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SUSTAINABLE GROUNDWATER MANAGEMENT (SGM) GRANT PROGRAM

Groundwater Recharge Feasibility Study

PRESENTED TO
Butte County Water Commission

DATE
May 6, 2026

Prepared by Geosyntec Consultants | In partnership with Butte County Department of Water & Resource Conservation

VINA GSA GRANT
COMPONENT 5

Butte County
WATER & RESOURCE CONSERVATION

Vina
GSA

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Agenda

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01	Overview	
02	Initial List of Sites	
03	Field Investigations	<i>Perched Groundwater Systems</i>
04	Pilot Studies	<i>Infiltration Basins • Reverse Tile Drain • Water Code §1242.1</i>
05	Proposed Projects	<i>Rock Creek / Keefer Slough • Comanche Creek FloodMAR • DMWC Pipeline</i>
06	Key Takeaways	
07	Next Steps	
08	Questions	

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Questions for Successful Groundwater Recharge


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Nine foundational questions guided the feasibility analysis:

<p style="margin: 0;">01</p> <p style="margin: 0;">Where in the subbasin can recharge water infiltrate?</p>	<p style="margin: 0;">02</p> <p style="margin: 0;">Where will the recharge water go after infiltration?</p>	<p style="margin: 0;">03</p> <p style="margin: 0;">Are there landowners that will support the project?</p>
<p style="margin: 0;">04</p> <p style="margin: 0;">Where will the recharge water come from — source?</p>	<p style="margin: 0;">05</p> <p style="margin: 0;">How will recharge water get to project area — conveyance?</p>	<p style="margin: 0;">06</p> <p style="margin: 0;">What are the benefits of the recharge water?</p>
<p style="margin: 0;">07</p> <p style="margin: 0;">Who can use the recharge water — legal?</p>	<p style="margin: 0;">08</p> <p style="margin: 0;">What approvals are needed — permitting?</p>	<p style="margin: 0;">09</p> <p style="margin: 0;">How much does the water cost?</p>

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Project Scope


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The Groundwater Recharge Feasibility Study consists of four core tasks:

<div style="font-size: 48px; font-weight: bold; margin-bottom: 10px;">1</div> <p style="margin: 0; font-weight: bold; font-size: small;">Develop List of Potential Sites</p> <p style="margin: 0; font-size: x-small;">Identify potential groundwater recharge sites and projects in coordination with landowners and stakeholders.</p>	<div style="font-size: 48px; font-weight: bold; margin-bottom: 10px;">2</div> <p style="margin: 0; font-weight: bold; font-size: small;">Conduct Site Visits</p> <p style="margin: 0; font-size: x-small;">Visit candidate sites to confirm accessibility, existing conditions, and stakeholder interest.</p>	<div style="font-size: 48px; font-weight: bold; margin-bottom: 10px;">3</div> <p style="margin: 0; font-weight: bold; font-size: small;">Conduct Recharge Investigation</p> <p style="margin: 0; font-size: x-small;">Characterize subsurface conditions using geophysics, borings, and monitoring wells.</p>	<div style="font-size: 48px; font-weight: bold; margin-bottom: 10px;">4</div> <p style="margin: 0; font-weight: bold; font-size: small;">Conduct Pilot Tests</p> <p style="margin: 0; font-size: x-small;">Where feasible, implement pilot tests to quantify recharge rates and validate project viability.</p>
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Previous Studies & Existing Data


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This study builds on an extensive body of prior work:

2013	Lower Tuscan Aquifer Monitoring, Recharge, and Data Management Project
2017	Stable Isotope Recharge Study
2018	Evaluation of Restoration and Recharge within Butte County Groundwater Basins
2021	Vina Groundwater Sustainability Plan (GSP)
2024	Butte County Recharge Action Plan
—	SAGBI • AEM Survey • SGMA Data Viewer

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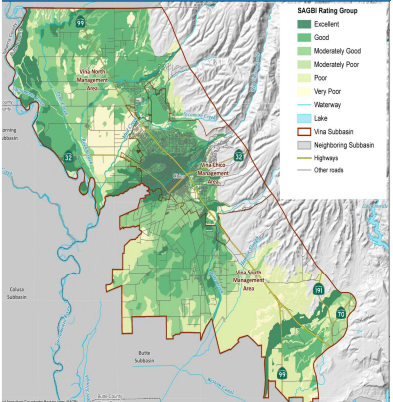


Physical Setting

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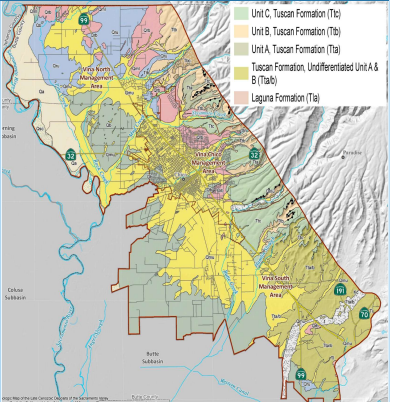
Three datasets informed the initial screening of recharge potential:

Soils (SAGBI – Recharge Potential)



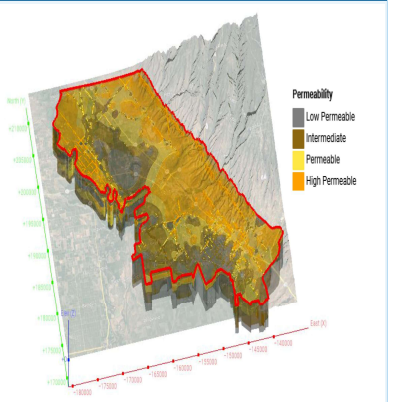
Soil Agricultural Groundwater Banking Index rating across subbasin

