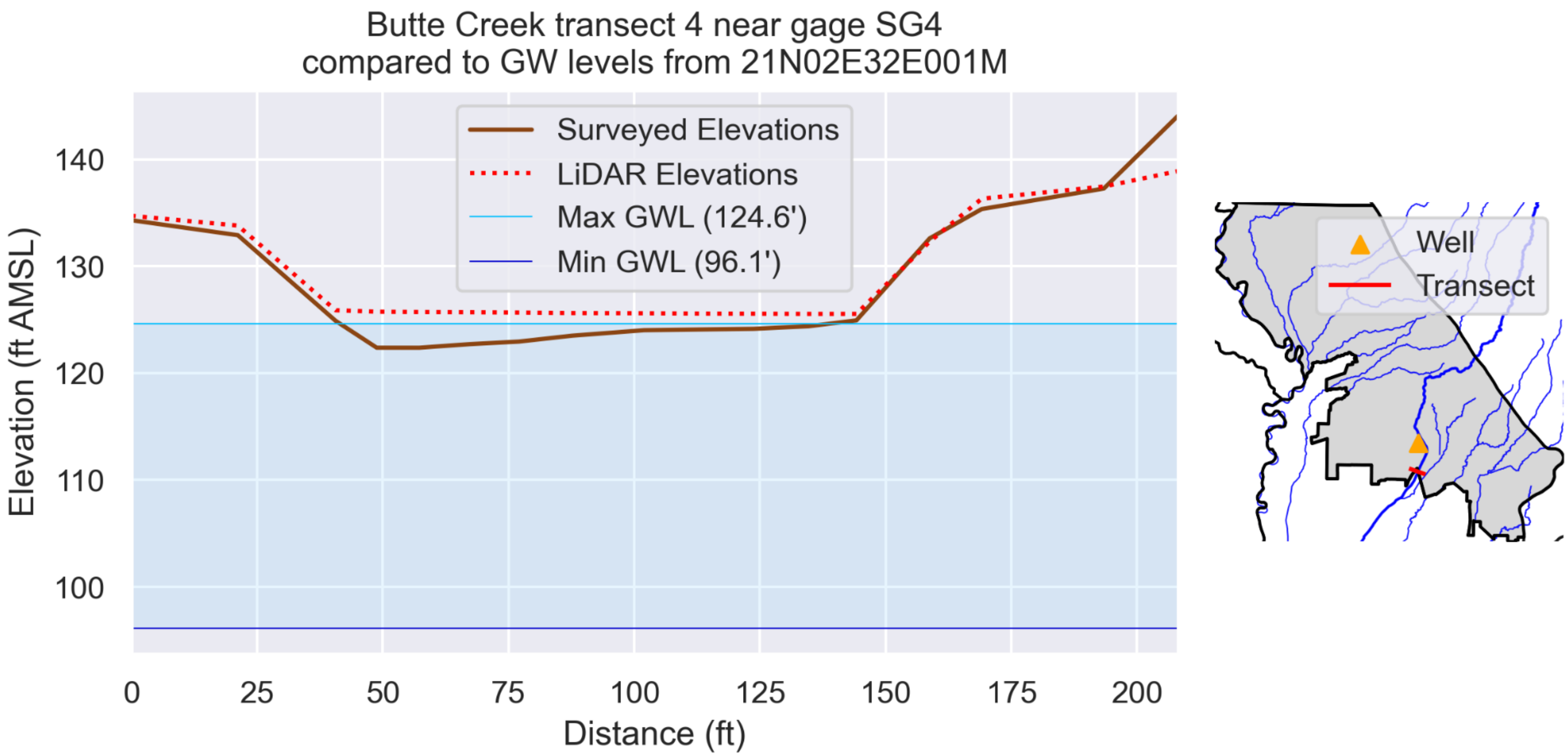


Figure C- 2: Transect Comparing Surveyed and LiDAR Extracted Elevations on Lower Reach of Butte Creek (distance from well to transect: 2.0 miles).

