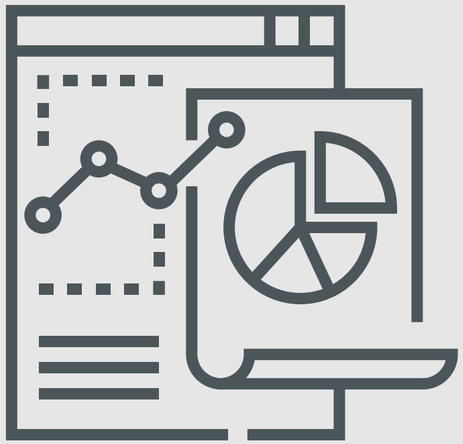
From Data to Decisions: Tribal Water Quality Analysis and Assessments

Brianda Hernandez Rosales
BISHOP PAIUTE TRIBE

EPA CWA Workshop - Fallon, NV
May 20, 2025

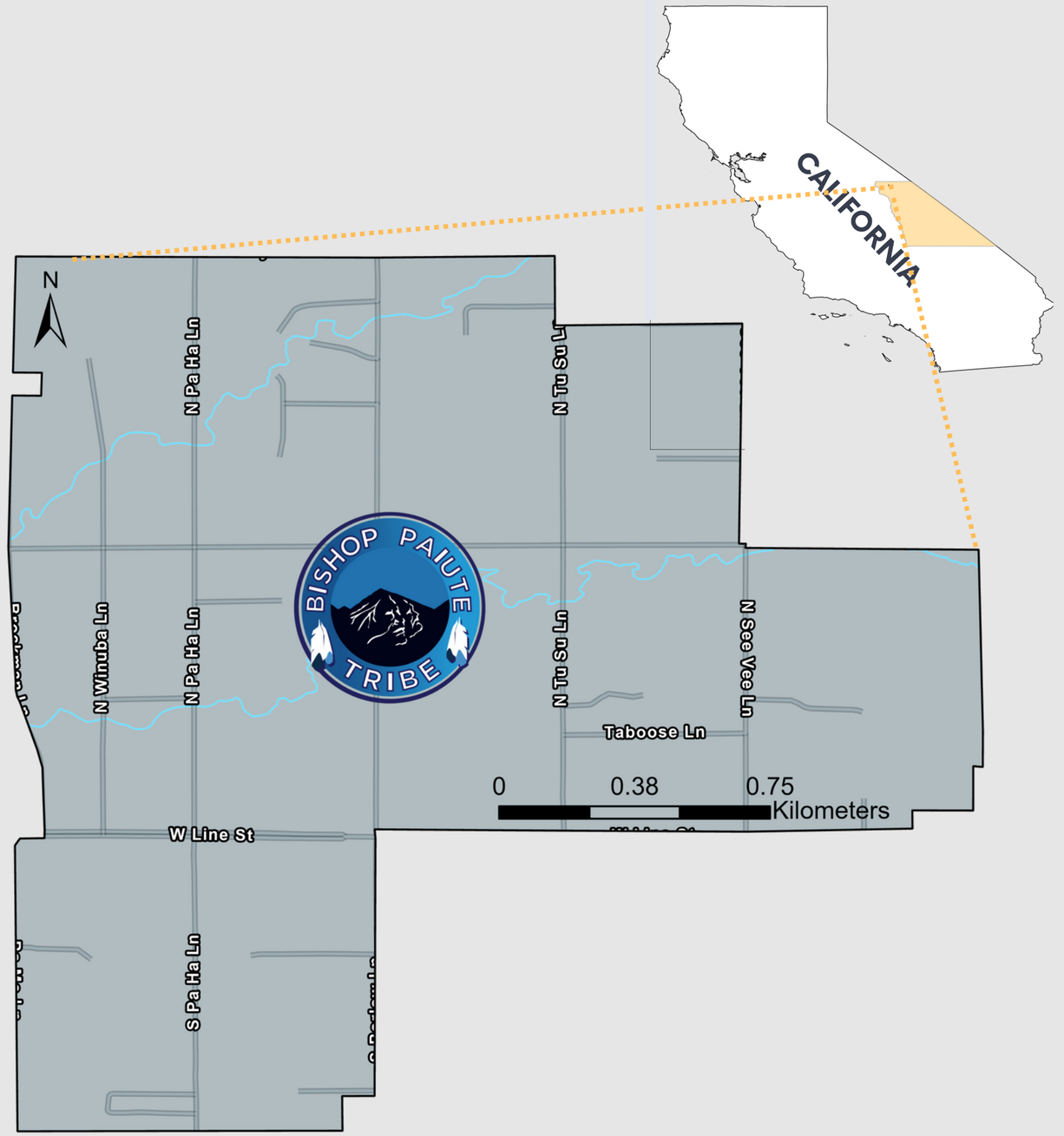
OUTLINE:

- Introduction
- Data Workflow for Tribal WQ Program
- Data Management: Organizing for Impact
- Data Analysis and Assessment
- Turning Data into Action



BISHOP PAIUTE TRIBE

- Federally recognized tribe located on the eastern slope of the Sierra Nevada in Bishop, CA
- Bishop Paiute is the 5th largest tribe in CA with approximately 2,200 members
- The Reservation consist of 875 acres within the Bishop Creek watershed
- Environmental Management Office
  - Water Quality Program - est. 1998
  - Air Quality Program - est. 2001
  - Natural Resources Program - est. 2015



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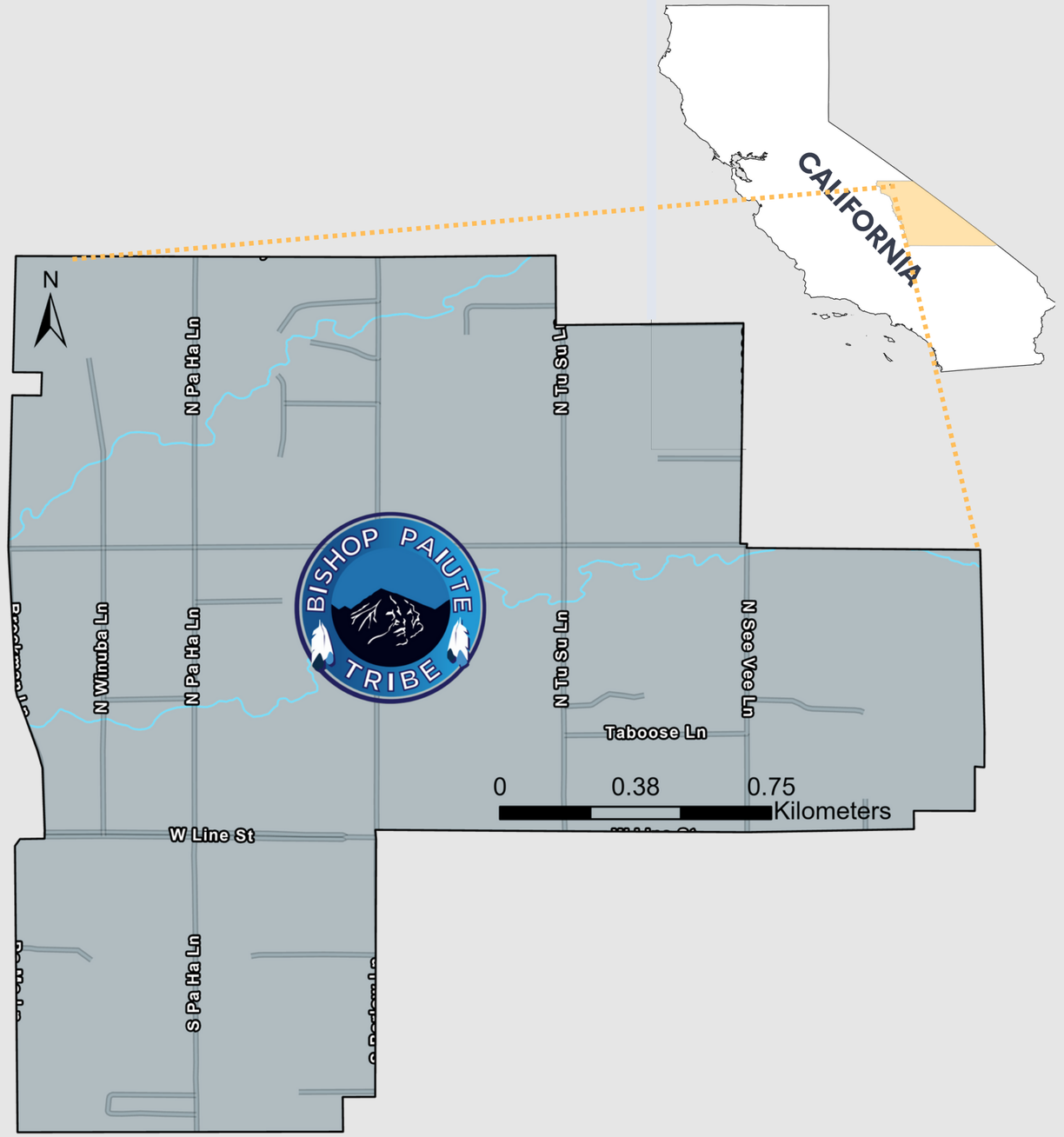
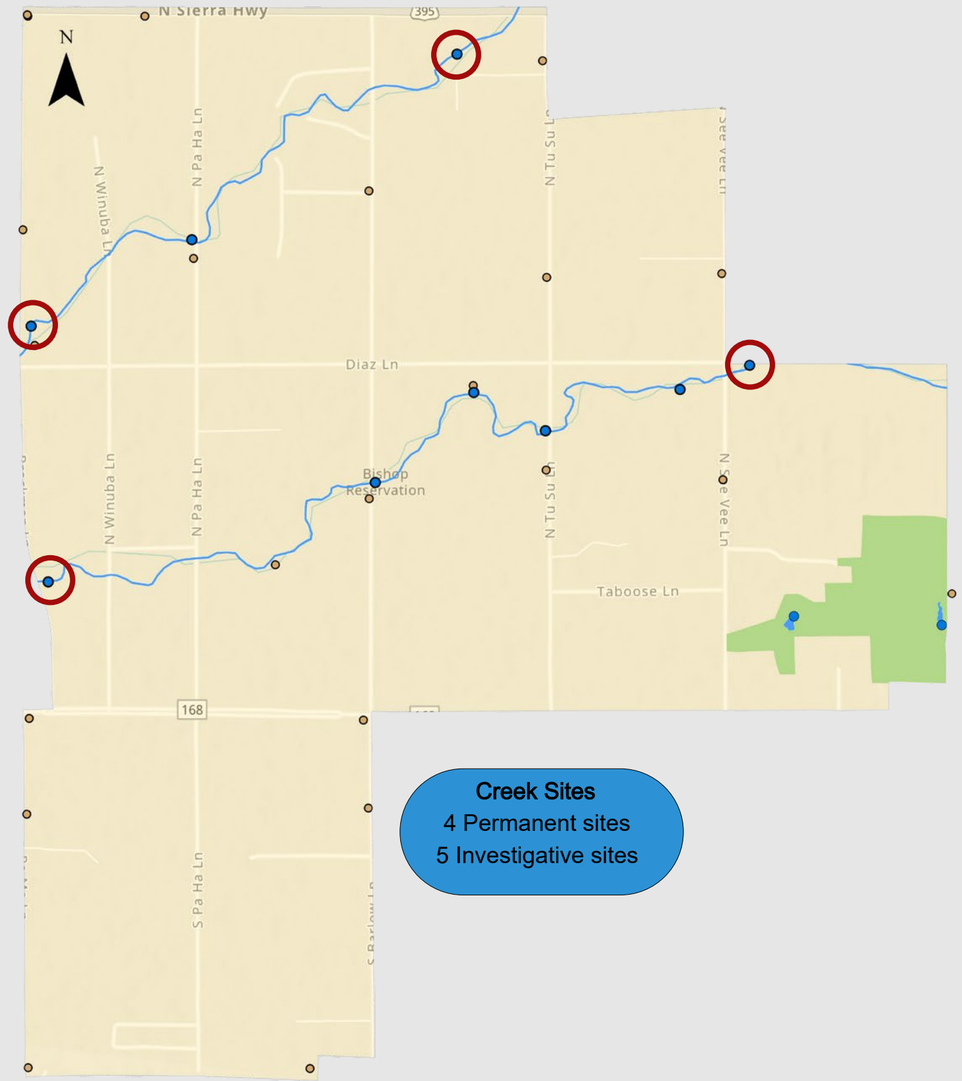
  - **Water Quality Program - est. 1998**
    - Water Quality Program Coordinator (WQC)
    - Water Quality Specialist (WQS)
    - Water Quality Technician (WQT)



WATER QUALITY MONITORING

Creek Sites

- Continuous Monitoring Sites - Physical Parameters
  - Four sites - entrance and exit of BC
  - 30 min intervals
  - Text files



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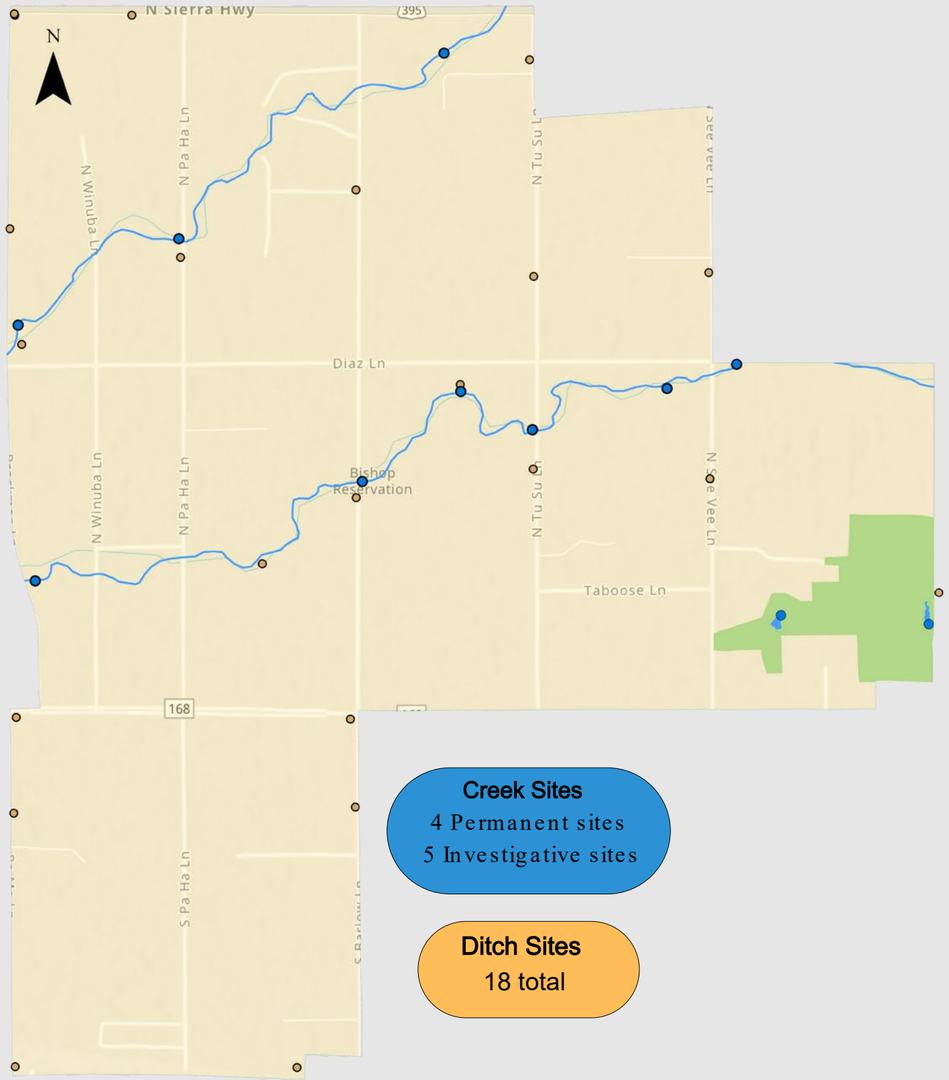
- Bacteria and Nutrient Monitoring
  - Total Coliform + E. coli, Phosphorus & Total Nitrogen, Physical Parameters
  - 9 sites (4 permanent &5 investigative)