Geology



Surface geology classifications — alluvium, volcanic, sedimentary

AEM Data



Airborne Electromagnetic survey showing subsurface texture in 3D

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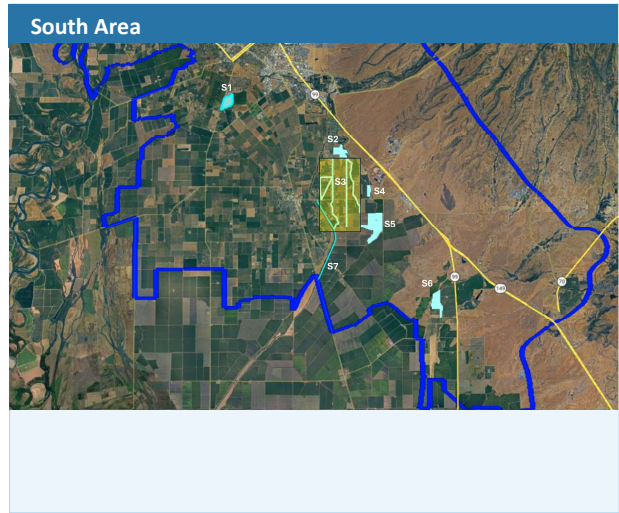
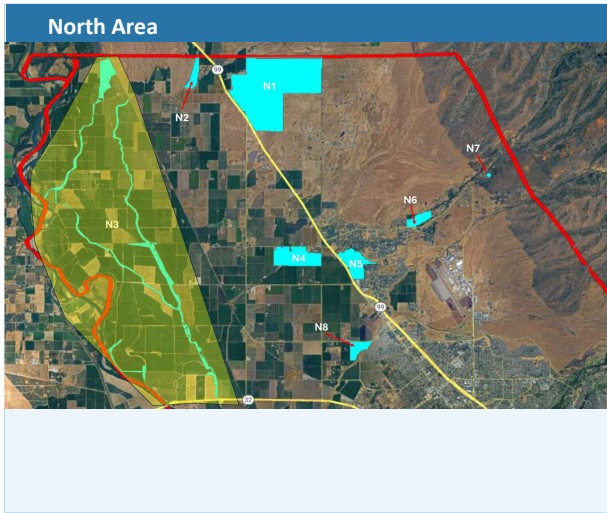
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Potential Sites

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Initial inventory of candidate recharge locations across the Vina Subbasin:

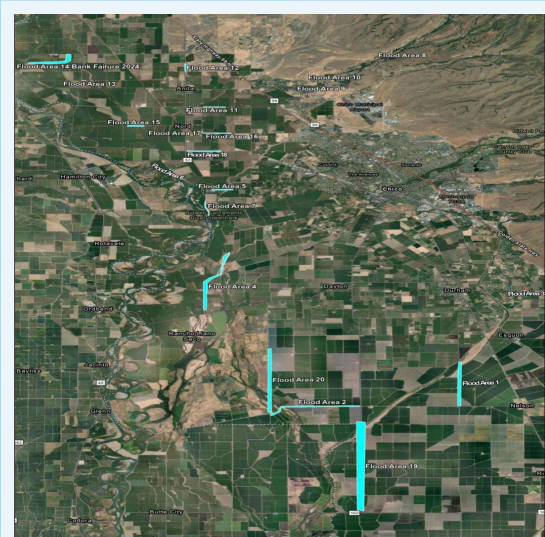


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Potential Sites — Flood Areas

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Locations of Identified Flooding


Source: Butte County Public Works

Why This Matters

Identified flood areas represent a multi-benefit: sites where surface water regularly accumulates can serve as candidate locations for FloodMAR recharge projects, while providing a natural flood mitigation benefit for surrounding communities.

20+ flood-prone areas
 were catalogued across the subbasin, ranging from bank failures to chronic flooding of roadways near Butte City, Nelson, and the Sacramento River corridor.

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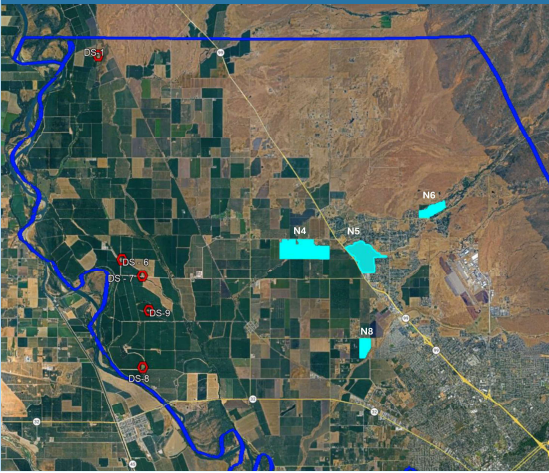


Groundwater Recharge Investigation Sites

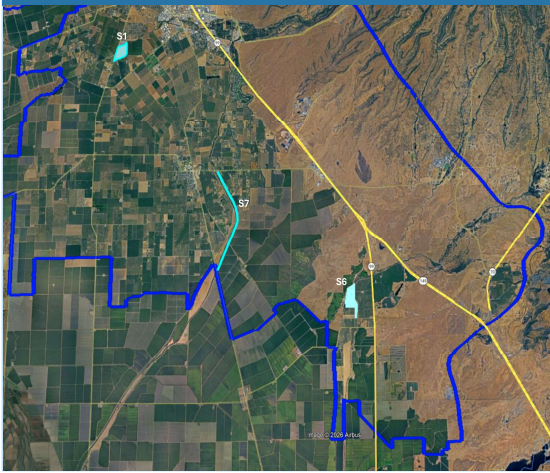
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Sites advanced to field investigation after initial screening:

North Area — N3 (DS Sites), N4, N5, N6, N8




South Area — S1, S6, S7



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Field Investigations

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Investigative activities conducted at each site:

Activity	N3 (DS Sites)	N4	N5	N6	N8	S1	S6	S7
tTEM		●	●	●	●	●	●	
CPT			●			●		
Soil Boring / Perm Testing	●	●	●	●		●	●	
Monitoring Well		●	●				●	
Stream Stilling Well		●	●	●				
Water Quality Testing		●	●				●	
Condition Assessment								●

●
Activity conducted at this site

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Butte County **tTEM and AEM Geophysics** VINA GSA GRANT
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Airborne (AEM) provides large scale 3D subsurface texture assessment across basin for initial selection of areas. Towed (tTEM) electromagnetic data provides the detail 3D subsurface texture needed to assess project sites.

Why This Matters
Tools like AEM and tTEM help understand what's happening beneath the surface – where recharge water can go and whether a project is likely to work.