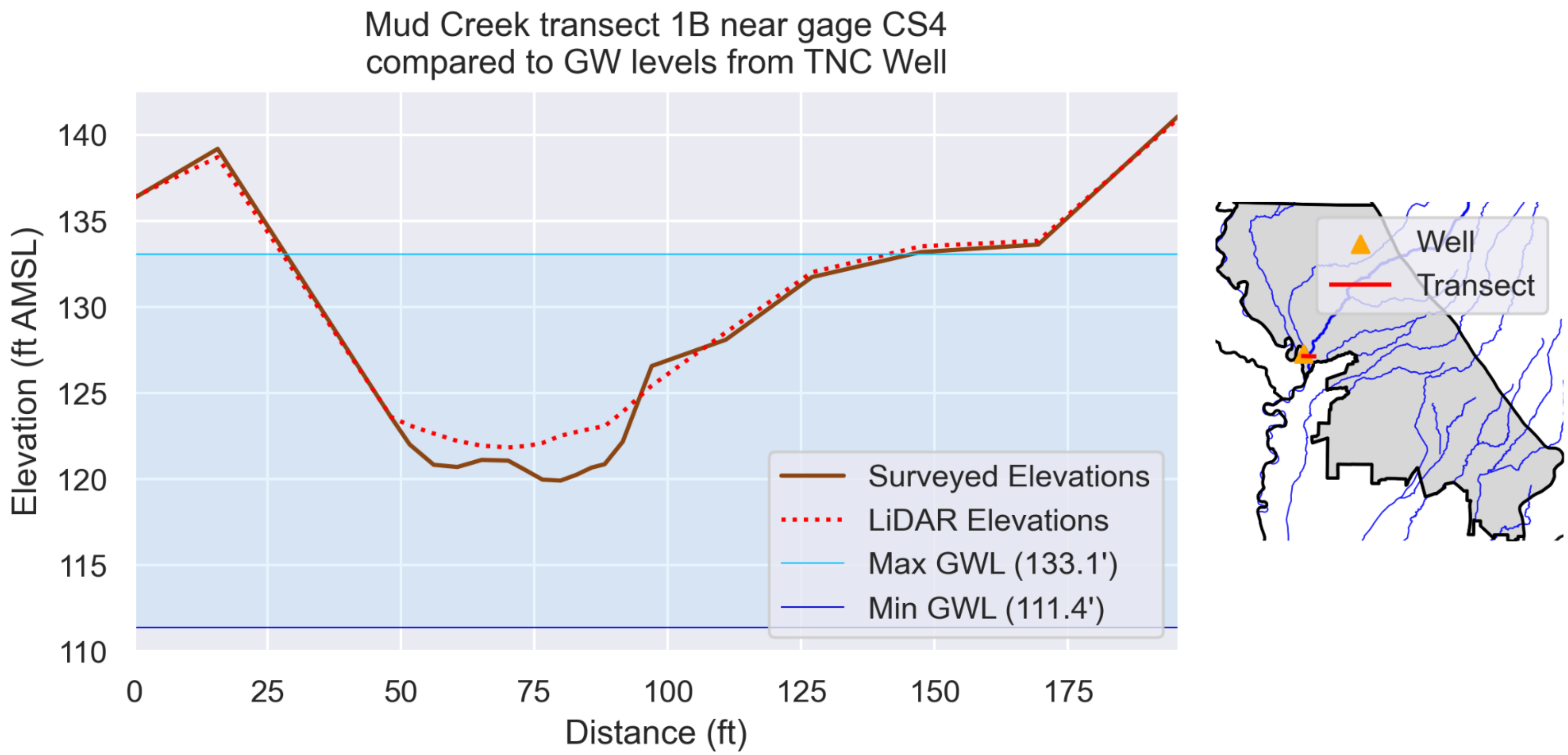


Figure C- 3: Transect Comparing Surveyed and LiDAR Extracted Elevations on Lower Reach of Mud Creek (distance from well to transect: 0.38 miles).