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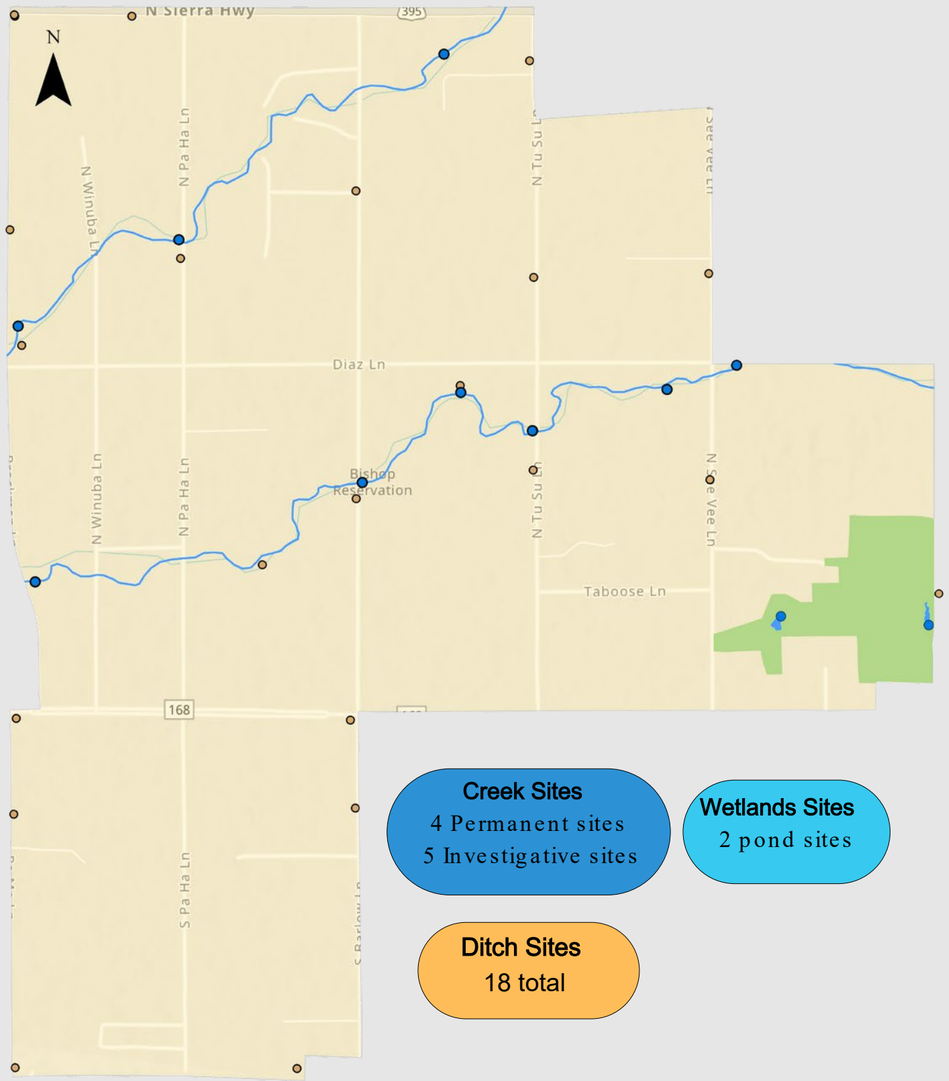
Ditch Sites

- Bacteria and Nutrient Monitoring
  - 18 sites



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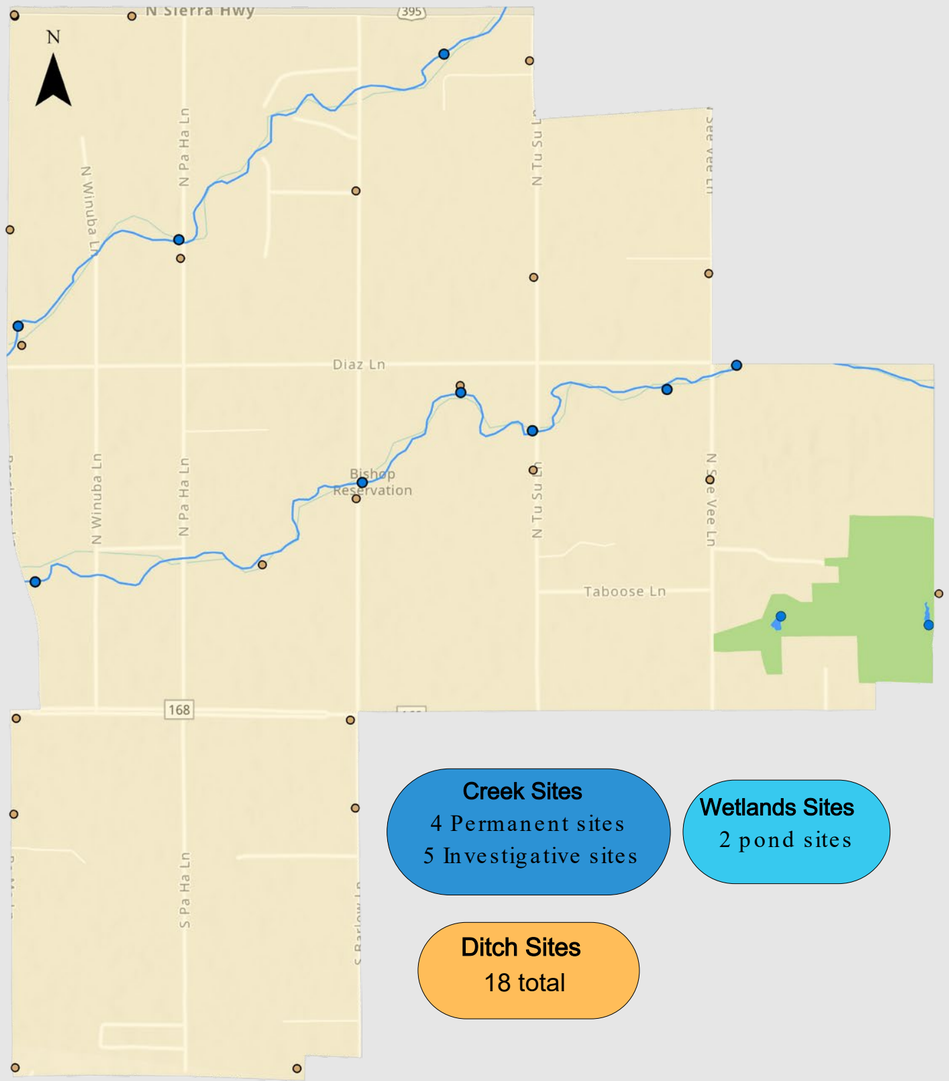
  - 18 sites

Wetlands

- Continuous Monitoring - Temp and DO
- Bacteria, Nutrient Monitoring, Physical Parameters
- 2 Ponds



WATER QUALITY DATA WORKFLOW

BACTERIA: TOTAL COLIFORM + E COLI

1

Field Work:
Collect
Samples

Lab Work:
Analyze
Samples

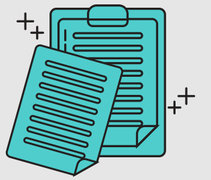
2

3

Data
Management

Data
Analysis and
Assessment

4



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Reporting

WATER QUALITY DATA WORKFLOW

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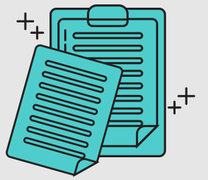

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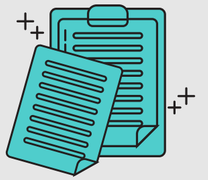

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Reporting

Decision
Making

WATER QUALITY

DATA MANAGEMENT

DATA ENTRY

- Excel Spreadsheets
- CSV Spreadsheets
  - Long format (1 row per sample/parameter) → Easier for analysis in R/Python and Excel
  - Wide format (1 record per sample, multiple parameter columns → Easier for human readable tables
- AWQMS Database
- ArcGIS Online

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SITE	VARIABLE	VALUE	UNIT
SW-1	E coli	98	MPN
SW-1	Temp	19	℃
SW-1	pH	7.5	-
SW-2	DO	11.6	mg/L
SW-2	E coli	92	MPN
SW-2	Temp	20.3	℃
SW-3	pH	7.56	-
SW-3	E coli	102	MPN
SW-3	Sp. Cond	127	µS/cm
SW-4	DO%	102	%
SW-4	Temp	19.8	℃
SW-4	E coli	96	MPN

SITE	E coli (MPN)	Temp (°C)	pH	DO (mg/L)
SW-1	98	19	7.5	10.8
SW-2	92	20.3	8	11.6
SW-3	102	19.7	7.56	12.7
SW-4	96	19.8	7	10.2

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IMPORTANT!

Long format = tidy data for automation; wide format = intuitive viewing for reports

Pick based on how you'll use the data.

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DATA RETRIEVAL

- Directly from CSV or Excel Spreadsheets
  - Majority of Data
- Application Program Interface (API) using R software for AWQMS
  - Bacteria and physical parameter data
- Water Quality Portal
  - Continuous Data (summary data)
  - Resources on API and Web Service
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Start at minute 24:50
Demo at minute 44:17

WATER QUALITY
DATA ANALYSES

EXCEL

- Instant Analyses
  - No coding needed - start analyzing immediately
- Spot Errors Fast
  - Filter/Sort to flag critical data or missing data
- Good for quick summary
  - Use PivotTables to group by site, date, or parameter.
- Best for: Small-to-medium datasets, quick reports, and collaborating with non-technical teams.

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  - Length of total bank condition for both creeks to put in PPG quarterly report

	A	C	D	I	J	K	S
1	OBJECTID	Shape__Length (m)	Shape_length (ft)	Date Observed	Observer	Fork	Bank Condition
2	1	17.29108906	56.73206321	2/26/2025 20:36	Jared Hess	South	Stable
3	2	33.35293609	109.4309833	2/25/2025 17:58	Jared Hess	South	Stable
4	3	17.48349306	57.36334073	2/25/2025 18:00	Sage Neely	South	Eroded
5	4	32.10920685	105.3503077	2/25/2025 18:00	Brianda Herr	South	Stable
6	5	54.03636679	177.2933194	2/25/2025 18:02	Jared Hess	South	Stable
7	6	8.922162878	29.2736164	2/25/2025 18:03	Brianda Herr	South	Active Erosion
8	7	98.82008639	324.2287034	2/25/2025 18:05	Sabrina Barl	South	Stable
9	8	19.35804636	63.51375011	2/25/2025 18:07	Sabrina Barl	South	Stable
10	9	57.6854407	189.2659309	2/25/2025 18:08	Brianda Herr	South	Stable
11	10	6.043233558	19.8278493	2/25/2025 18:08	Sabrina Barl	South	Vulnerable
12	11	98.66851751	323.731406	2/25/2025 18:08	Jared Hess	South	Stable
13	12	31.79280082	104.3121795	2/25/2025 18:10	Sabrina Barl	South	Stable
14	13	13.90465889	45.62118582	2/25/2025 18:11	Brianda Herr	South	Eroded
15	14	30.00301429	98.43988989	2/25/2025 18:12	Sabrina Barl	South	Stable
16	15	0.017928746	0.058824216	2/25/2025 18:16	Sage Neely	South	Vulnerable
17	16	32.33228476	106.0822263	2/25/2025 18:16	Sabrina Barl	South	Stable
18	17	31.57399785	103.5942869	2/25/2025 18:17	Jared Hess	South	Stable
19	18	140.7752633	461.8836389	2/25/2025 18:18	Brianda Herr	South	Stable
20	19	18.65477429	61.20631445	2/25/2025 18:20	Sabrina Barl	South	Eroded
21	20	9.205053451	30.20178037	2/25/2025 18:20	Jared Hess	South	Eroded
22	21	8.280775118	27.16922316	2/25/2025 18:21	Brianda Herr	South	Other
23	22	66.52699461	218.2750693	2/25/2025 18:22	Sage Neely	South	Vulnerable
24	23	11.42217278	37.47614889	2/25/2025 18:23	Sabrina Barl	South	Stable
25	24	16.97786838	55.70438615	2/25/2025 18:22	Jared Hess	South	Vulnerable
26	25	9.739043233	31.95380085	2/25/2025 18:25	Sabrina Barl	South	Stable
27	26	57.03236729	187.1231971	2/25/2025 18:25	Sage Neely	South	Stable
28	27	50.72054215	166.4140988	2/25/2025 18:27	Brianda Herr	South	Stable
29	28	16.75259747	54.9652723	2/25/2025 18:26	Jared Hess	South	Active Erosion
30	29	15.41927975	50.59065686	2/25/2025 18:28	Sabrina Barl	South	Stable
31	30	15.21753648	49.92873719	2/25/2025 18:32	Sabrina Barl	South	Stable
32	31	31.96258206	104.8692317	2/25/2025 18:30	Jared Hess	South	Vulnerable
33	32	72.09023905	236.5280743	2/25/2025 18:32	Brianda Herr	South	Vulnerable
34	33	78.98644219	259.1545168	2/25/2025 18:38	Brianda Herr	South	Stable

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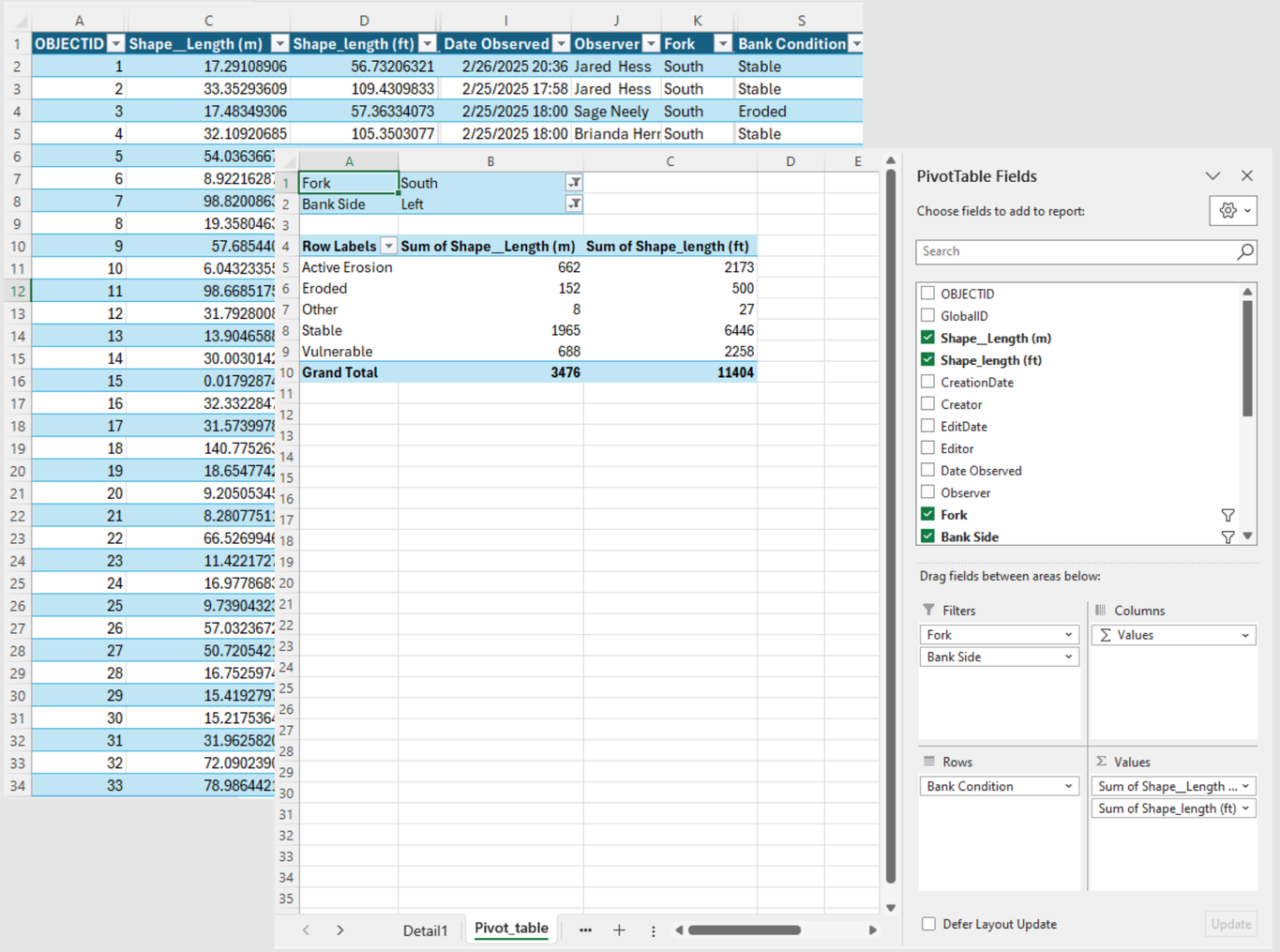

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6	8.9221628					
7	98.820086					
8	19.358046					
9	57.68544					
10	6.0432335					
11	98.668517					
12	31.792800					
13	13.904658					
14	30.003014					
15	0.0179287					
16	32.332284					
17	31.573997					
18	140.77526					
19	18.654774					
20	9.2050534					
21	8.2807751					
22	66.526994					
23	11.422172					
24	16.977868					
25	9.7390432					
26	57.032367					
27	50.720542					
28	16.752597					
29	28					
30	29					
31	30					
32	31					
33	32					
34	33					

Fork	South
Bank Side	Left

Row Labels	Sum of Shape__Length (m)	Sum of Shape_length (ft)
Active Erosion	662	2173
Eroded	152	500
Other	8	27
Stable	1965	6446
Vulnerable	688	2258
Grand Total	**3476**	**11404**

Detail1 | Pivot_table

PivotTable Fields

Choose fields to add to report:

Search

- OBJECTID
- GlobalID
- **Shape__Length (m)**
- **Shape_length (ft)**
- CreationDate
- Creator
- EditDate
- Editor
- Date Observed
- Observer
- **Fork**
- **Bank Side**

Drag fields between areas below:

Filters: Fork, Bank Side

Columns: Values

Rows: Bank Condition

Values: Sum of Shape__Length ..., Sum of Shape_length (ft)