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Butte County **Perched Groundwater Systems** VINA GSA GRANT
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Site N3 — Groundwater Level Response

Shallow perched water tables exist above the regional aquifer in portions of the Subasin. These must be characterized before recharge projects can be designed, as they constrain infiltration and surface water management.

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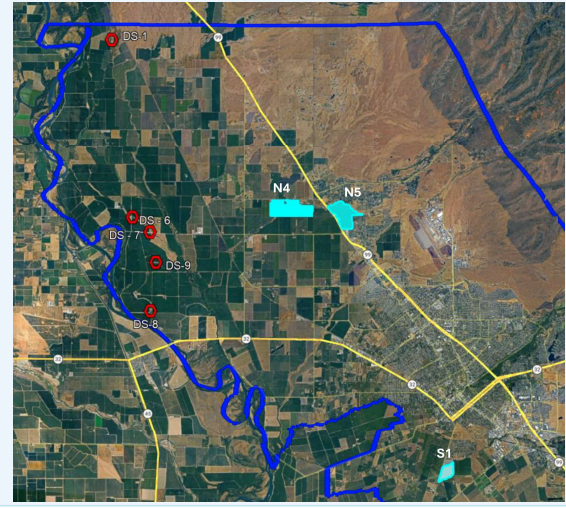
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Pilot Studies

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Three pilot testing approaches were evaluated across four sites:




Activity	N3 (DS)	N4	N5	S1
Infiltration Basin	●	●	●	●
Reverse Tile Drain				●
FloodMAR (WC §1242.1)				●

Three Methods Tested

Infiltration basins at all four sites; reverse tile drain and FloodMAR under Water Code §1242.1 were tested at Site S1 (Comanche Creek area).

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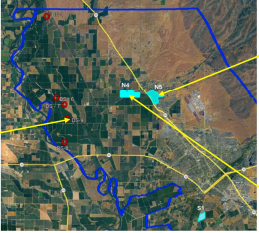
Infiltration Basins — Pilot Results


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Infiltration Basins




Poor Infiltration
Part of Shallow Perched Water





Poor Infiltration
Part of Shallow Perched Water

Good Infiltration




Observations

Two sites showed poor infiltration due to shallow perched water tables. A third site demonstrated excellent infiltration — confirming that site specific investigation is critical and that the subbasin contains locations capable of supporting productive recharge.

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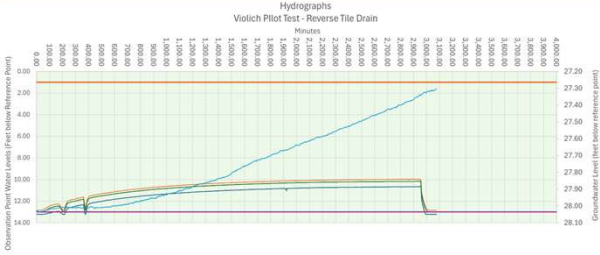
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Reverse Tile Drain

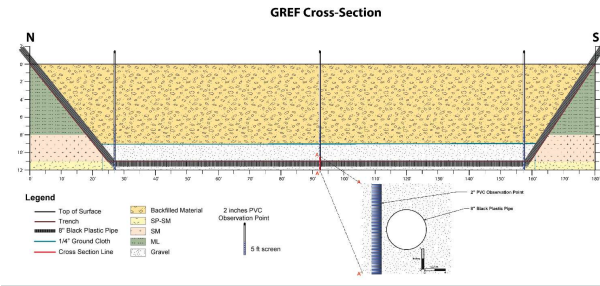
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Hydrographs
Violich Pilot Test - Reverse Tile Drain

GREF Cross-Section



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Pilot System

0.34 acre-ft/day


≈ 100 gallons per minute sustained recharge

Full-Scale Potential

13 acre-ft/day

≈ 3,000 gallons per minute

Projected output from a 4,000-foot reverse tile drain system. One line going north to south on the 87-acre parcel is over 2,000 feet.



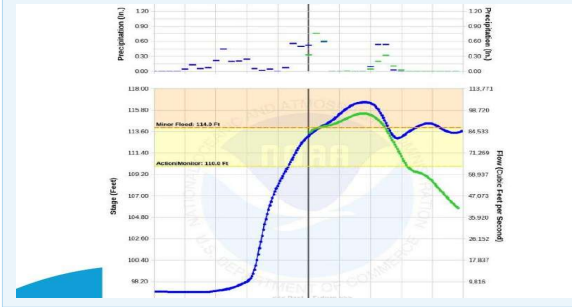
FloodMAR — Water Code §1242.1

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Flood Event Data & Forecast Verification

Date of flood event	Reported Flooding	Prior fore (OR)
11-23-2024	Ord Ferry Rd/River Rd ⁷	7.35
2-5-2025	Ord Ferry Rd/River Rd ⁸	3.75
12-15-2024	Ord Ferry/River Rd ⁹	2.05



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What It Allows

Diversion Without a Water Right


Parties may divert for recharge when downstream flows present an imminent risk of flooding or inundation of land, roads, or structures.

Defining "Imminent Risk"

Determined by analyzing previous flood events and forecasted precipitation prior to those events.

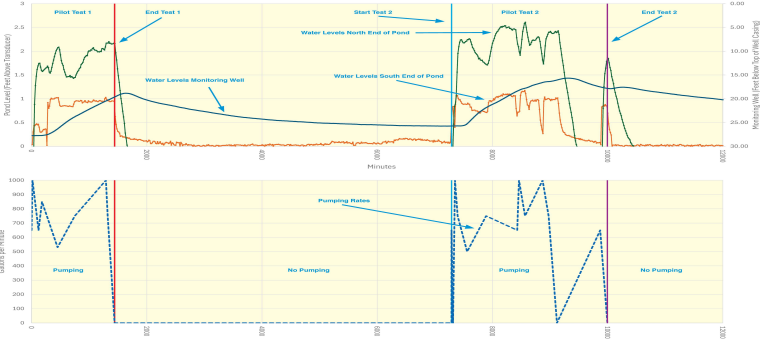
Required Coordination


Butte County WRC, Public Works, Emergency Management, Vina GSA, participating landowner, and California DWR. Results of project are reported to the California State Water Board.