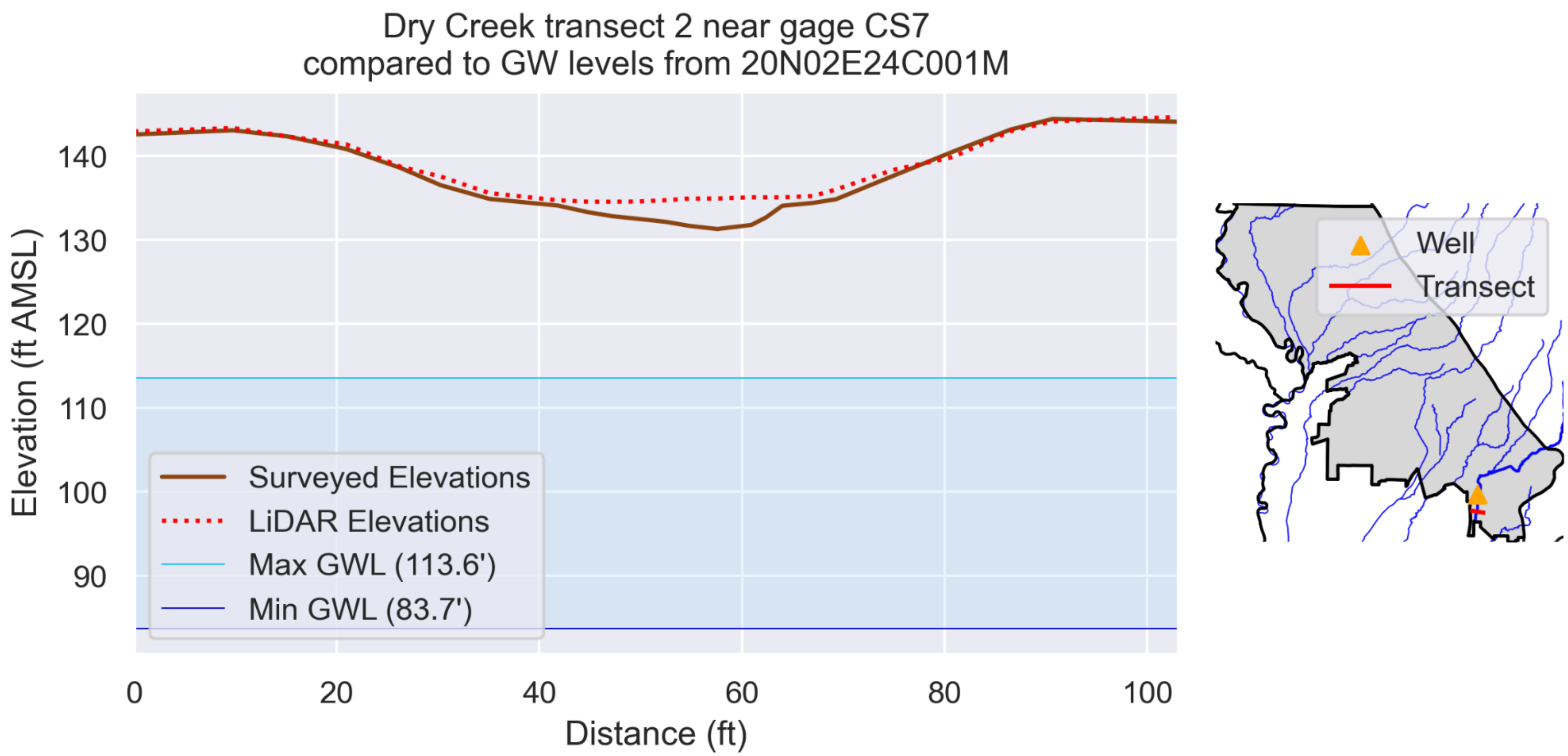


Figure C- 4: Transect Comparing Surveyed and LiDAR Extracted Elevations on Dry Creek (distance from well to transect: 1.3 miles).