Defer Layout Update | Update

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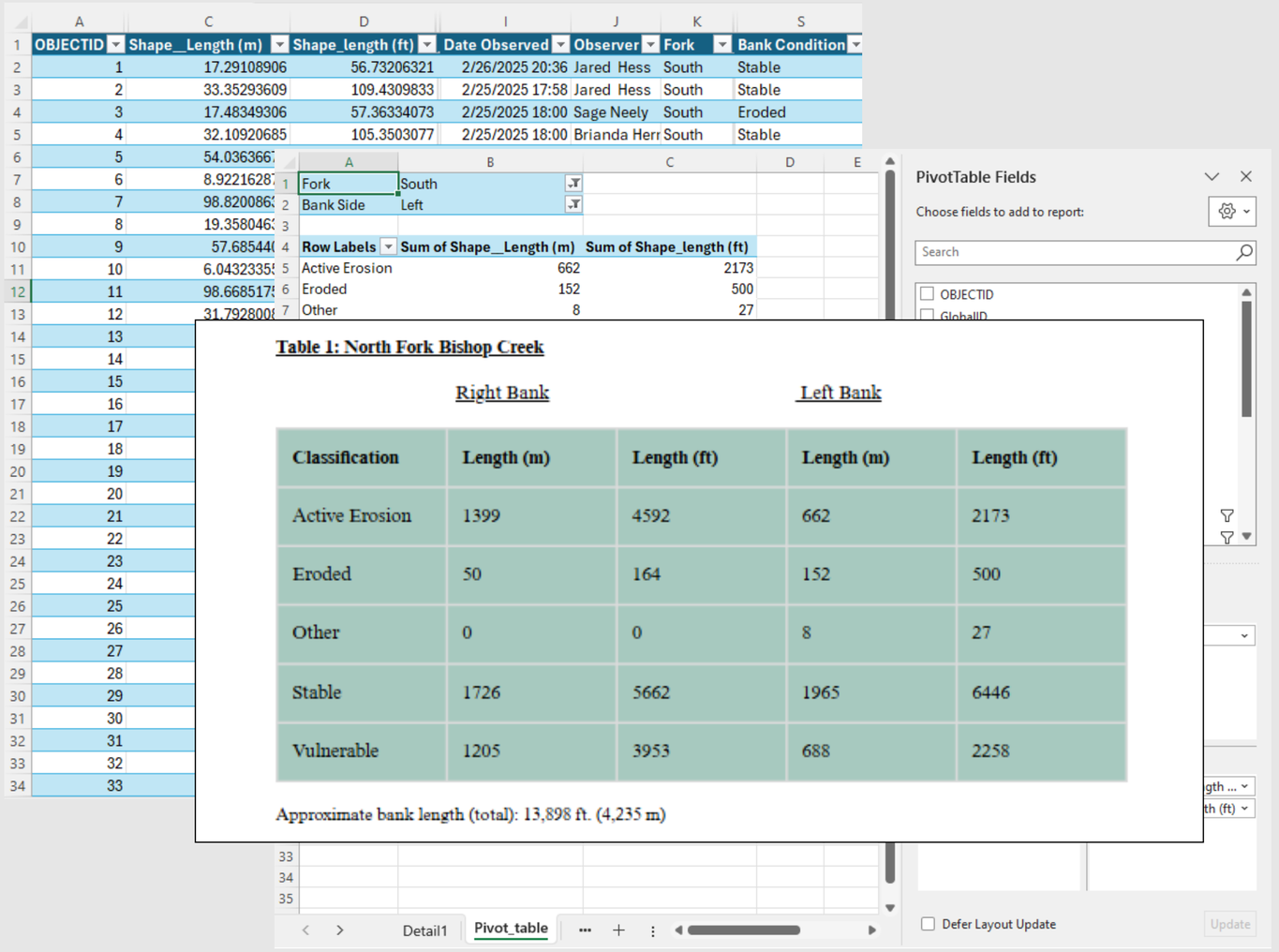

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Table 1: North Fork Bishop Creek

	Right Bank		Left Bank	
Classification	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (ft)**
Active Erosion	1399	4592	662	2173
Eroded	50	164	152	500
Other	0	0	8	27
Stable	1726	5662	1965	6446
Vulnerable	1205	3953	688	2258

Approximate bank length (total): 13,898 ft. (4,235 m)

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Update

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ARCGIS PRO & OTHER SPATIAL SOFTWARE

- Map Data
  - Visualize sampling sites and pollution hotspots instantly
- Spot Spatial Errors
  - Flag GPS mistakes (e.g., points on land when they should be in water)
- Compare Over Time/Location
  - Layer historical data to track contamination trends
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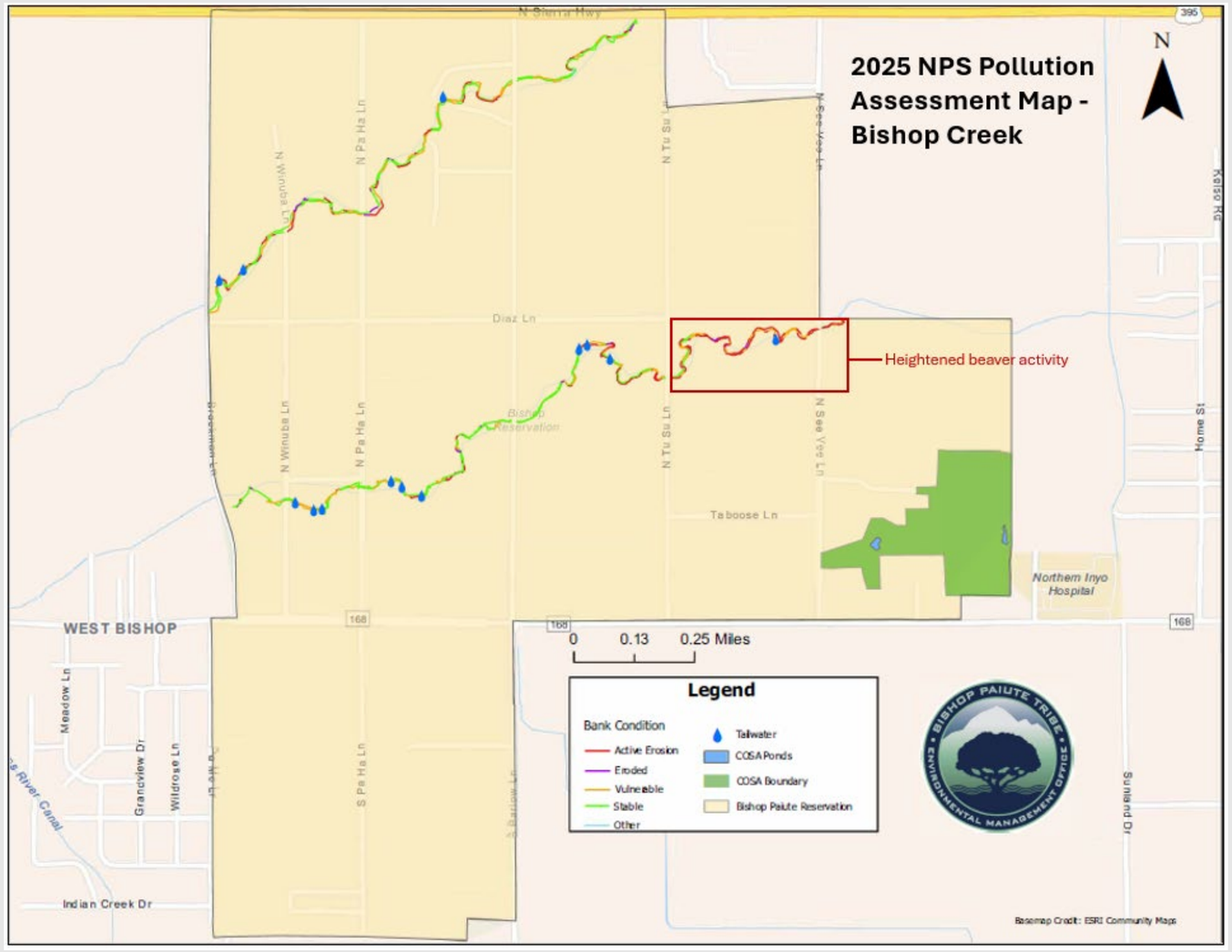

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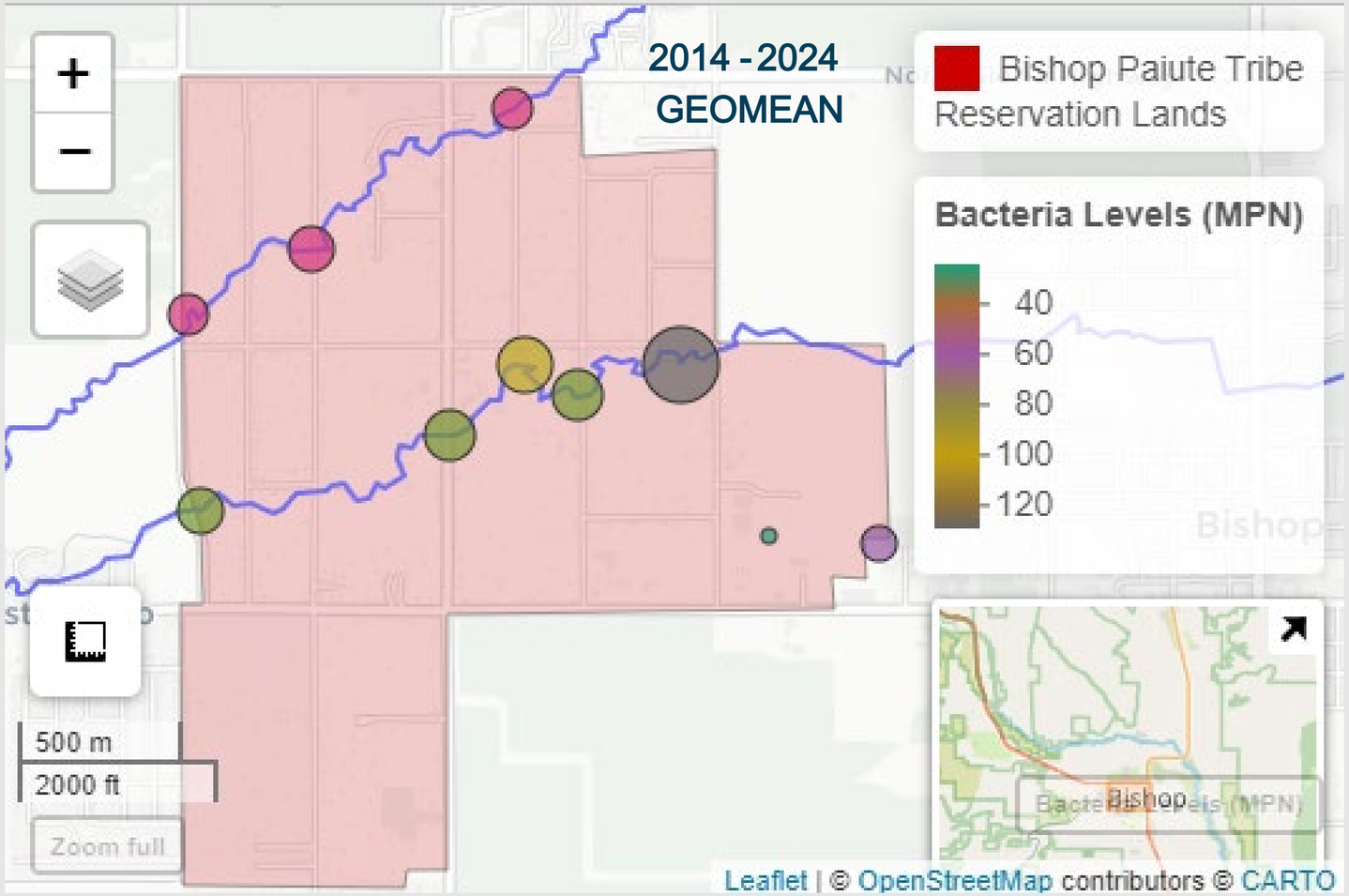

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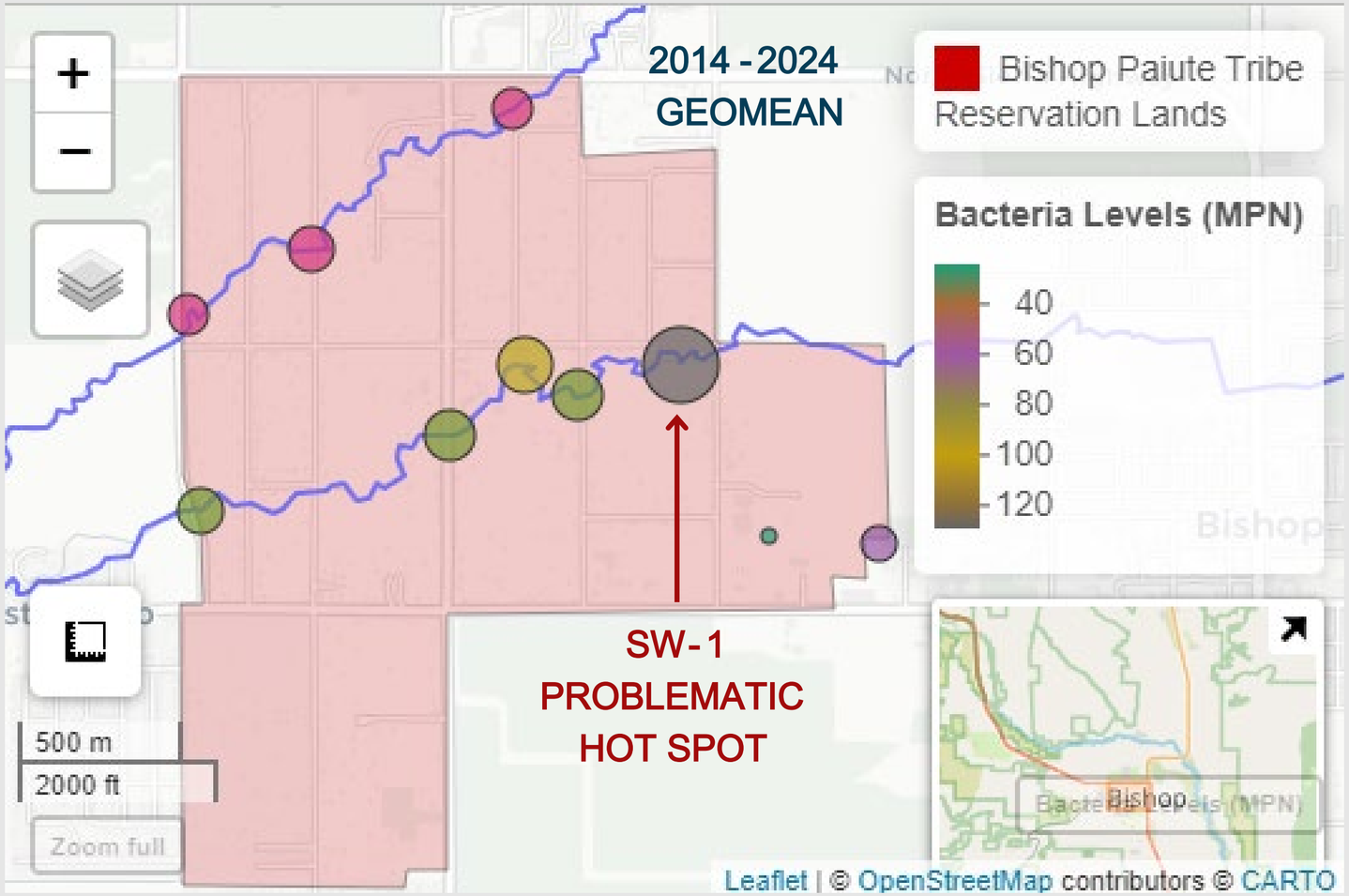

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R SOFTWARE & TIME SERIES

- Powerful Analysis
  - Run advanced stats (trends, TMDLs, machine learning) beyond Excel's limits
- Reproducible Workflows
  - Scripts let you re-run analyses with new data in one click
- Publication-Quality Visuals
  - Create interactive maps/time series
- Connect to Databases
  - Pull data automatically from WQP, APIs, or tribal databases
- Free and Open Source
  - No software costs - runs on any computer