FloodMAR §1242.1 — Pilot Implementation

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Pilot Results — February 2025

Two events triggered §1242.1 diversion:

- February 20–21
- February 25–27

WATER DISCHARGED TO BASIN

~2M gallons


≈ 6 acre-feet recharged

FULL-SCALE PROJECTION (20 ACRES)

62 acre-ft/day

Reverse tile drain showed similar results

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Proposed Projects

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Three projects are recommended for advancement to design and funding:

01

FloodMAR Infiltration Basins

Rock Creek / Keefer Slough

Up to 438 acres of floodplain infiltration with potential 200 AF/day recharge during qualifying events.

02

FloodMAR / Reverse Tile Drain

Comanche Creek

Rehabilitation of historic diversion plus 34-acre pond and reverse tile drain system.

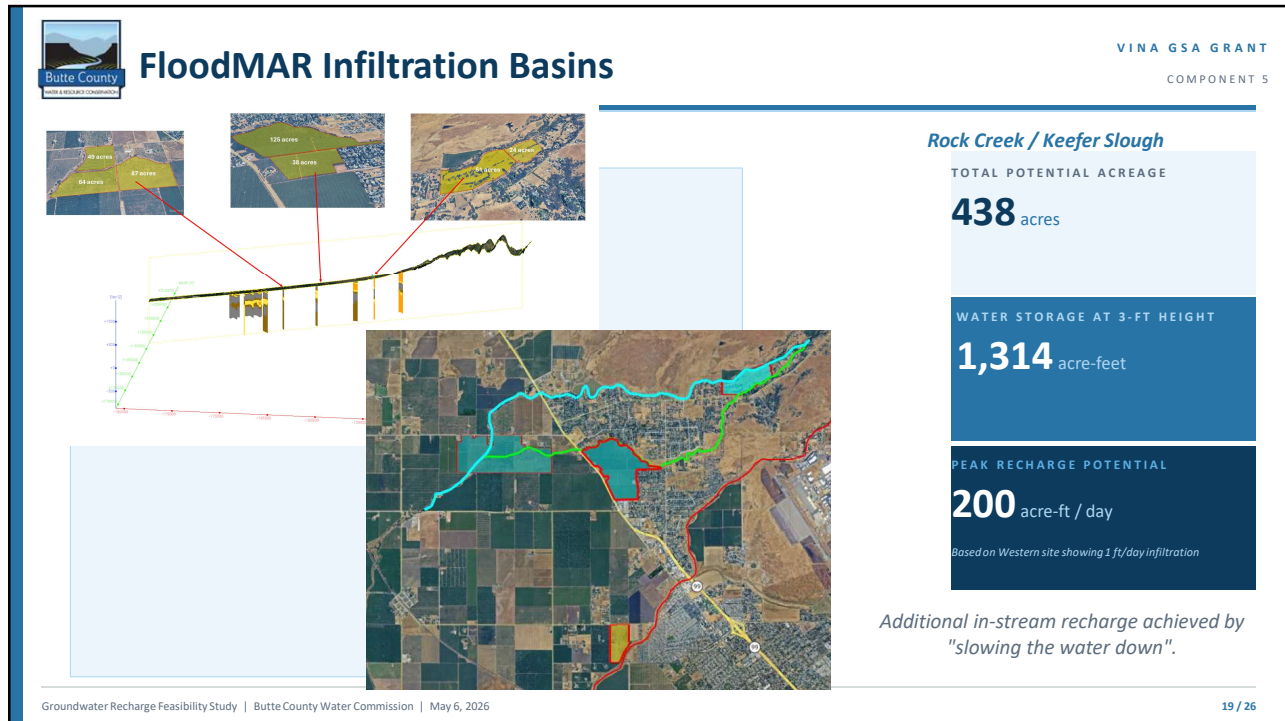
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DMWC Pipeline Restoration

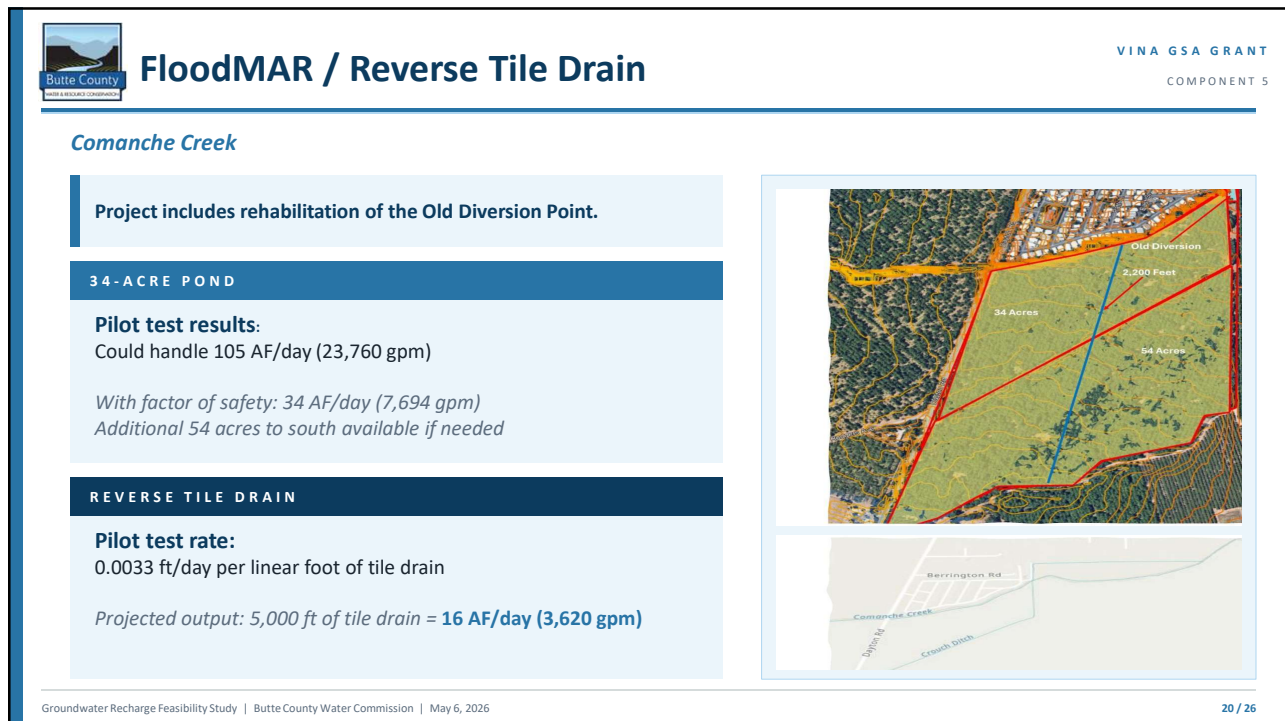
Durham Mutual Water Company

Condition assessment of ~16,000 LF of 36-inch concrete pipeline with an estimated 20–40% water loss.