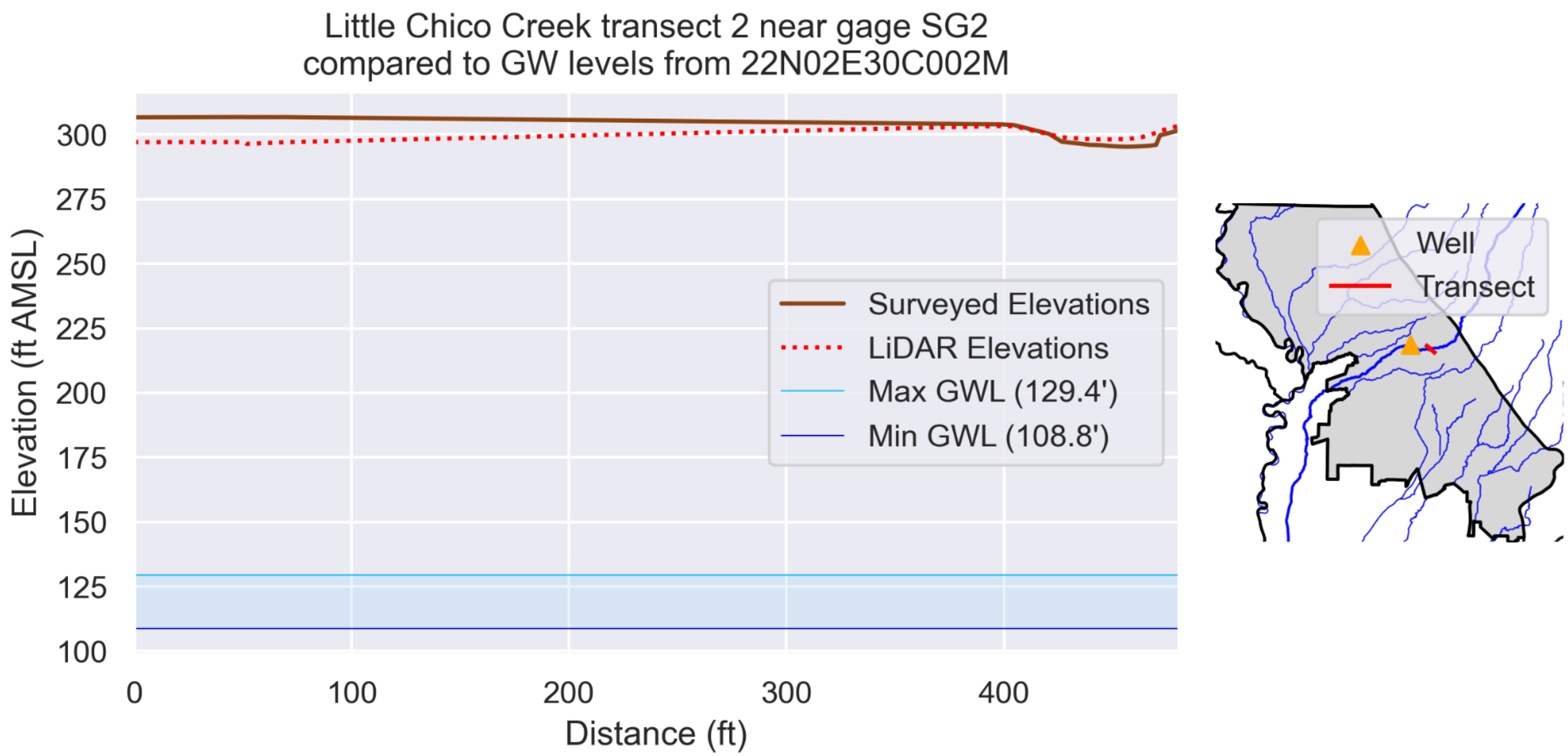


Figure C- 5: Transect Comparing Surveyed and LiDAR Extracted Elevations on Little Chico Creek (distance from well to transect: 1.8 miles).