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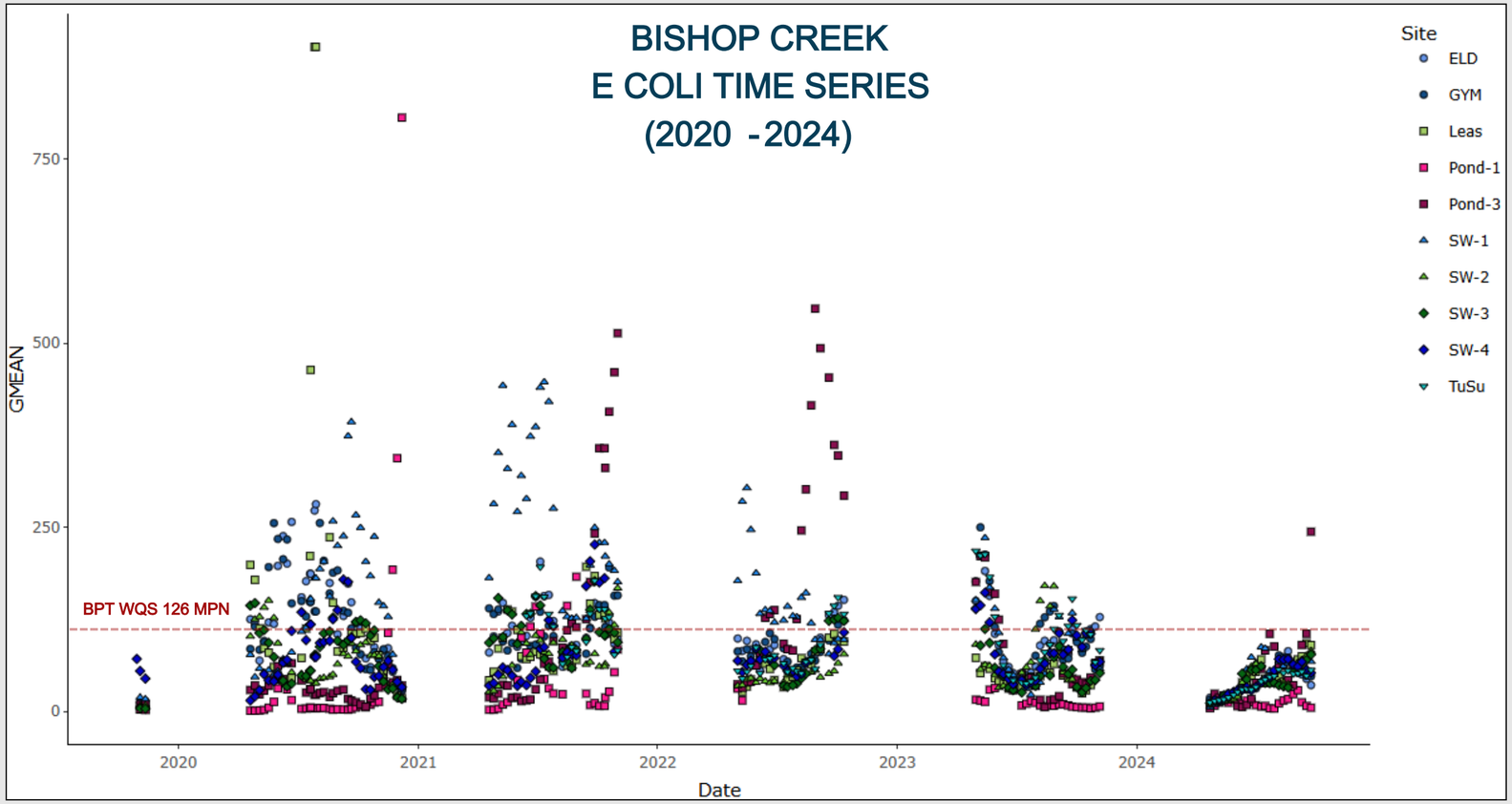

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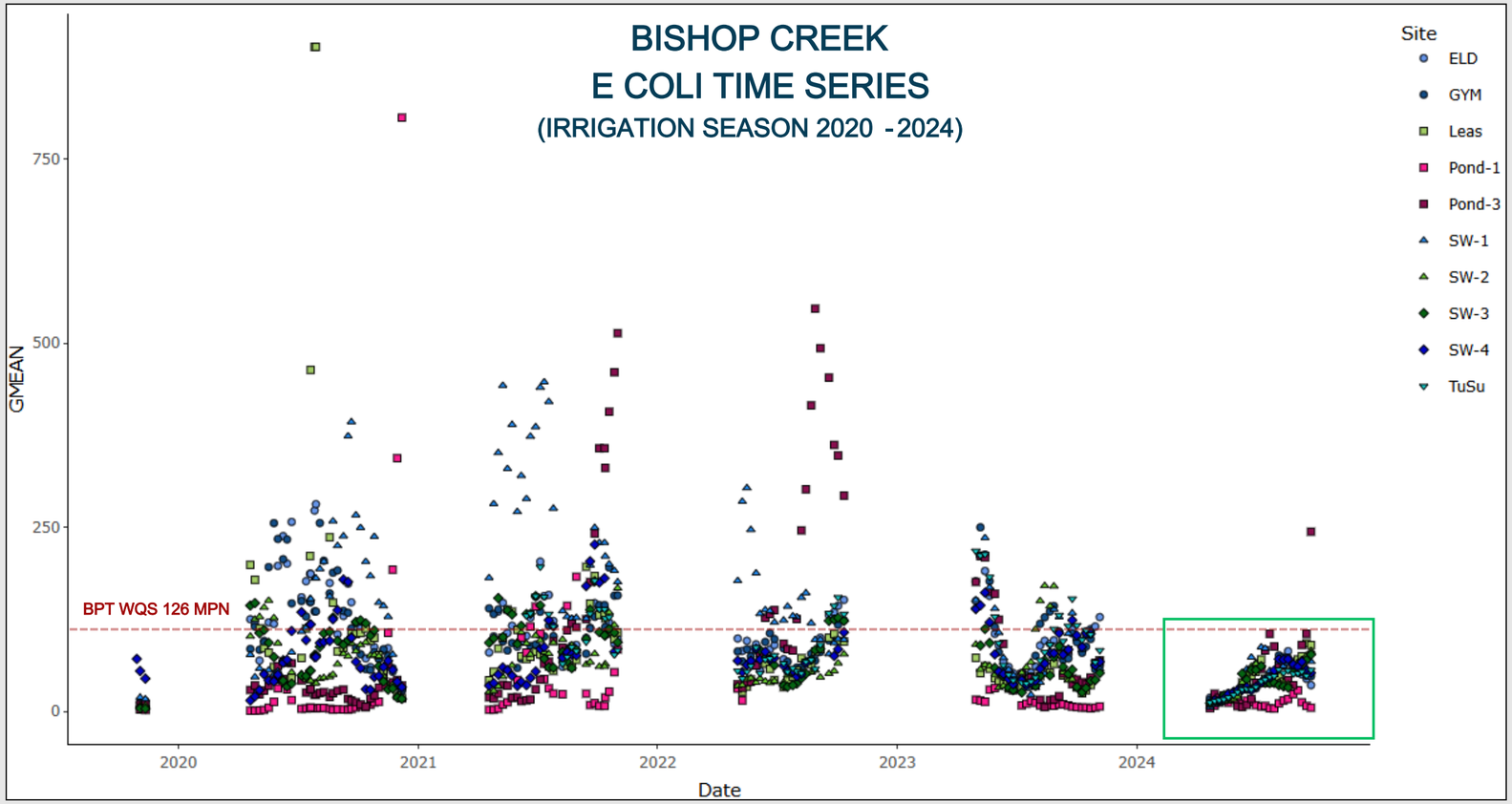

WATER QUALITY
DATA ANALYSES

R SOFTWARE & TIME SERIES

- Powerful Analysis
  - Run advanced stats (trends, TMDLs, machine learning) beyond Excel's limits
- Reproducible Workflows
  - Scripts let you re-run analyses with new data in one click
- Publication-Quality Visuals
  - Create interactive maps/time series
- Connect to Databases
  - Pull data automatically from WQP, APIs, or tribal databases
- Free and Open Source
  - No software costs - runs on any computer

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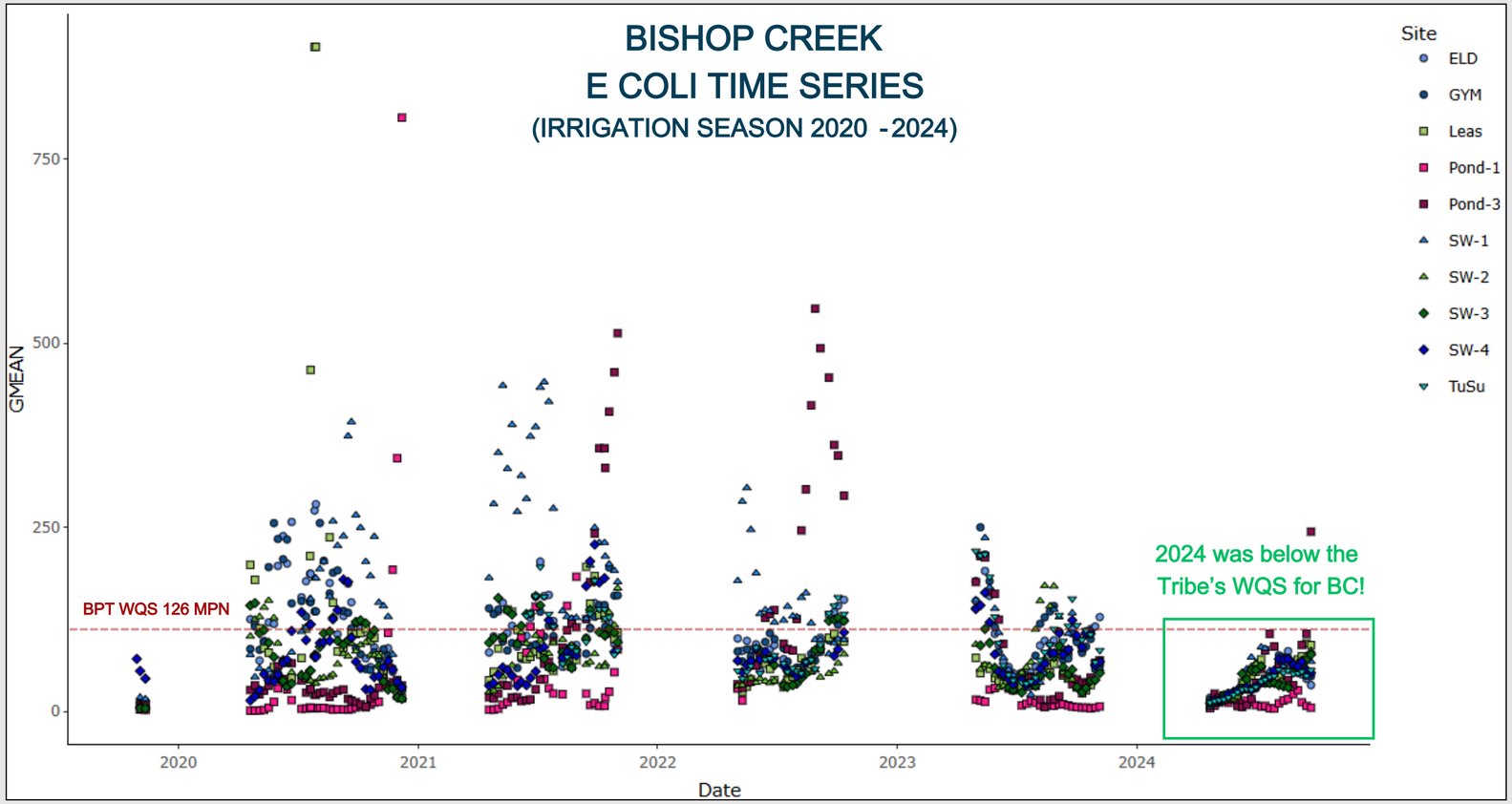
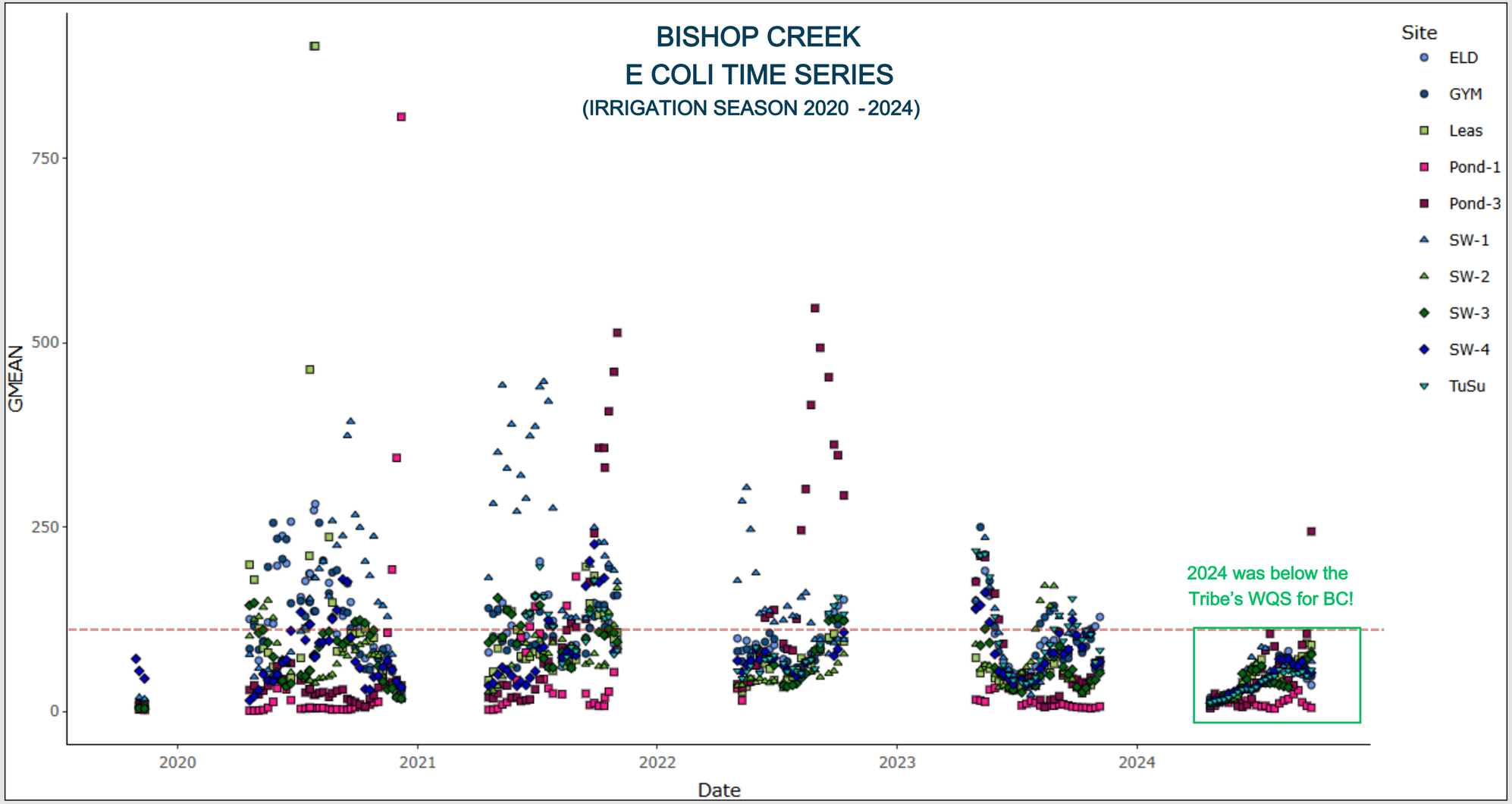


DATA ASSESSMENT

THE POWER OF A TIME SERIES



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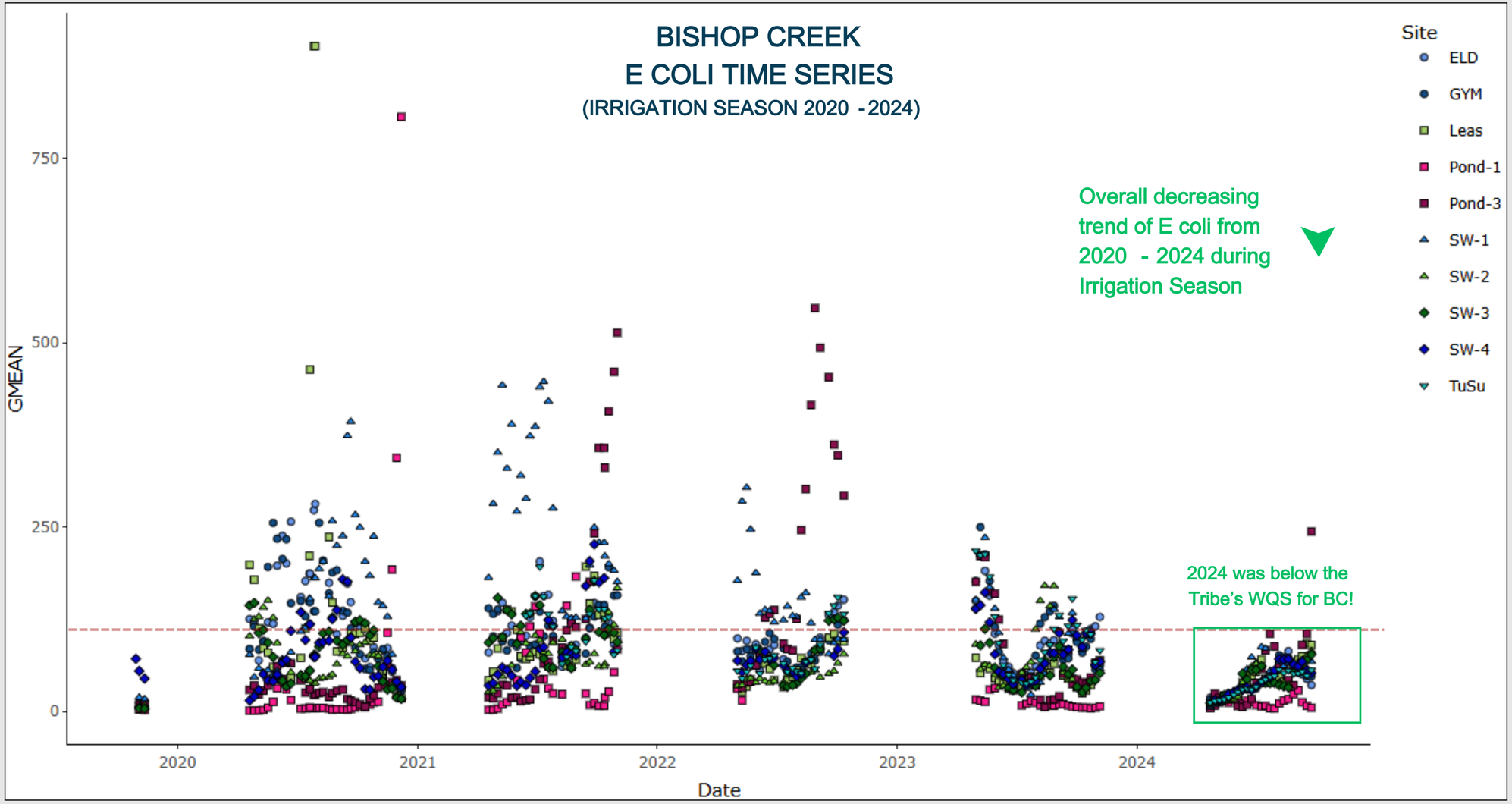