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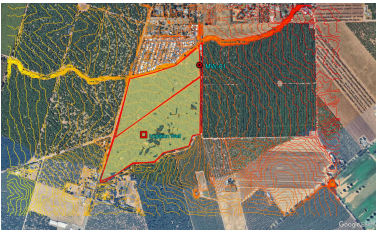
Water Quality

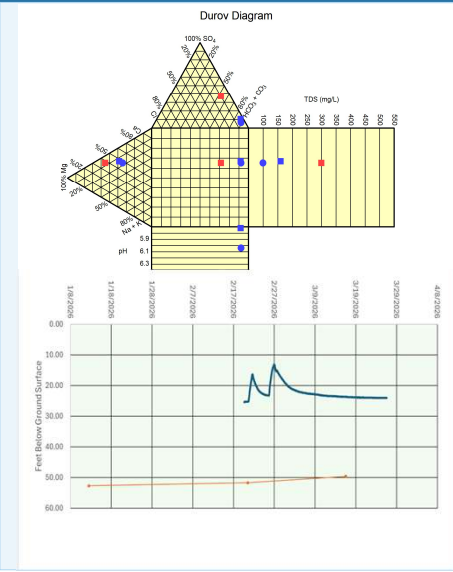
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FloodMAR / Reverse Tile Drain Site

Findings

- Project is down-gradient from a reported VOC plume
- Reported impacts near site are in deeper aquifers
- Two rounds of samples from the on-site monitoring well — both returned no detected VOCs
- Shallow well water levels are well above deeper well levels where impacts have been reported
- Comanche Creek acts as a hydraulic barrier to water migrating to the north
- Slight increase in TDS and temperature from January to March indicates recharge is occurring






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Durham Mutual Water Company Pipeline

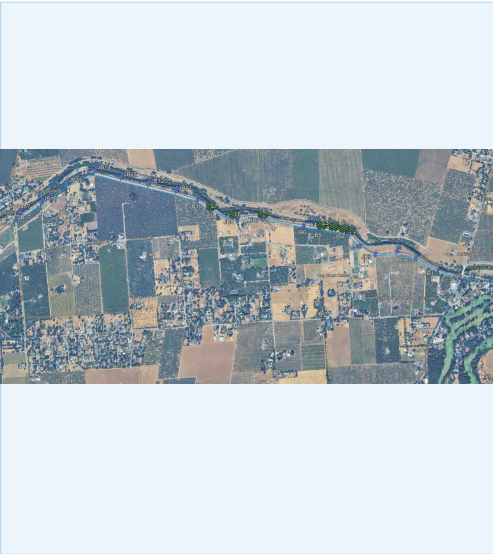
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Project Purpose

- Assess condition and performance of DMWC's primary irrigation conveyance system
- Quantify potential leakage and infrastructure deficiencies
- Support near-term repair prioritization and longer-term funding applications

System Overview


<p>LENGTH</p> <p>~16,000 LF</p>	<p>PIPE TYPE</p> <p>36" concrete</p>
<p>ERA</p> <p>Early 1900s</p>	<p>ESTIMATED WATER LOSS</p> <p>20–40%</p>



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Durham Mutual Water Company Pipeline

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What we are doing



- Comparing flow measurements between conjunction boxes
- Identifying potential leakage zones
- Targeted CCTV (Video) inspection

What we hope to accomplish

- Prepare condition assessment of pipeline
- Provide recommendations for repair with cost analysis


For what purpose?

- Assess condition and performance of primary irrigation conveyance system
- Quantify potential leakage and infrastructure deficiencies
- Support near-term repair prioritization and longer-term funding applications
- Reduce groundwater pumping in area
- Provide source water for future groundwater recharge projects

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Key Takeaways

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1. **Groundwater recharge projects can be implemented within the Vina Subbasin**
 - Successful recharge pilot tests were conducted using both infiltration basins and reverse tile drains
2. **Understanding the hydrogeology is a critical factor**
 - Perched groundwater** is a major constraint at several sites, causing poor infiltration despite surface flooding.
 - tTEM is a **high-value screening tool**, allowing rapid elimination or prioritization of sites before costly drilling.
3. **FloodMAR under Water Code 1242.1 was a successful operational tool**
 - The project demonstrates the Water Code can be applied practically and legally.
 - In the near term, this is an important source of water for recharge in the subbasin
4. **Pilot tests suggest significant capacity for groundwater recharge in the subbasin**
 - But safety factors need to be applied (assume less recharge will occur for planning purposes).
5. **Water quality risks appear manageable – but require continued due diligence.**
 - Water quality monitoring should be included as part of projects.
6. **Repairing Infrastructure for existing surface water conveyance will reduce dependence on groundwater pumping**

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Next Steps

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Three main tasks over the coming months:

01

Detailed Data Analysis

Compile and document investigation results

02

Feasibility Analysis of Proposed Projects

Advance the three proposed projects (Rock Creek/Keefer Slough, Comanche Creek, DMWC Pipeline) through refined feasibility, cost, and benefit evaluation; results could support grant applications such as Proposition 4 funding.


03

Preparation of Reports

Two parallel products combined into a single deliverable: Groundwater Recharge Investigation & Preliminary Design Report; and Pilot Project Implementation Report.