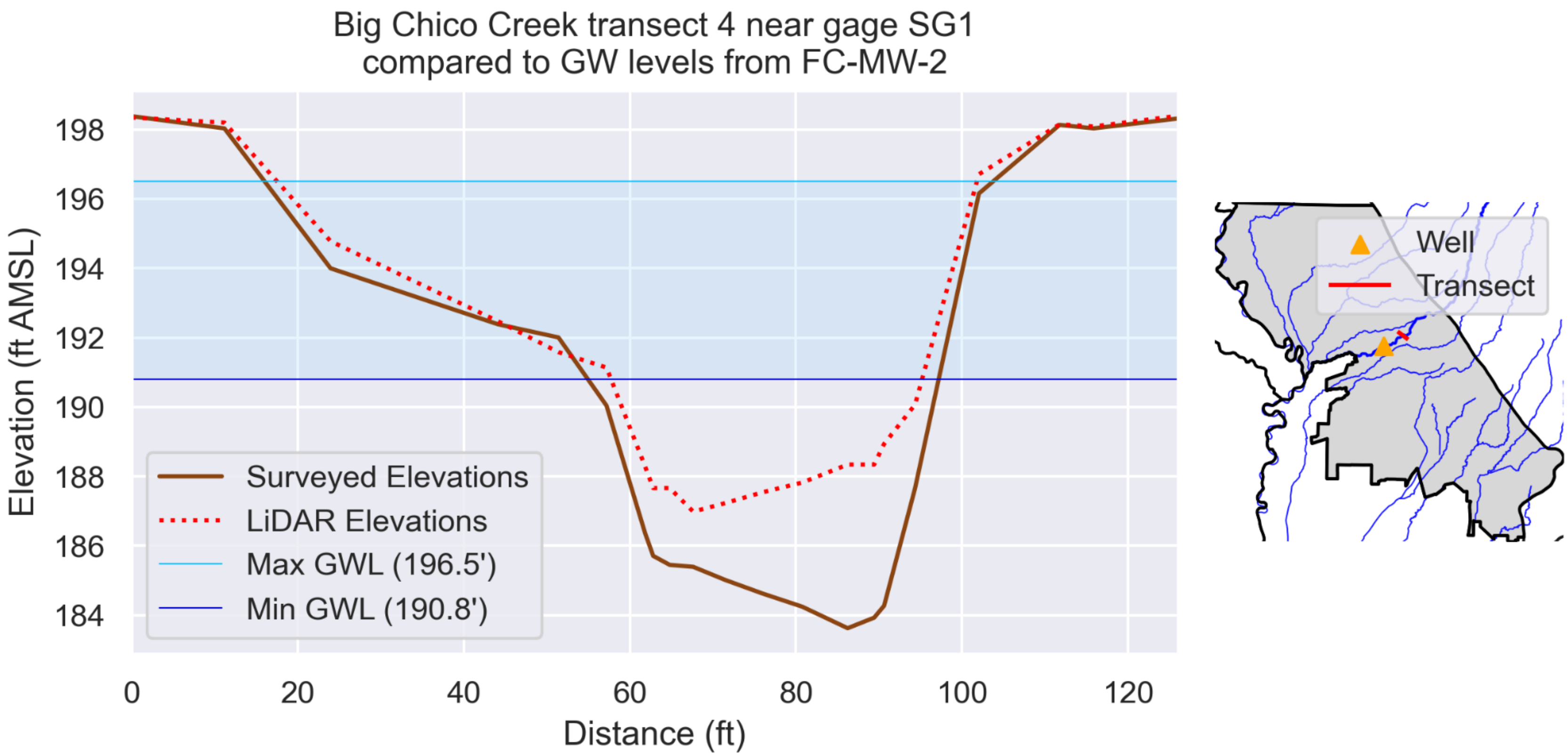


Figure C- 6: Transect Comparing Surveyed and LiDAR Extracted Elevations on Big Chico Creek (distance from well to transect: 1.8 miles).