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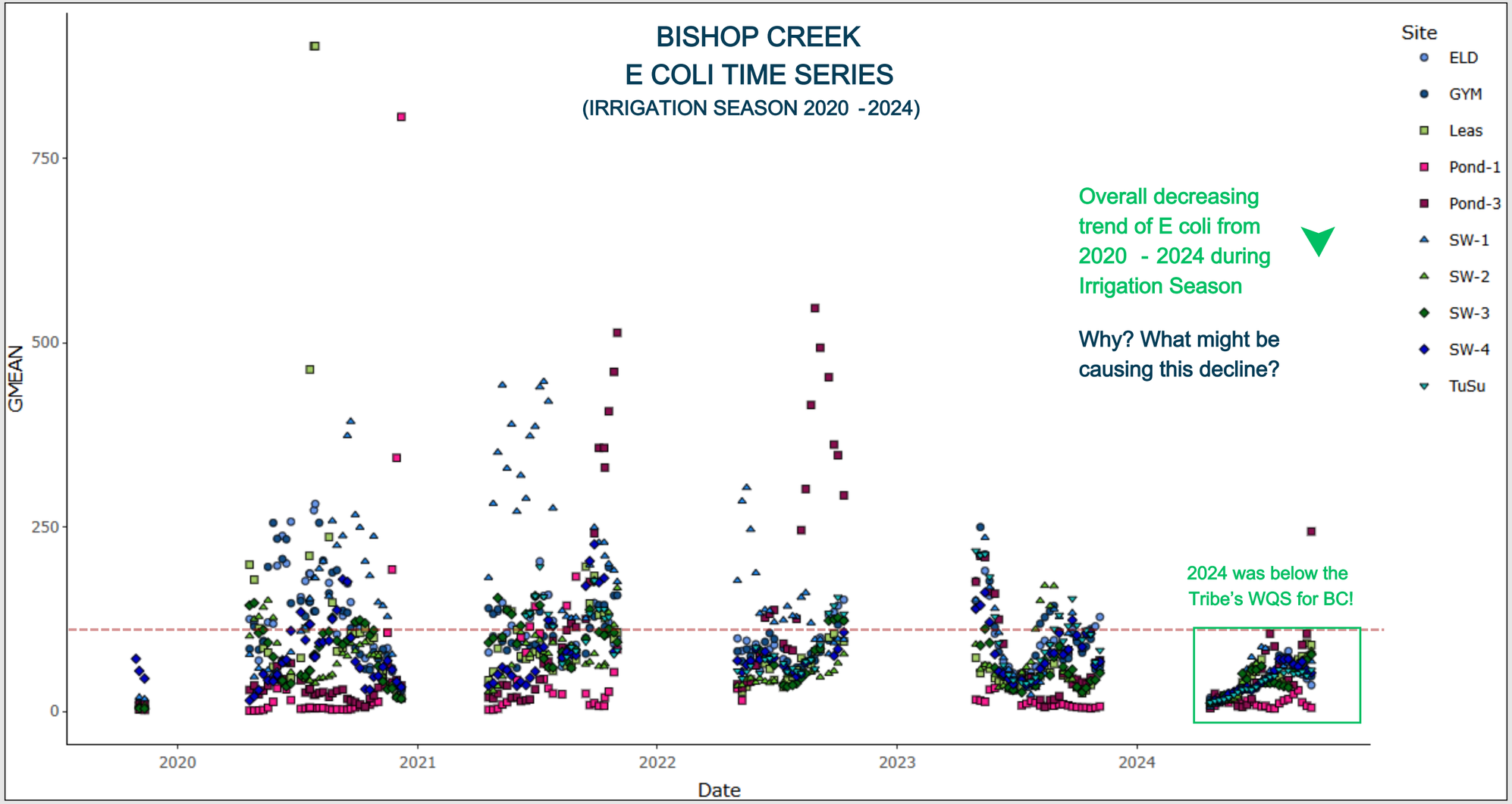

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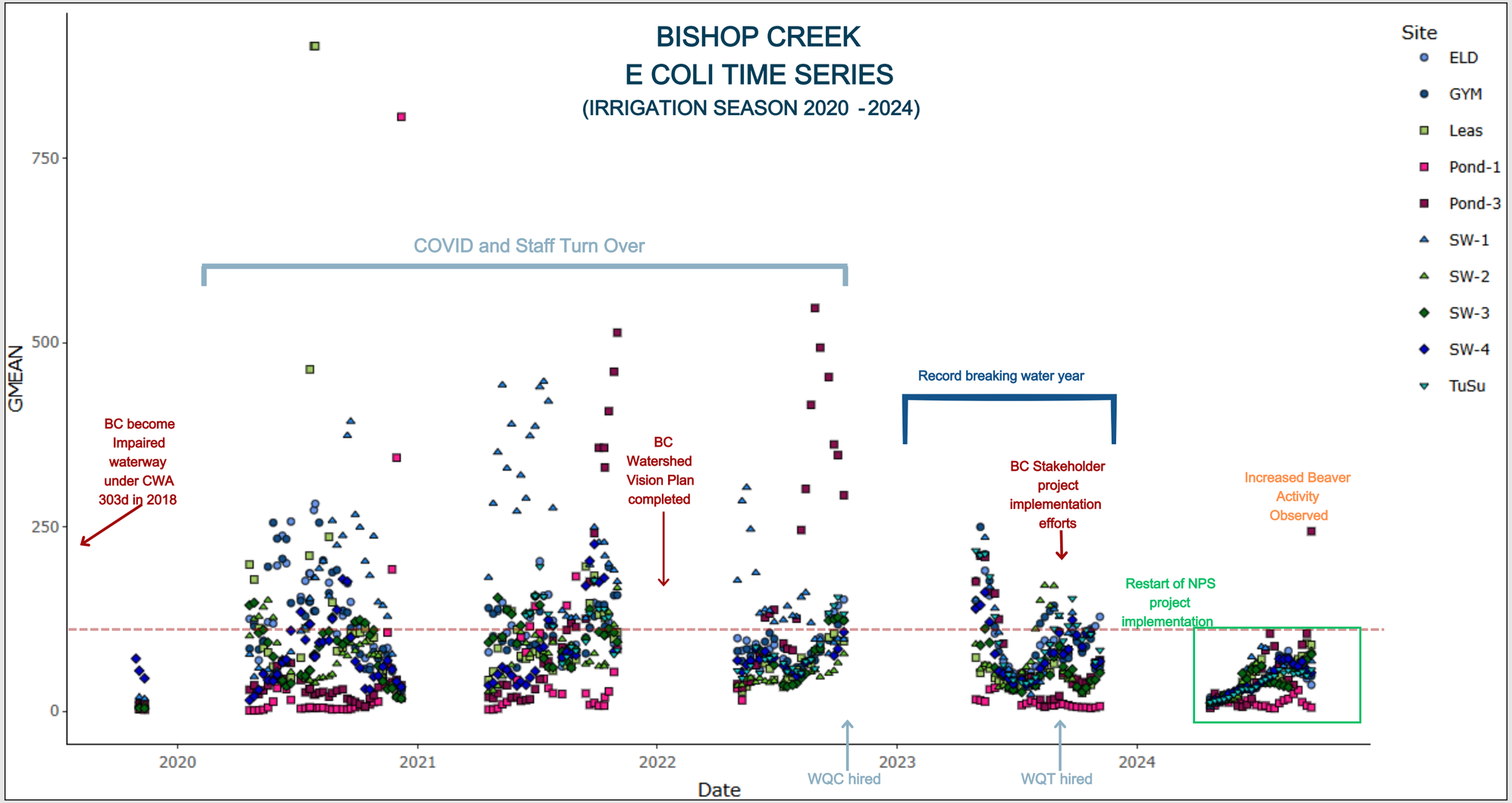

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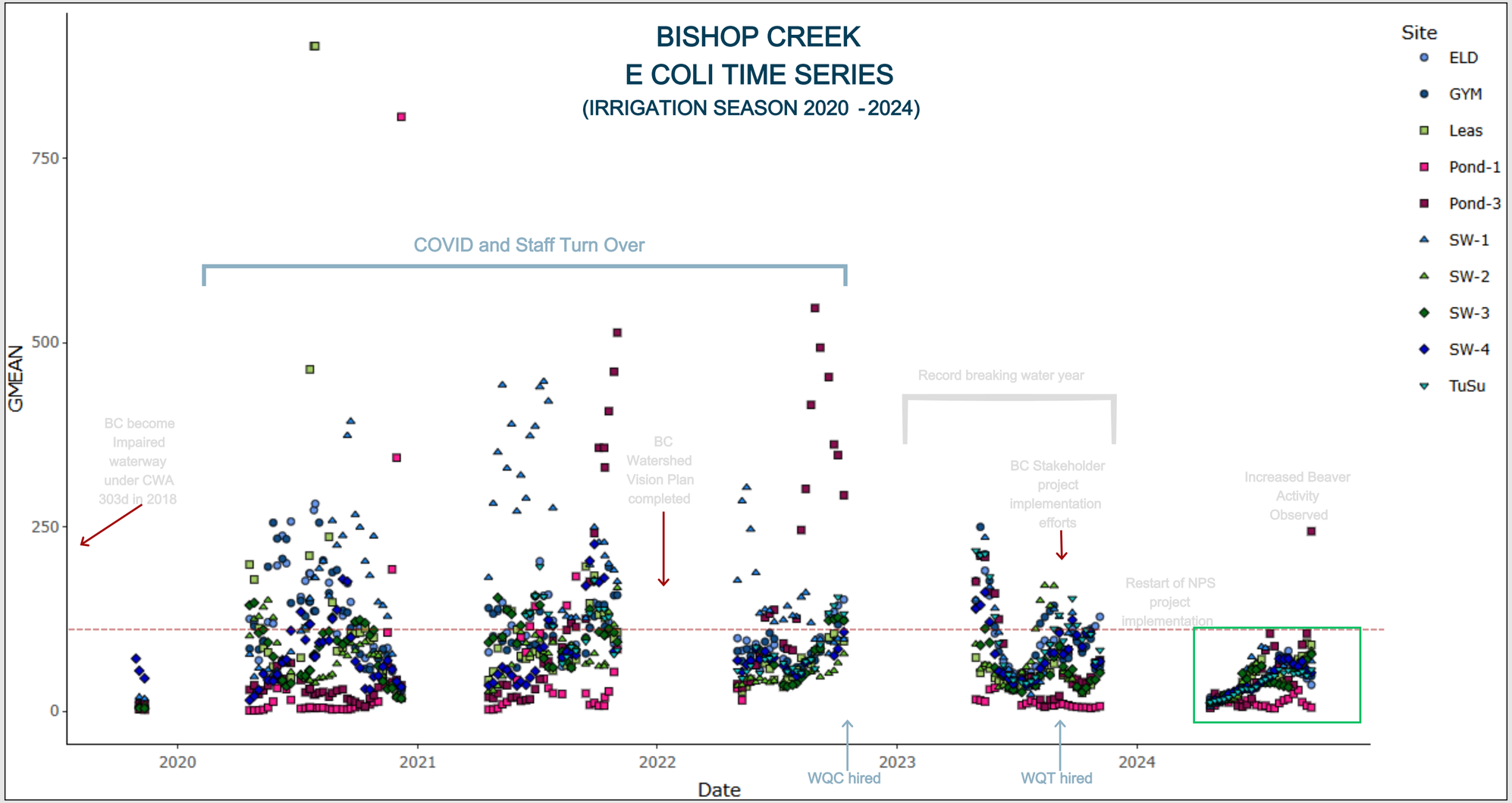

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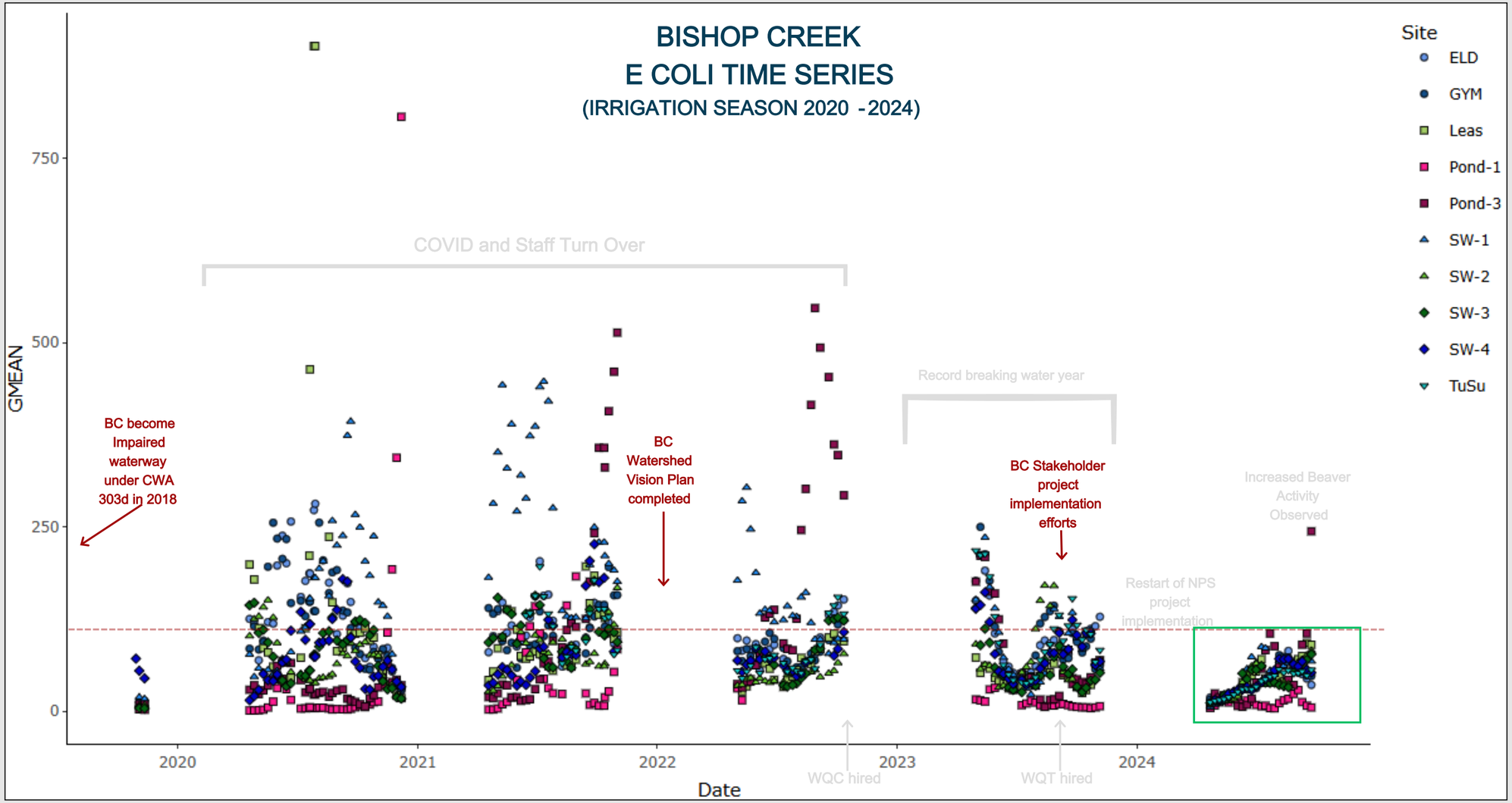