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Schedule

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Reporting milestones:



10 June, 2026

Vina Groundwater Sustainability Agency Board – Project Recap Presentation

30 JUNE 2026

Final Reports

Submitted to Vina GSA

24 June, 2026

Vina Stakeholder Advisory Committee – Project Recap Presentation

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This slide features a dark blue background with a lighter blue vertical bar on the right. On the left, the Butte County Water & Resource Conservation logo is displayed, showing a landscape with a river and mountains. To the right of the logo, the word "Questions?" is written in large white font, followed by a horizontal line and the text "Thank you." in a smaller white font. In the bottom right corner, the Geosyntec consultants logo is visible, with the tagline "engineers | scientists | innovators" below it. At the bottom left, small white text reads: "Vina GSA Grant — Component 5 | Groundwater Recharge Feasibility Study" and "May 6, 2026 | Butte County Water Commission".

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Questions?

Thank you.

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consultants
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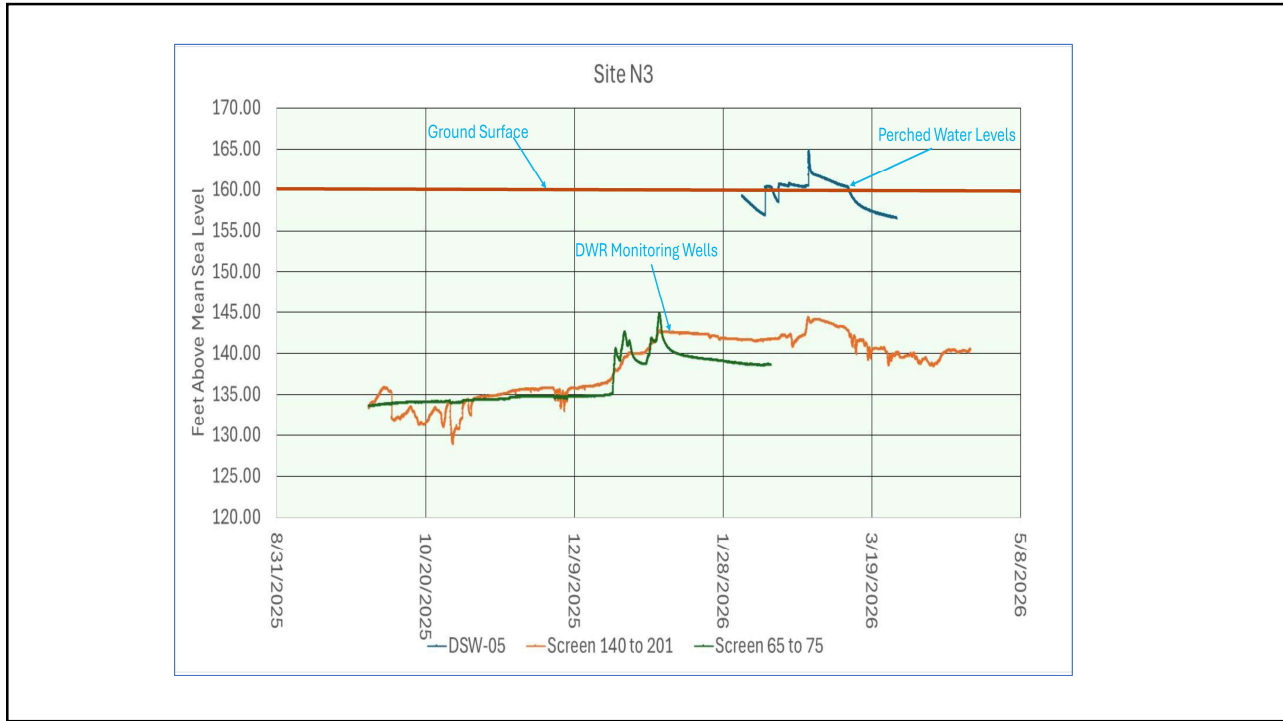
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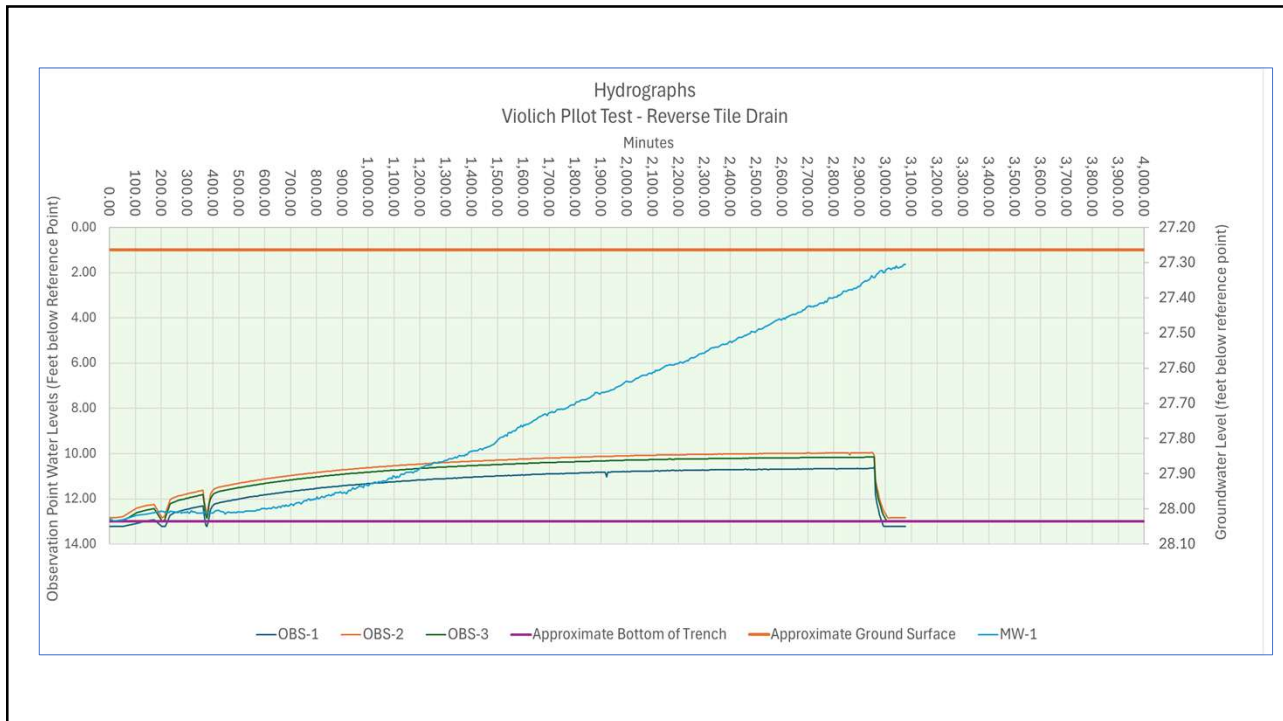
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BACKUP SLIDES