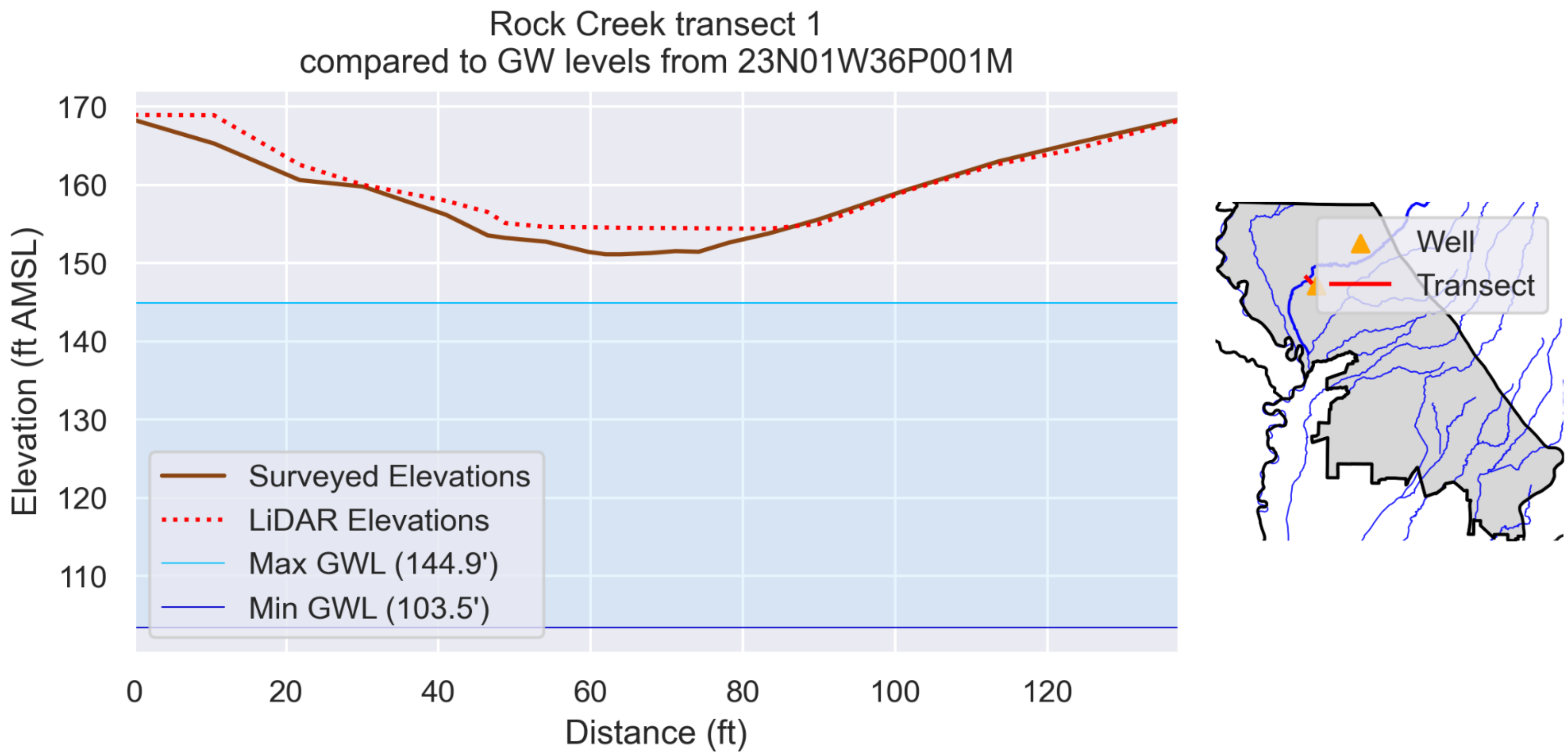


Figure C- 7: Transect Comparing Surveyed and LiDAR Extracted Elevations on Rock Creek (distance from well to transect: 0.7 miles).