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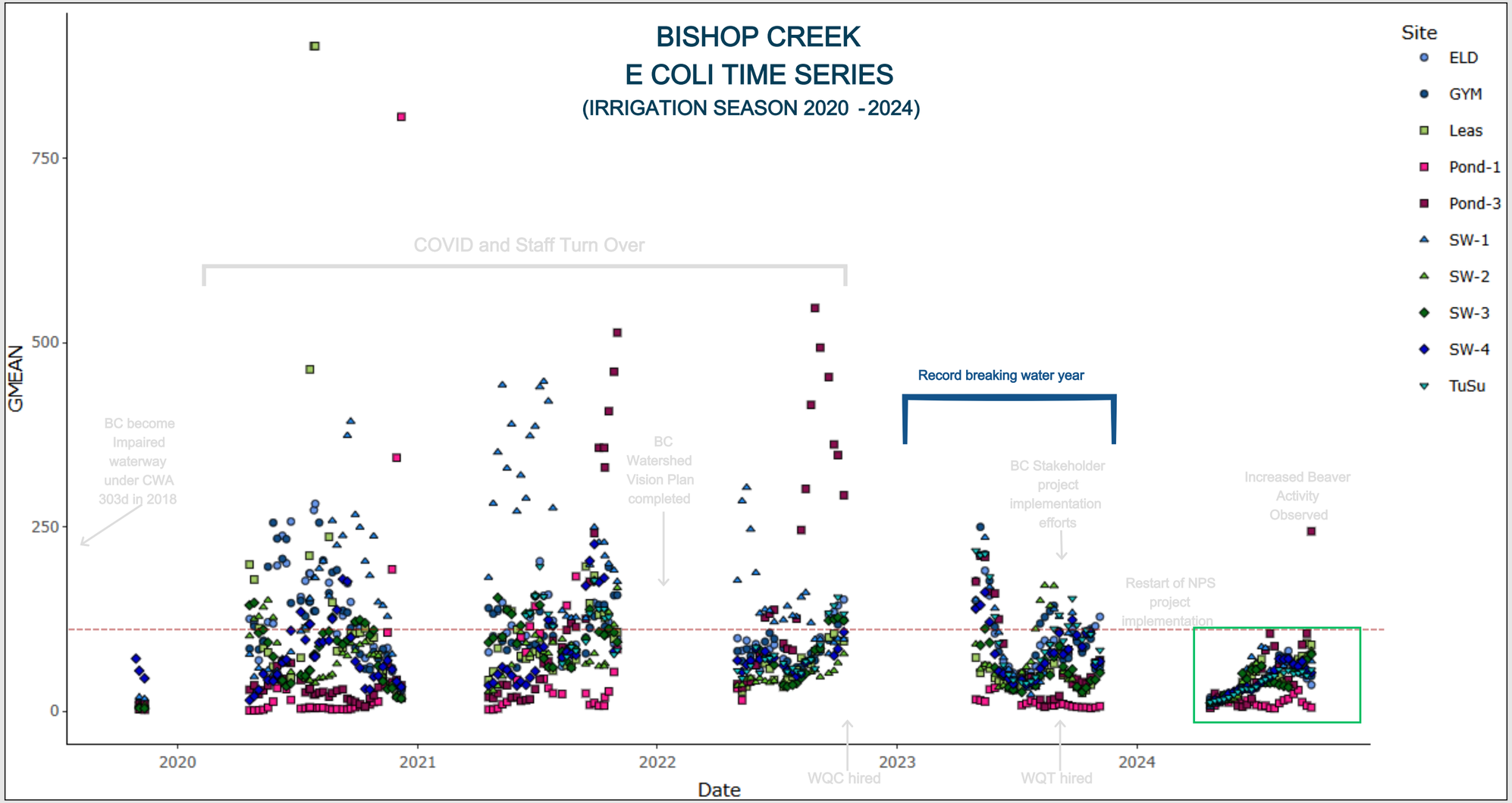

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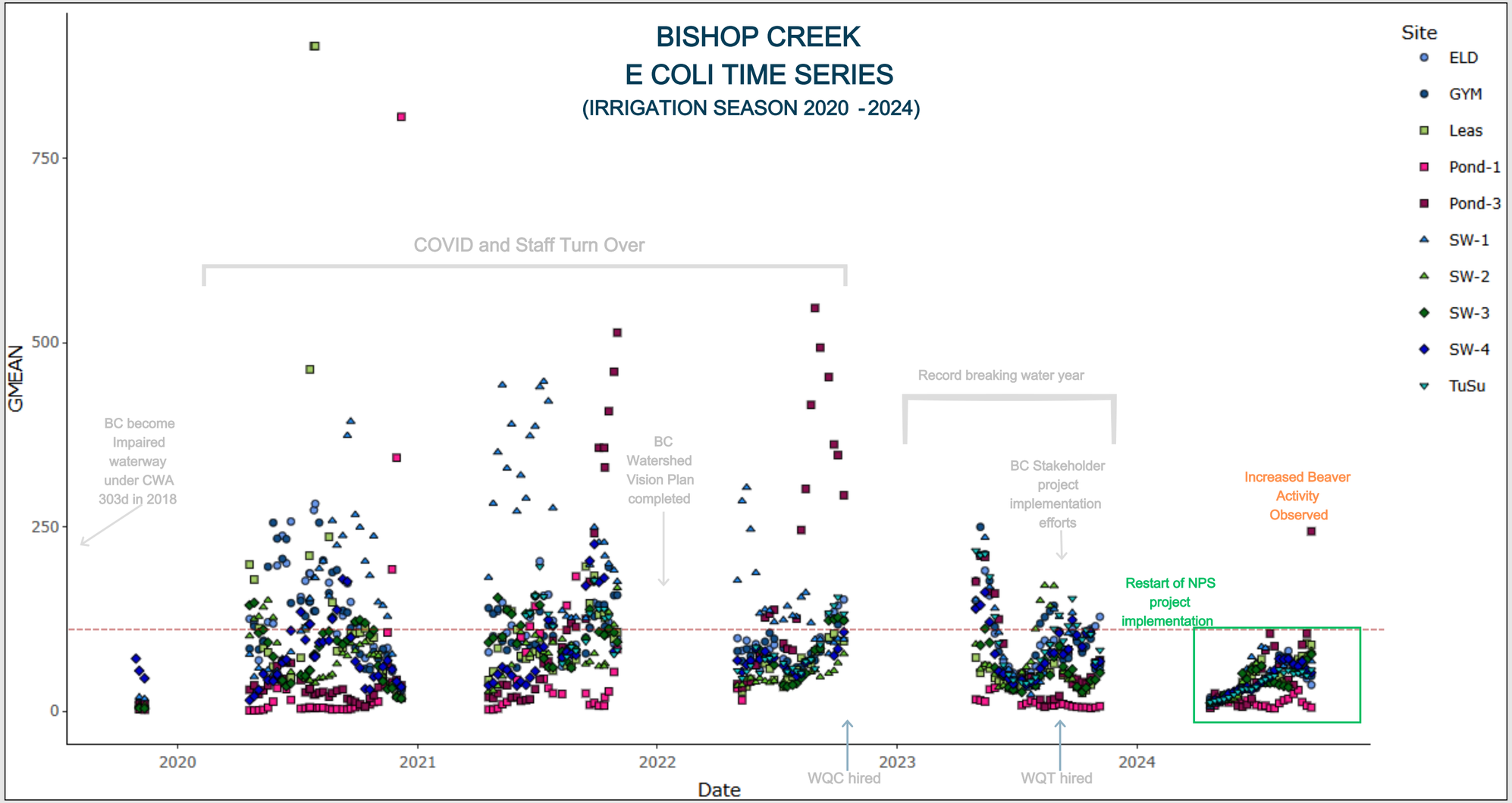

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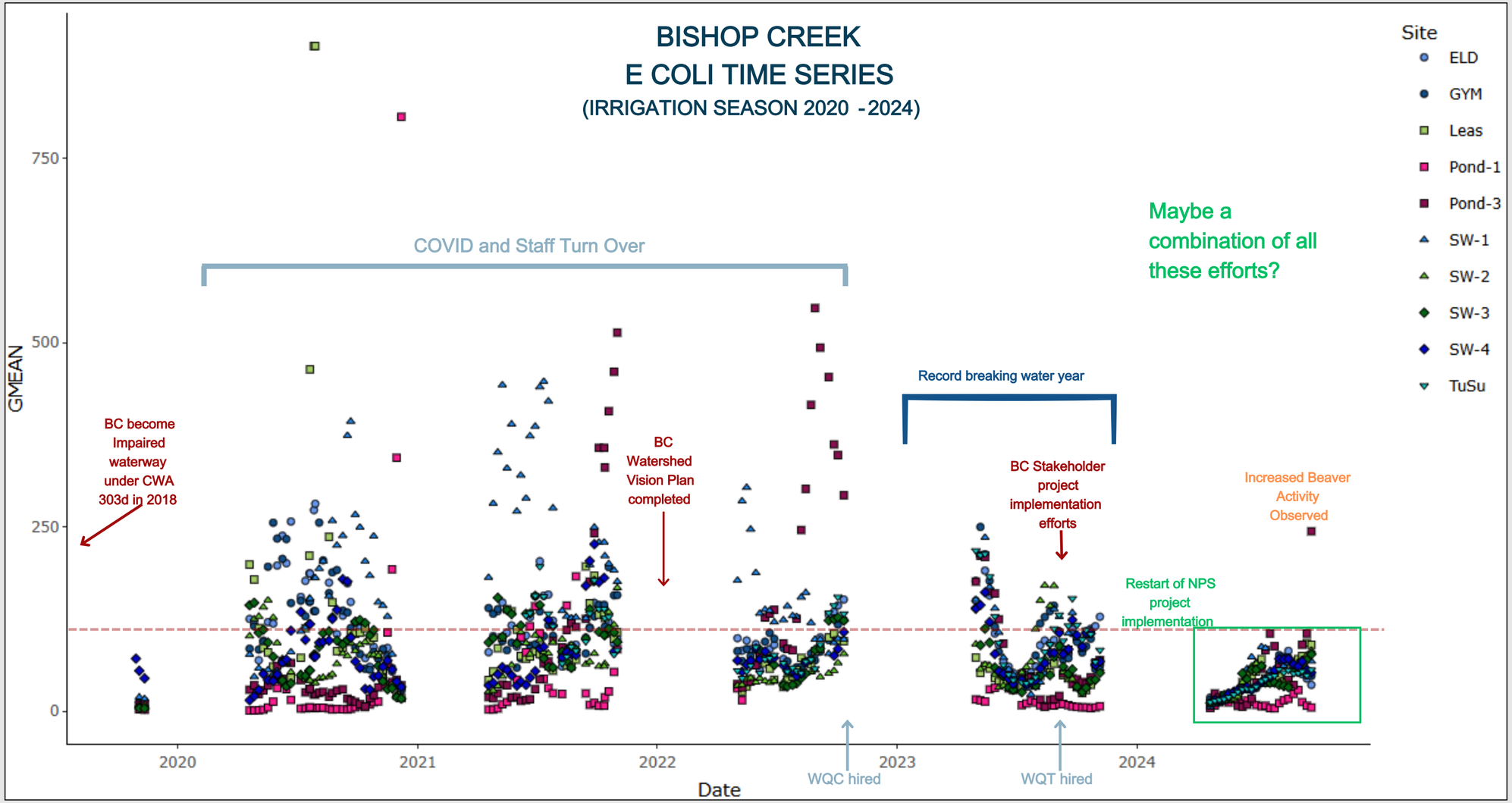

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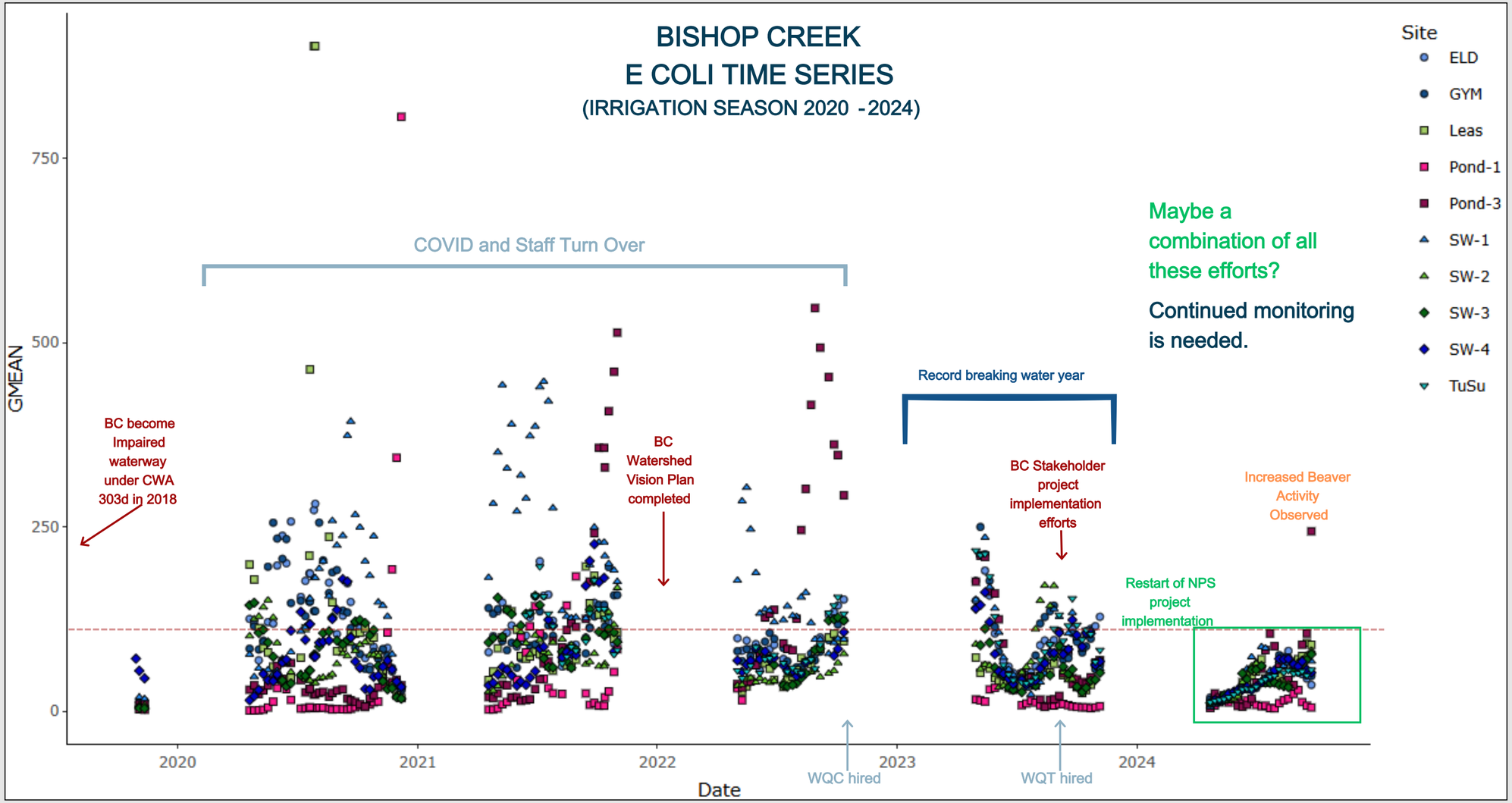
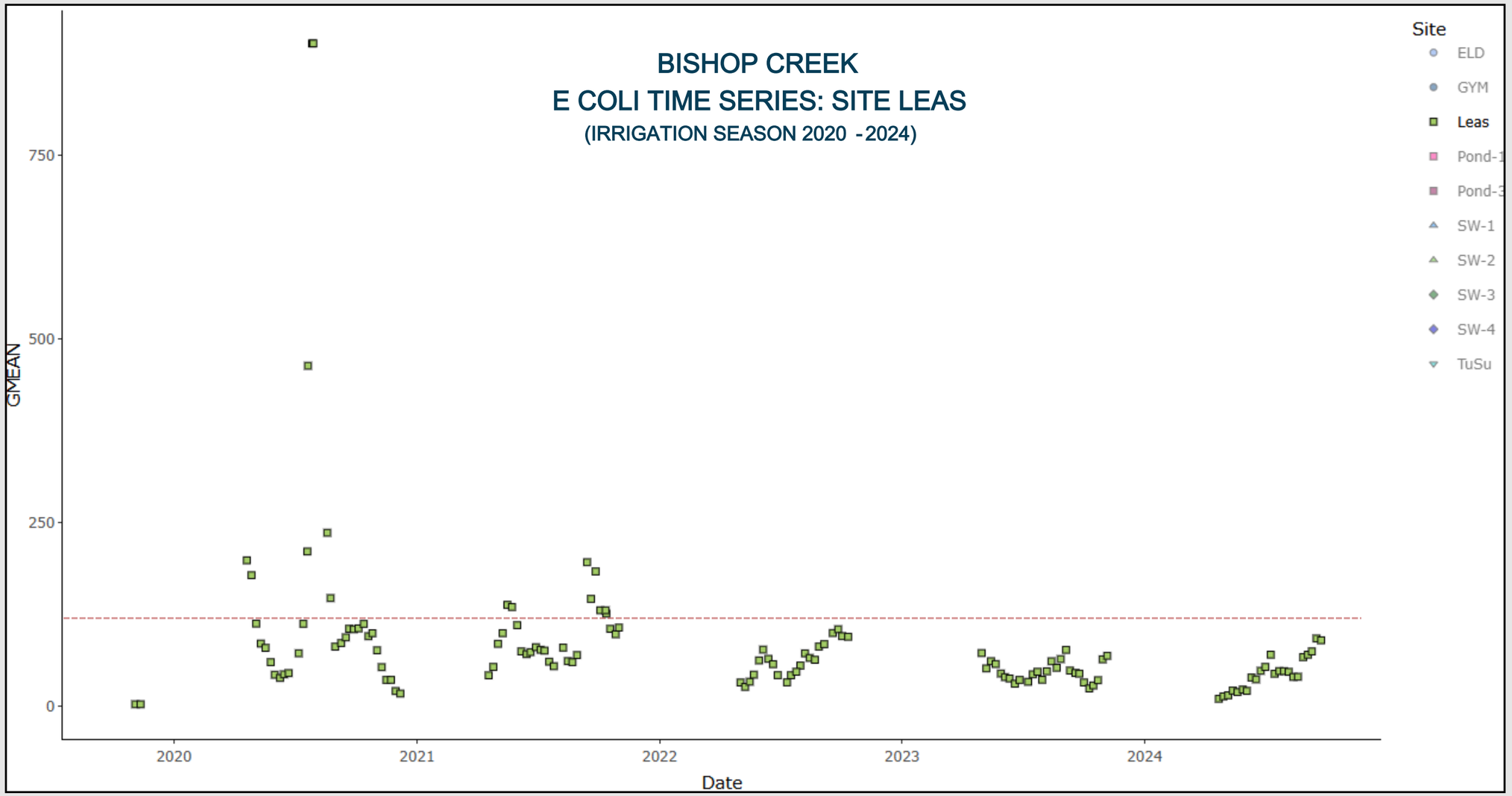
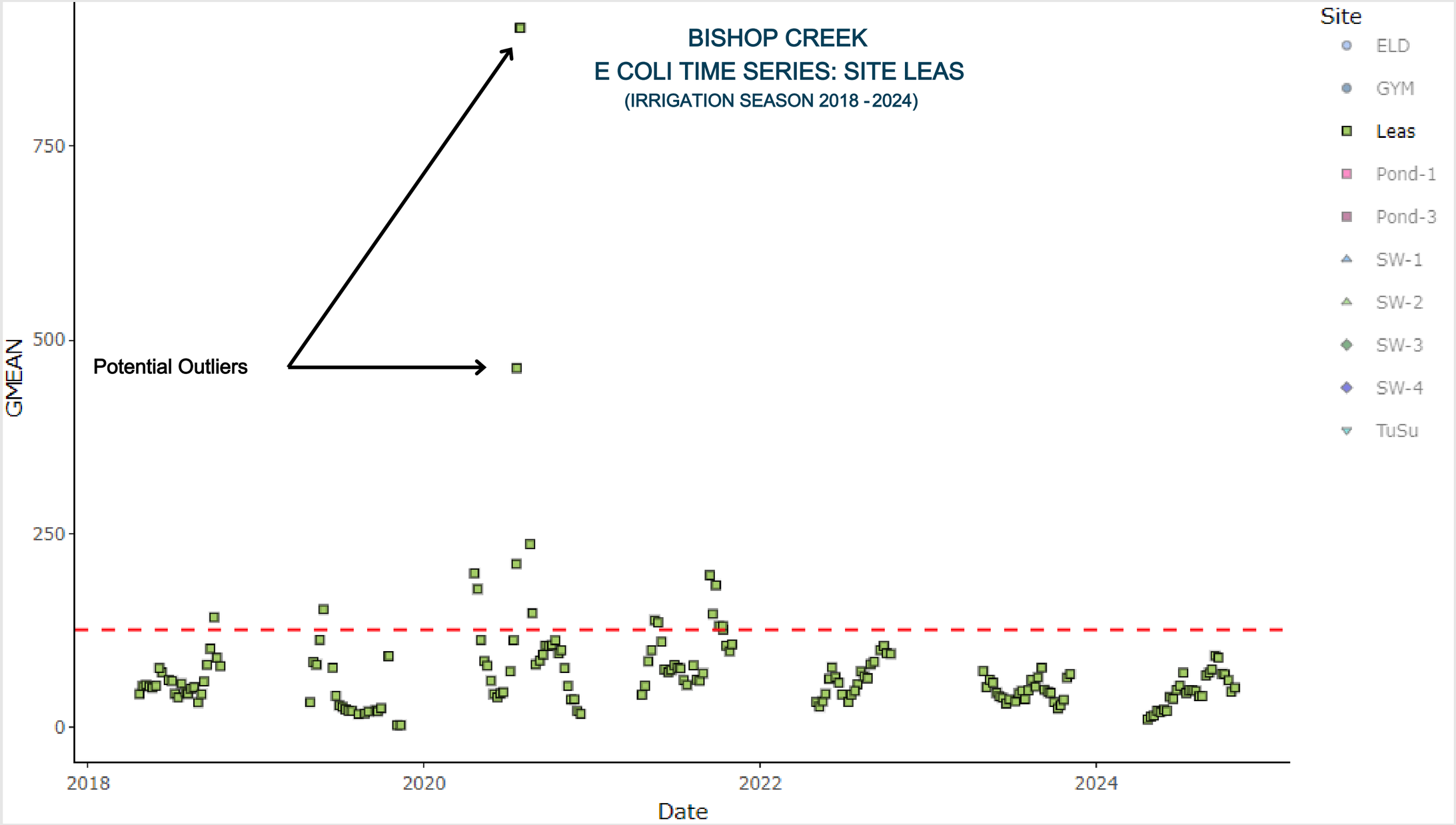