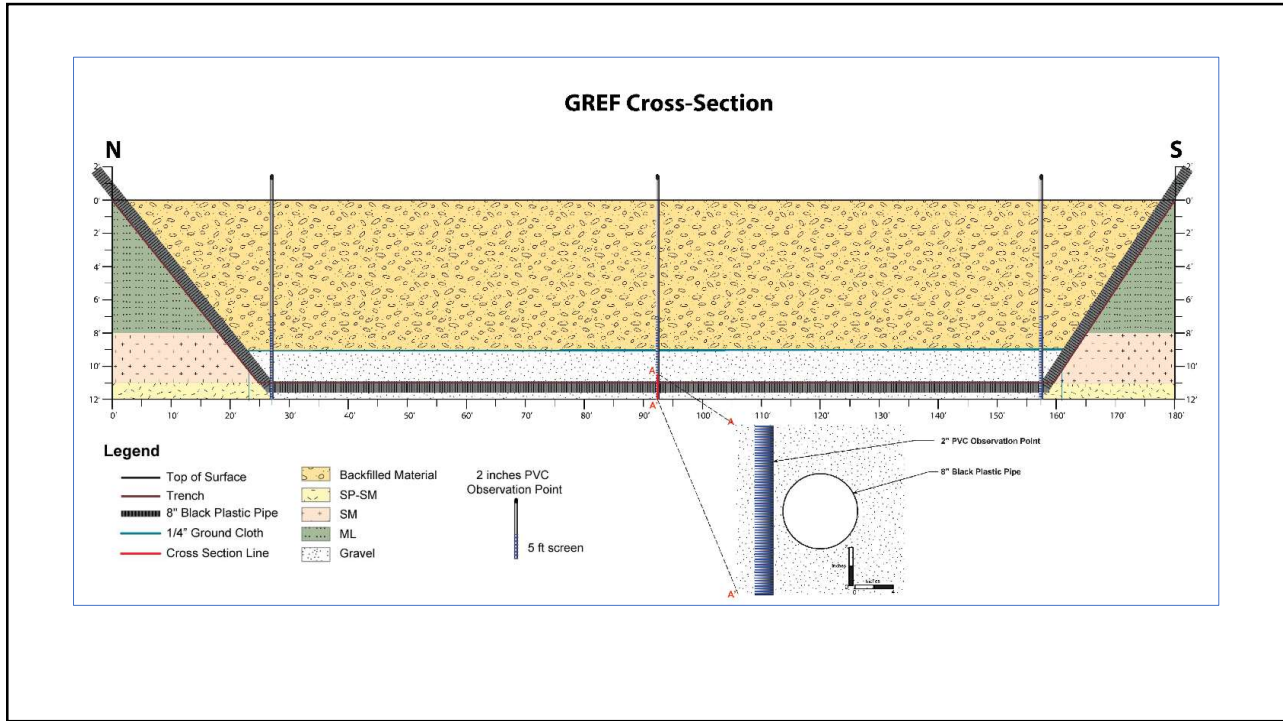
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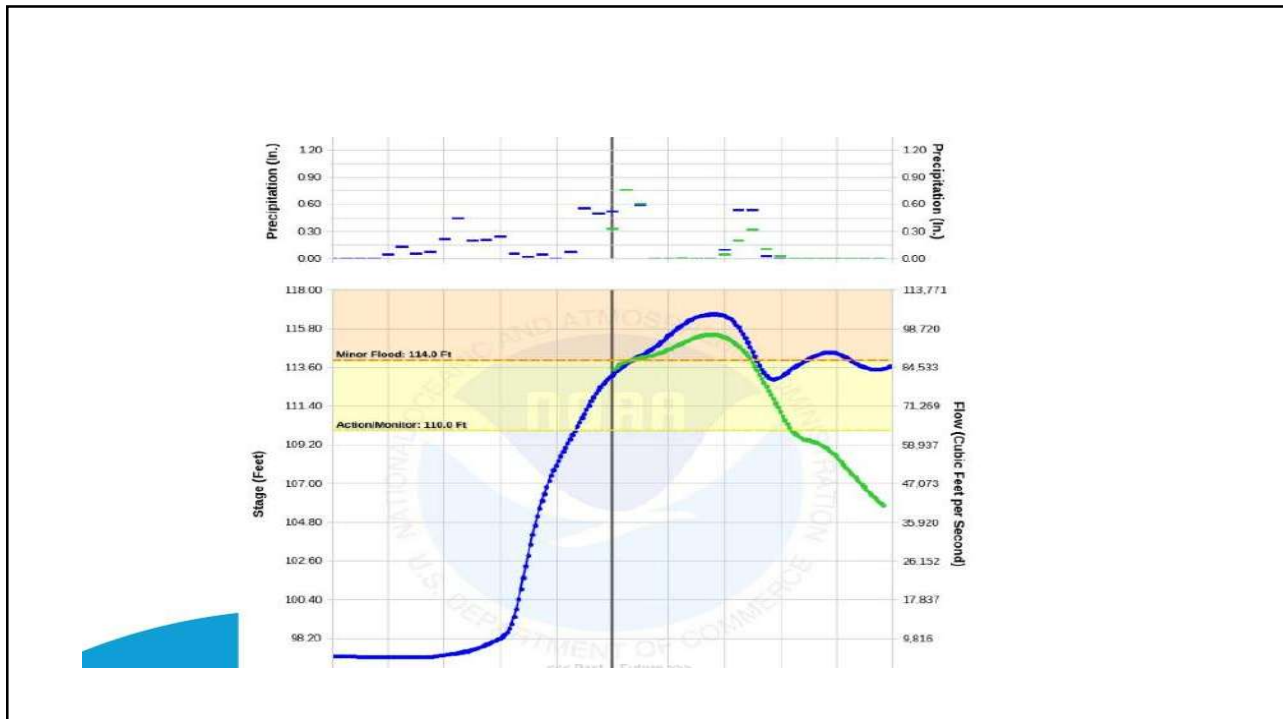
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