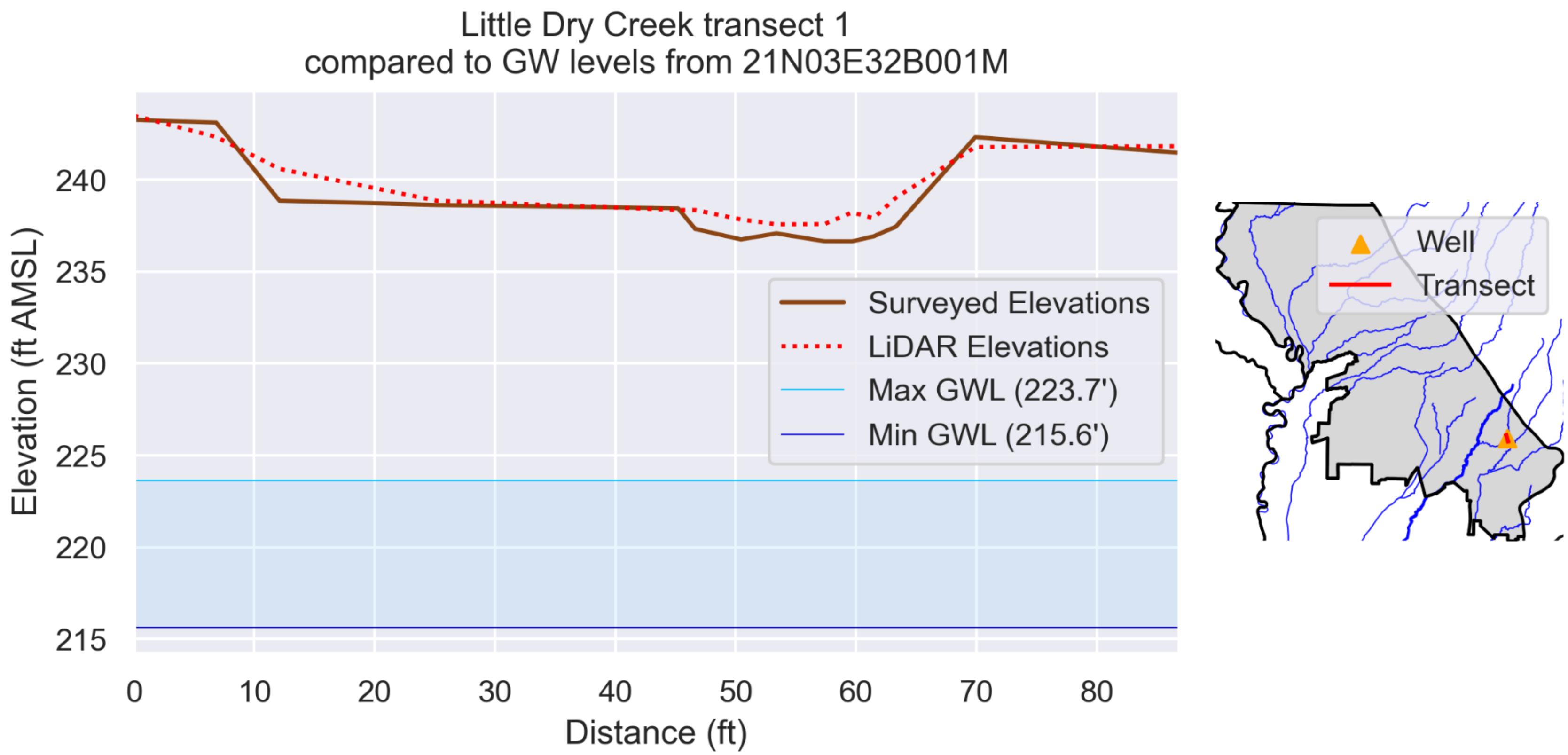


Figure C- 8: Transect Comparing Surveyed and LiDAR Extracted Elevations on Little Dry Creek (distance from well to transect: 0.01 miles).