THE POWER OF A TIME SERIES

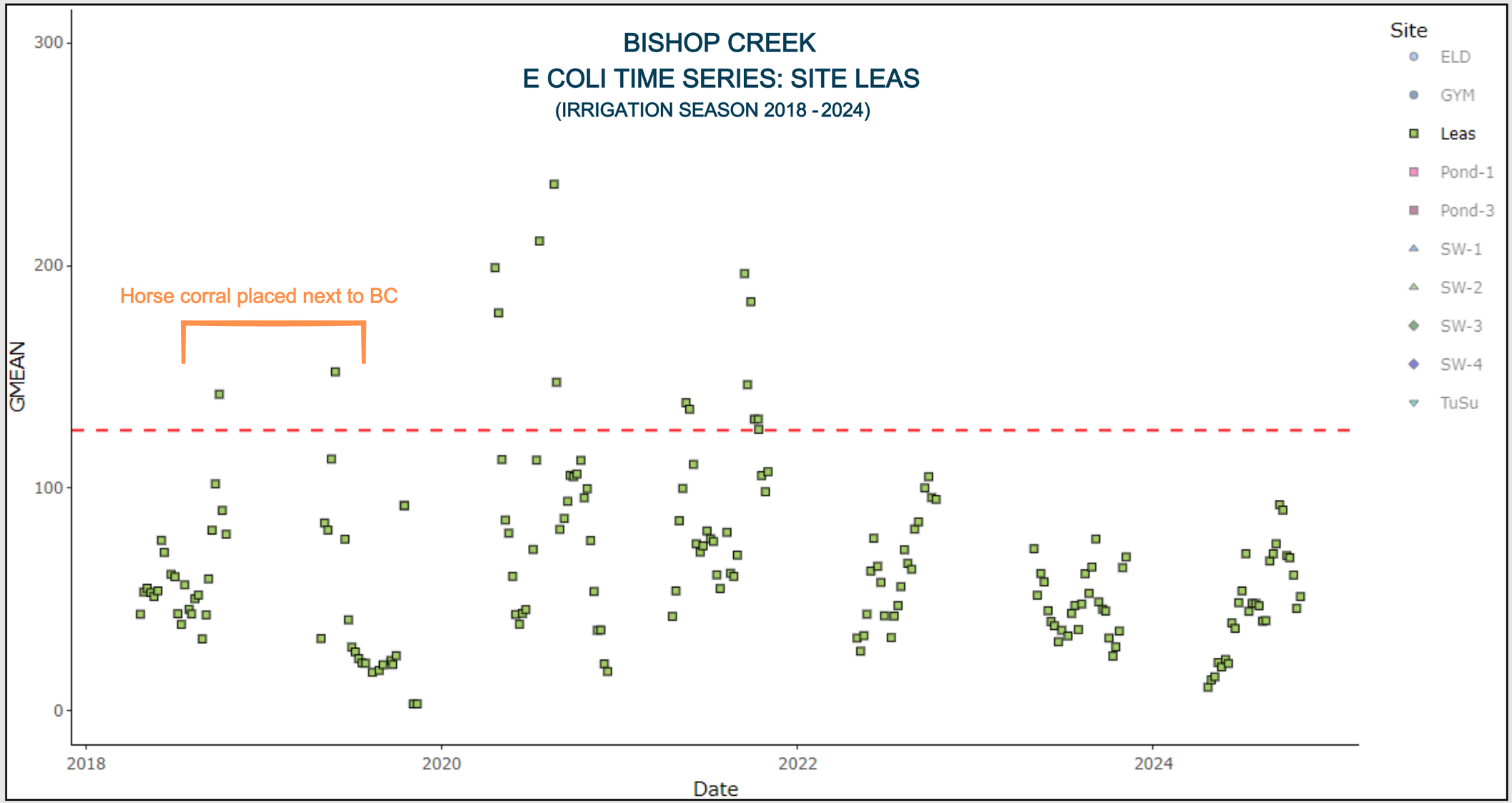
SCALING DOWN




BISHOP CREEK
E COLI TIME SERIES: SITE LEAS
(IRRIGATION SEASON 2018 - 2024)
Potential Outliers
GMEAN
750
500
250
0
2018
2020
2022
2024
Date
Site
ELD
GYM
Leas
Pond-1
Pond-3
SW-1
SW-2
SW-3
SW-4
TuSu

THE POWER OF A TIME SERIES

SCALING DOWN



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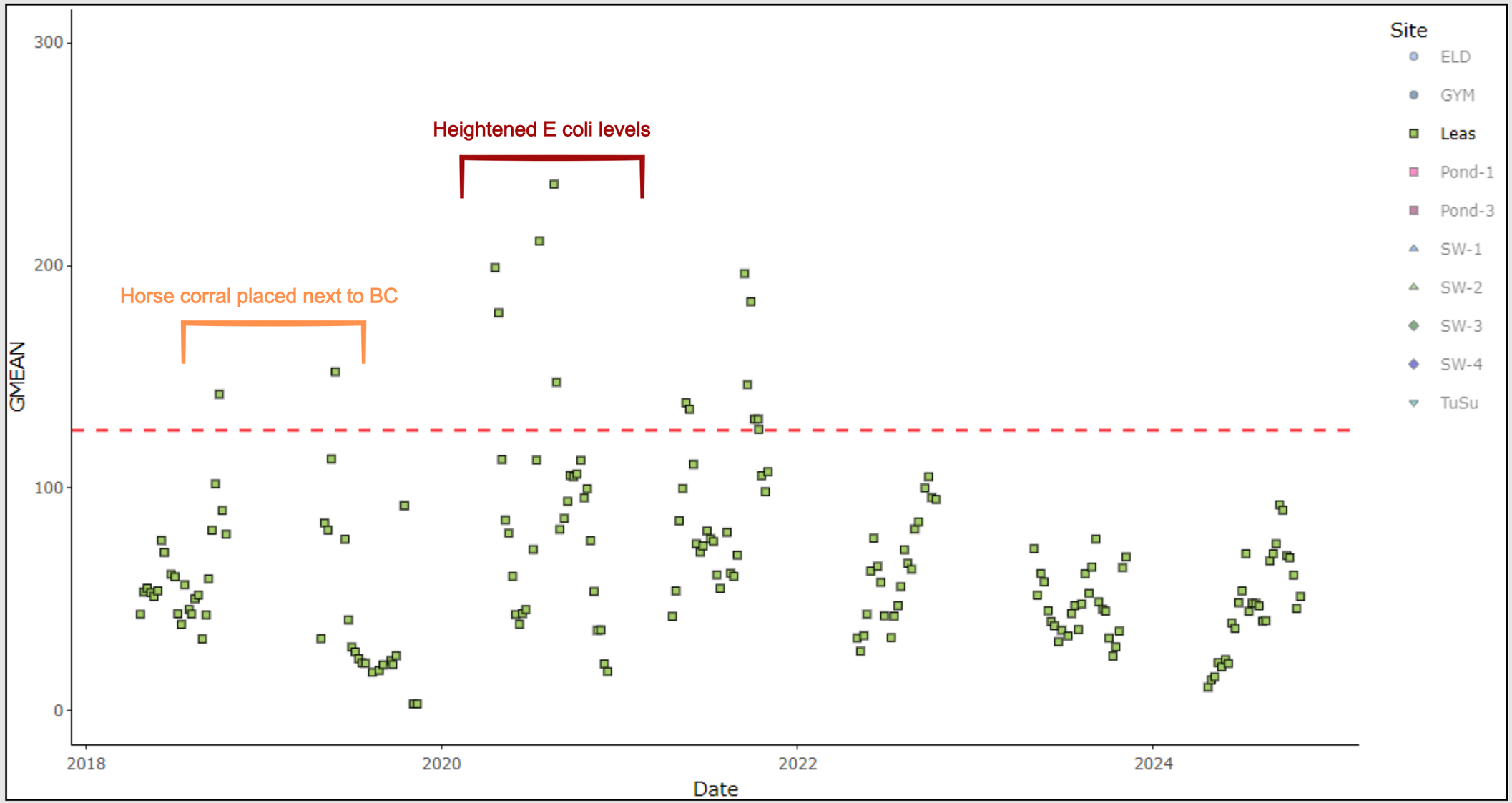

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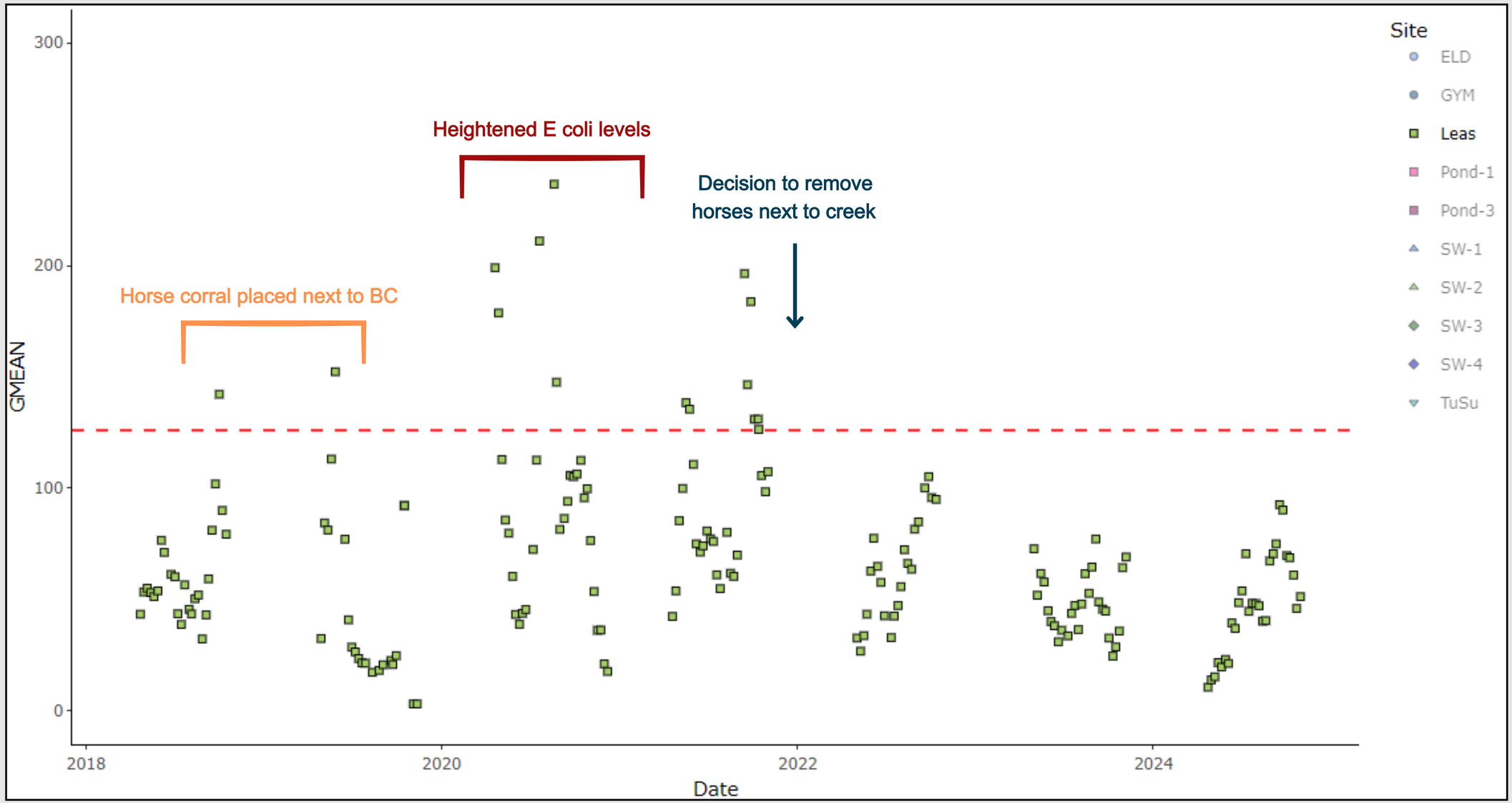