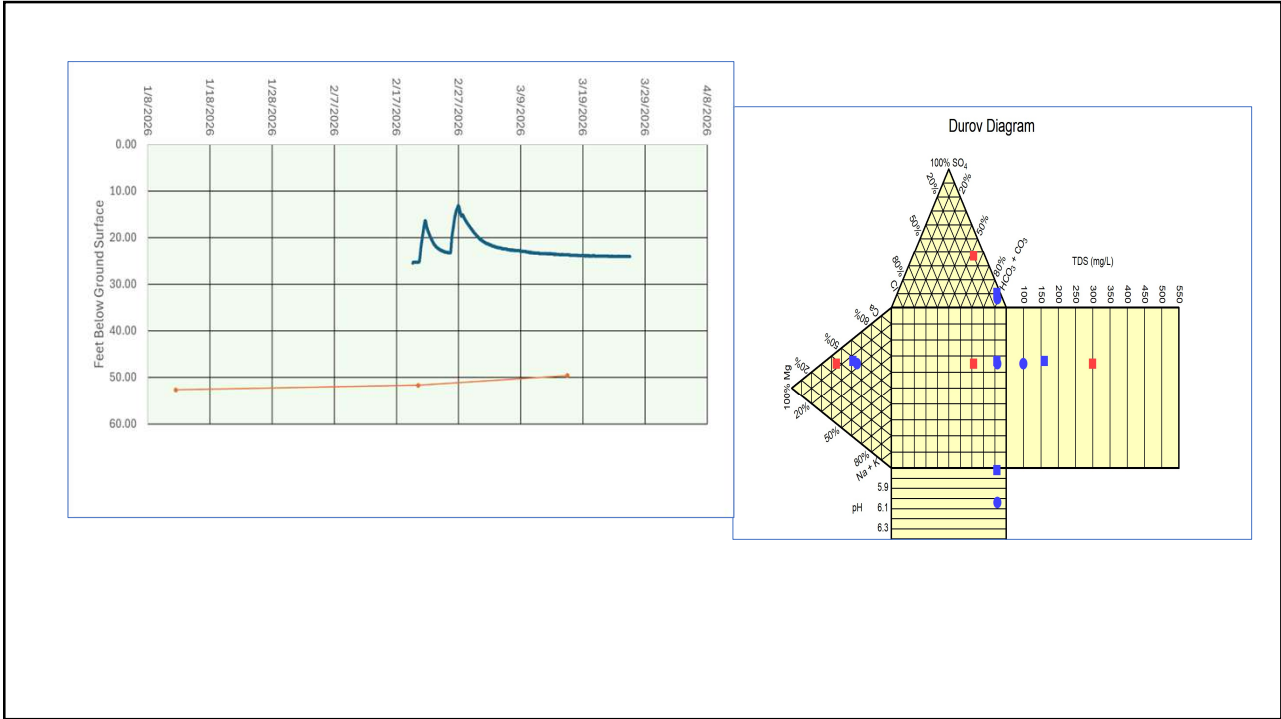
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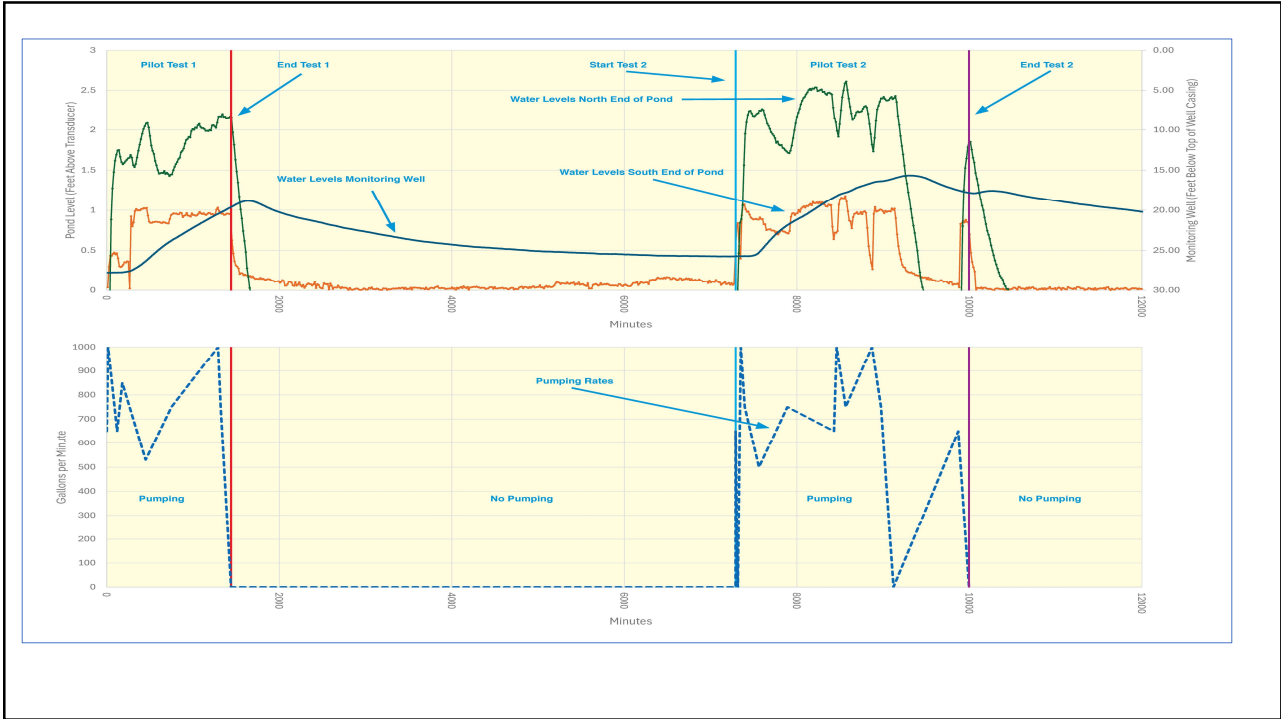
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