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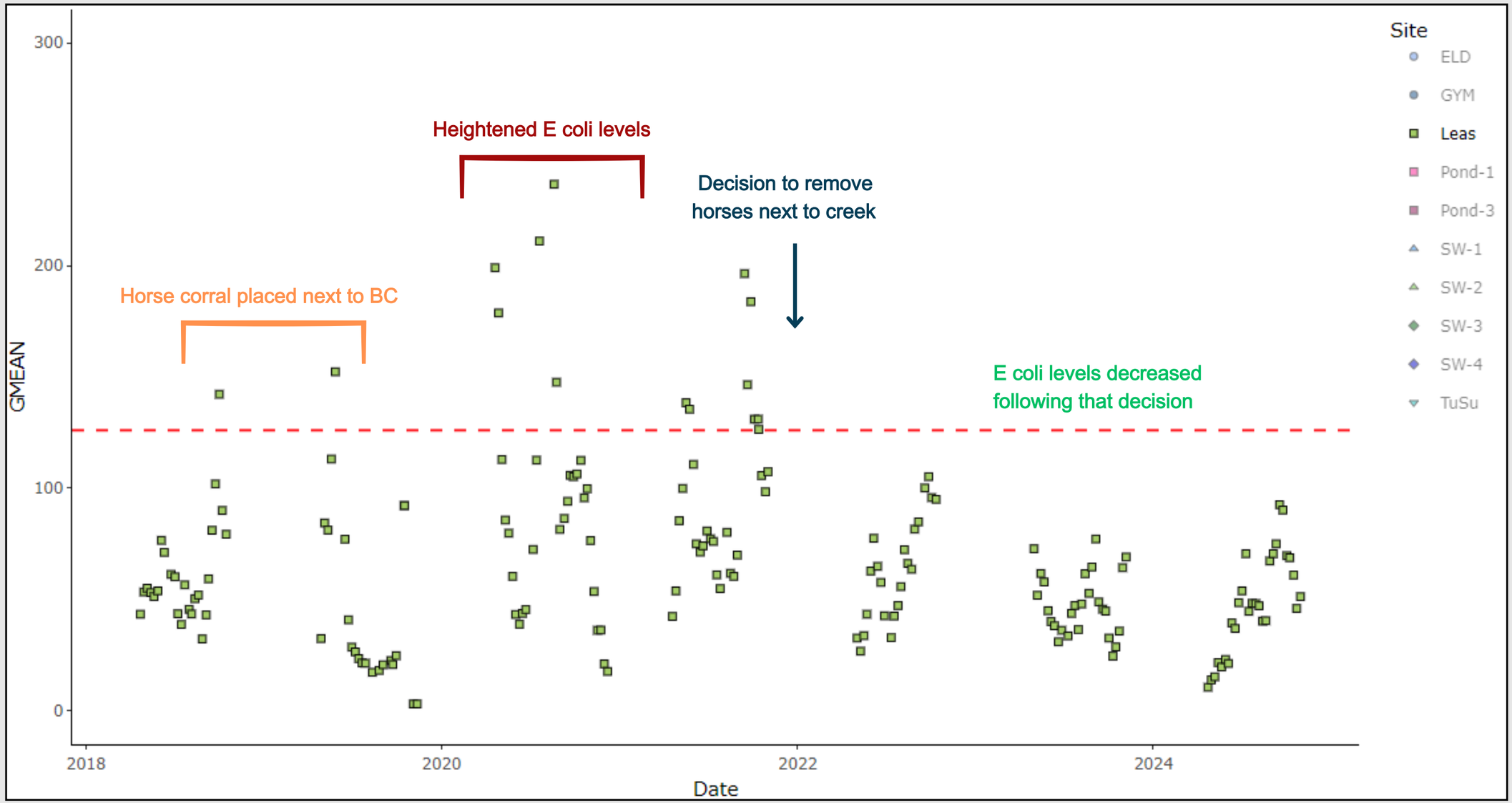

HOW WATER QUALITY ASSESSMENTS GUIDE DECISIONS ON TRIBAL LANDS

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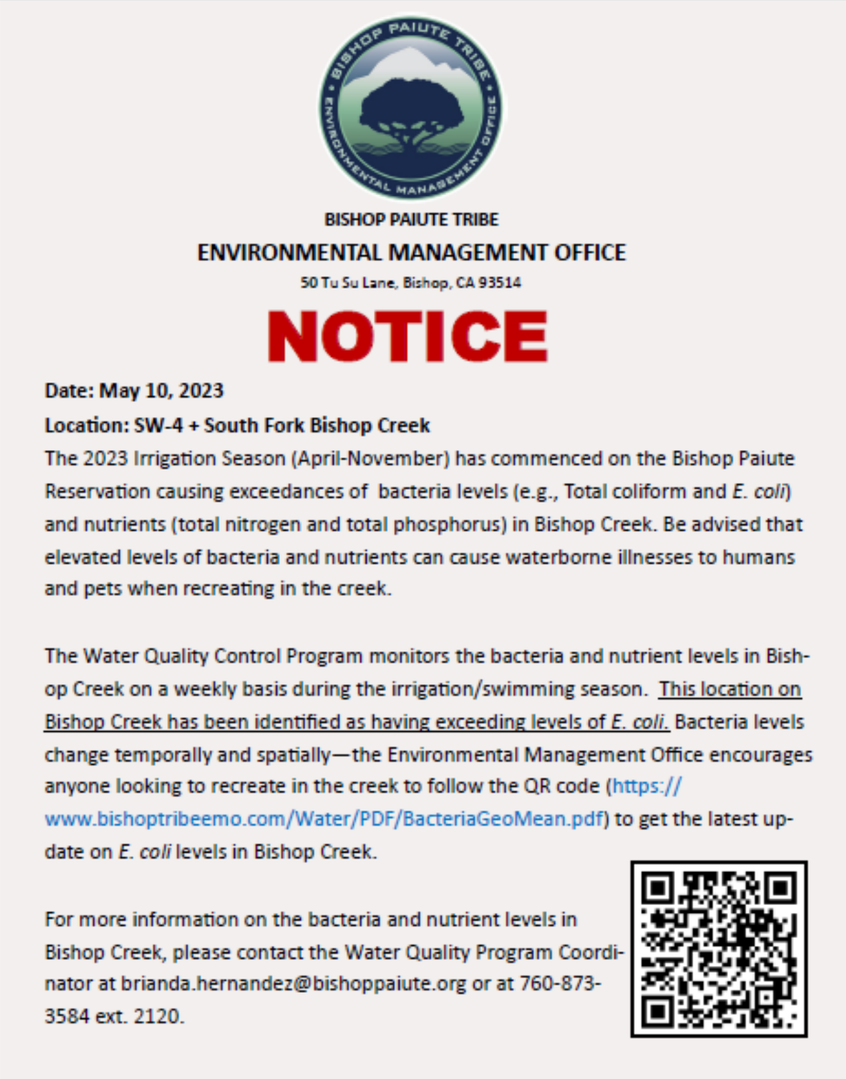
  - Example: Assessment reveals E. coli levels exceed EPA standards at swimming areas
  - Decision: Close unsafe sites or post advisories before community exposure



BISHOP PAIUTE TRIBE

ENVIRONMENTAL MANAGEMENT OFFICE

50 Tu Su Lane, Bishop, CA 93514

NOTICE

Date: May 10, 2023

Location: SW-4 + South Fork Bishop Creek

The 2023 Irrigation Season (April-November) has commenced on the Bishop Paiute Reservation causing exceedances of bacteria levels (e.g., Total coliform and *E. coli*) and nutrients (total nitrogen and total phosphorus) in Bishop Creek. Be advised that elevated levels of bacteria and nutrients can cause waterborne illnesses to humans and pets when recreating in the creek.

The Water Quality Control Program monitors the bacteria and nutrient levels in Bishop Creek on a weekly basis during the irrigation/swimming season. This location on Bishop Creek has been identified as having exceeding levels of *E. coli*. Bacteria levels change temporally and spatially—the Environmental Management Office encourages anyone looking to recreate in the creek to follow the QR code (https://www.bishoptribeemo.com/Water/PDF/BacteriaGeoMean.pdf) to get the latest update on *E. coli* levels in Bishop Creek.

For more information on the bacteria and nutrient levels in Bishop Creek, please contact the Water Quality Program Coordinator at brianda.hernandez@bishoppaiute.org or at 760-873-3584 ext. 2120.

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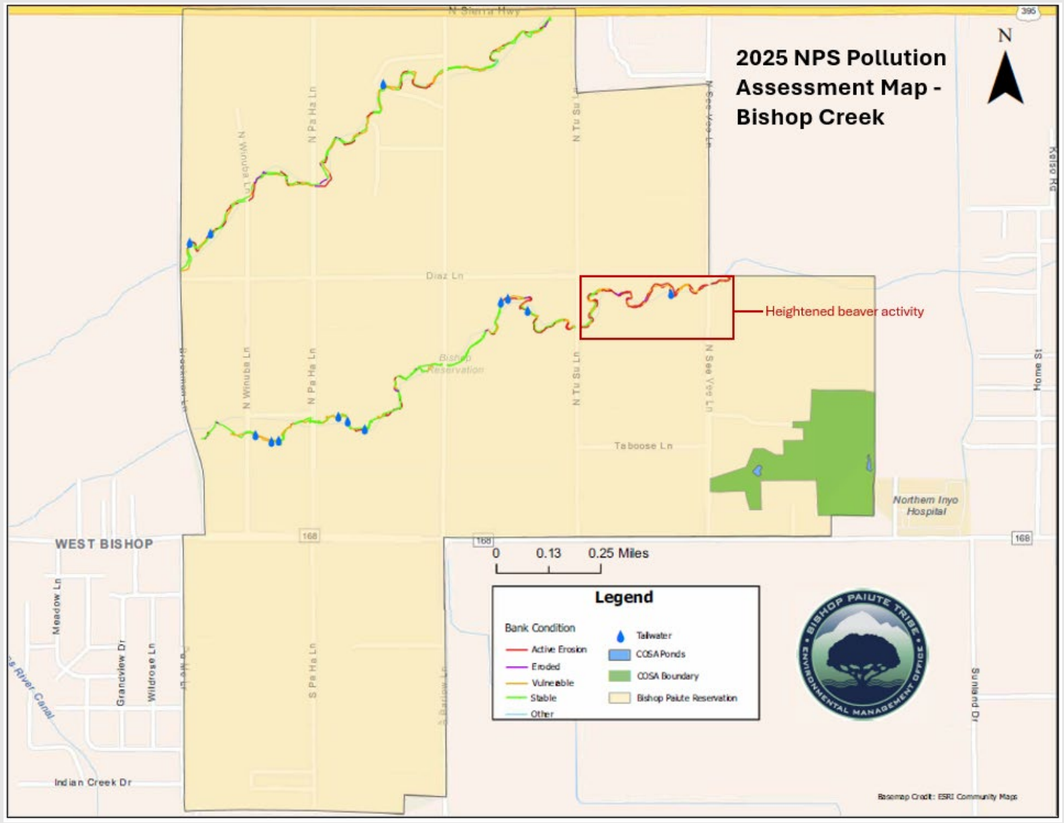
  - Example: Spatial assessment pinpoints upstream cattle ranches as nitrate sources
  - Decision: Allocate CWA §319 funds to riparian buffers, livestock exclusion, and increase understanding of beavers



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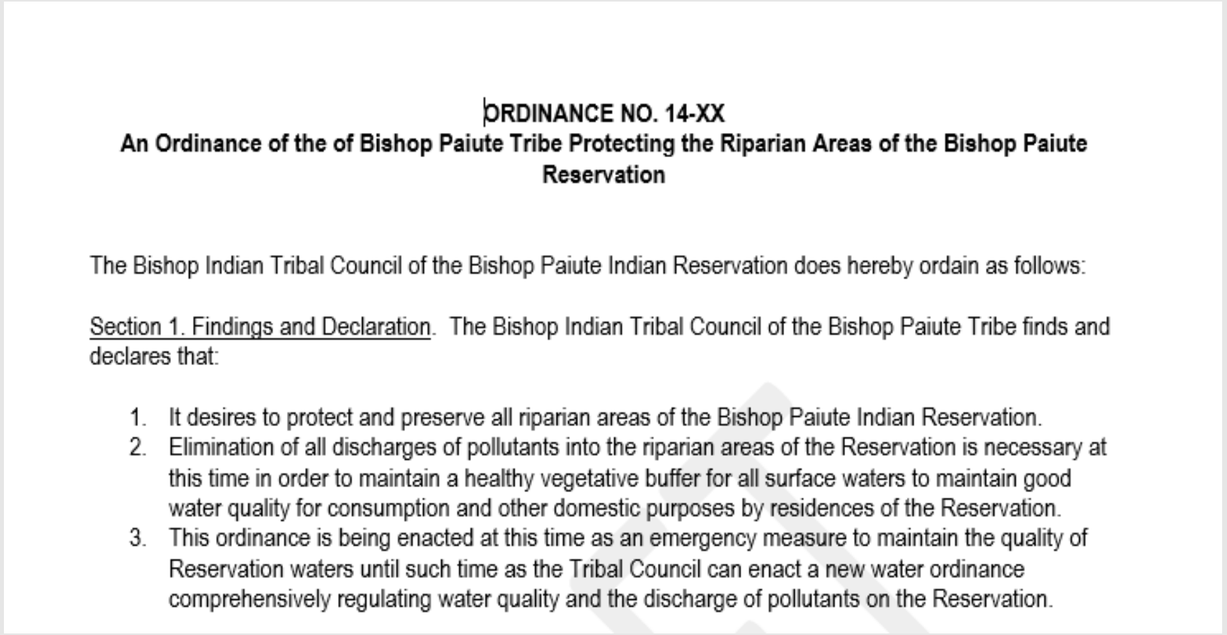
  - Decision: Secure grants and advocate for stricter land-use laws (e.g., riparian ordinance)



ORDINANCE NO. 14-XX
An Ordinance of the of Bishop Paiute Tribe Protecting the Riparian Areas of the Bishop Paiute Reservation

The Bishop Indian Tribal Council of the Bishop Paiute Indian Reservation does hereby ordain as follows:

Section 1. Findings and Declaration. The Bishop Indian Tribal Council of the Bishop Paiute Tribe finds and declares that:

1. It desires to protect and preserve all riparian areas of the Bishop Paiute Indian Reservation.
2. Elimination of all discharges of pollutants into the riparian areas of the Reservation is necessary at this time in order to maintain a healthy vegetative buffer for all surface waters to maintain good water quality for consumption and other domestic purposes by residences of the Reservation.
3. This ordinance is being enacted at this time as an emergency measure to maintain the quality of Reservation waters until such time as the Tribal Council can enact a new water ordinance comprehensively regulating water quality and the discharge of pollutants on the Reservation.

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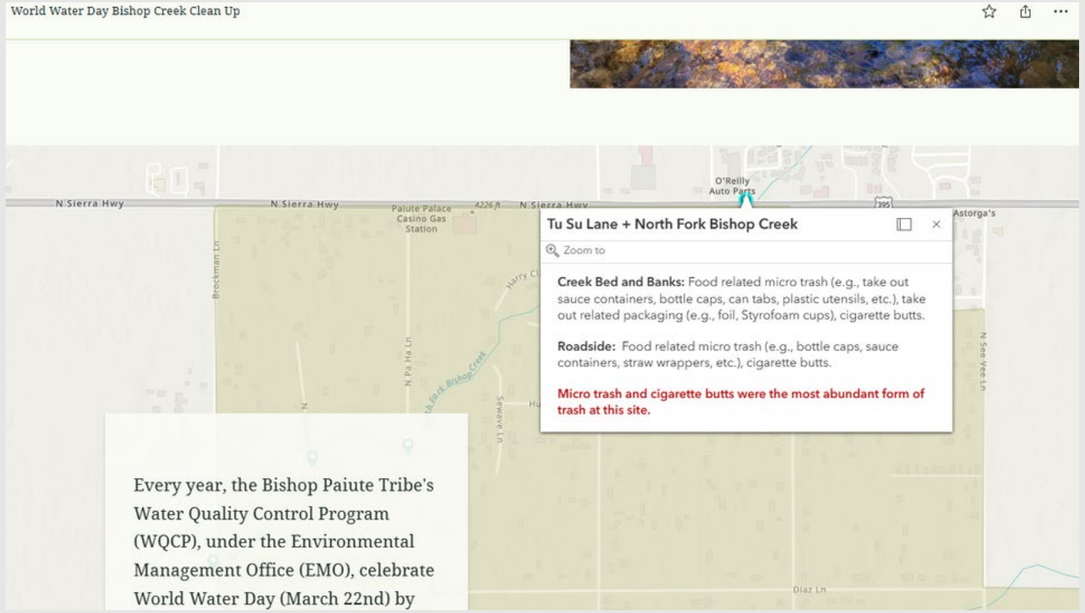
  - Example: Dashboard visualizes pollution hotspots on the Reservation
  - Decision: Mobilize tribal members for clean-up events or citizen science monitoring



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- **Measure Program Success**
  - Example: Post-restoration assessments of manure management to reduce bacteria input to Bishop Creek
  - Decision: Expand effective projects to other areas on the Bishop Creek Watershed

RESOURCES:

TRIBAL EXCHANGE NETWORK GROUP

- **TRAININGS & EVENTS**
  - Tribal Data & Technology Academy workshops Tribal Exchange Network Conference
- **TRIBAL ASSISTANCE**
  - Developing skills & knowledge through peer-to-peer support.
- **EXCHANGE NETWORK GRANTS**
  - EPA competitive funding supporting tribal environmental data systems.
- **RESOURCES & ADVOCACY**
  - Promoting tribal access, equity, & inclusion in the EN

txg@tribalexchangenetwork .org

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FREE TO TRIBES!

QUESTIONS?

Brianda Hernandez Rosales
Water Quality Program Coordinator

brianda.hernandez@bishoppaiute.org

www.bishoppaiuteenvironmental.net

THANK YOU!