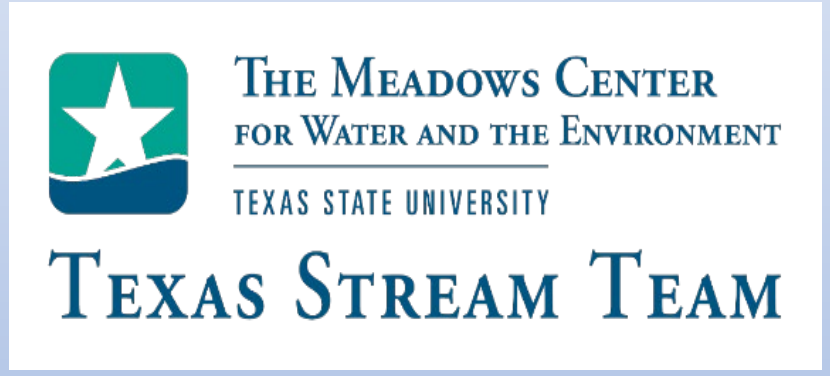
Lower Cypress Creek Pilot Project: Assessment of *E. coli* Bacteria and Optical Brighteners



Sandra Arismendez and Desiree Jackson

Cypress Creek Stakeholder Committee Meeting

December 15, 2022

Cypress Creek Clean Rivers Program

Quarterly Monitoring Data
(Sep. 2016 – Sep 2022)

E. coli (MPN/100 mL)

- TCEQ water quality standard for the contact recreation use is 126 MPN/100 mL
- Geometric mean for all sites combined (N=155) is 47.0 MPN/100 mL
- Geometric mean above WQS at two sites downstream of RR12:
  - RR12 Wimberley
  - Blanco River Confluence

Station Name	No. Samples	Geometric Mean (MPN/100 mL)
Jacob's Well	23	3.2
Camp Judea	15	28.0
Woodcreek Dr.	15	13.2
RR12 Cottages	23	47.3
Blue Hole	23	46.6
*RR12 Wimberley	33	**214.9**
Blanco Confluence	23	**254.7**

*Period of record for GBRA site is Aug 2016 – Jul 2022.

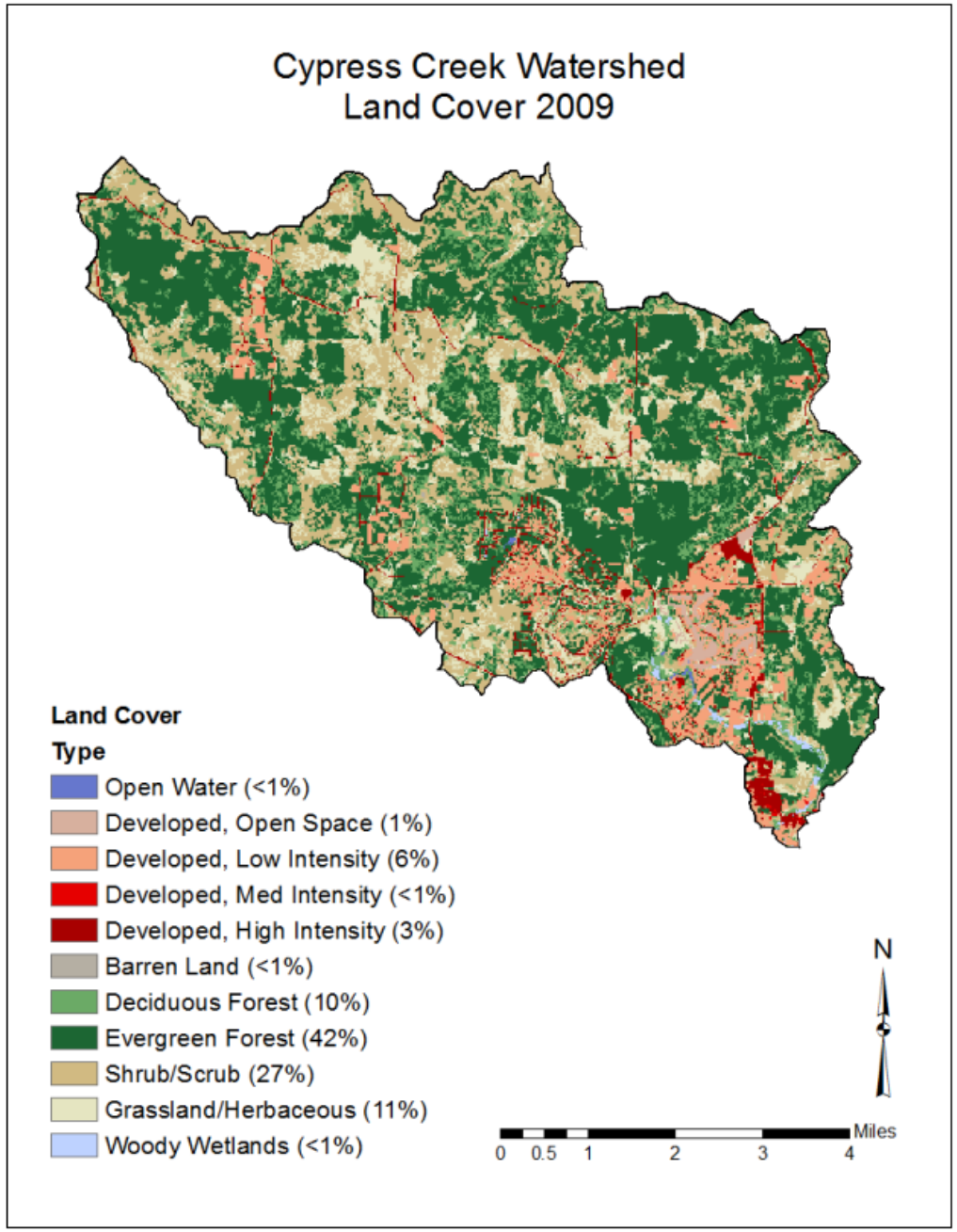
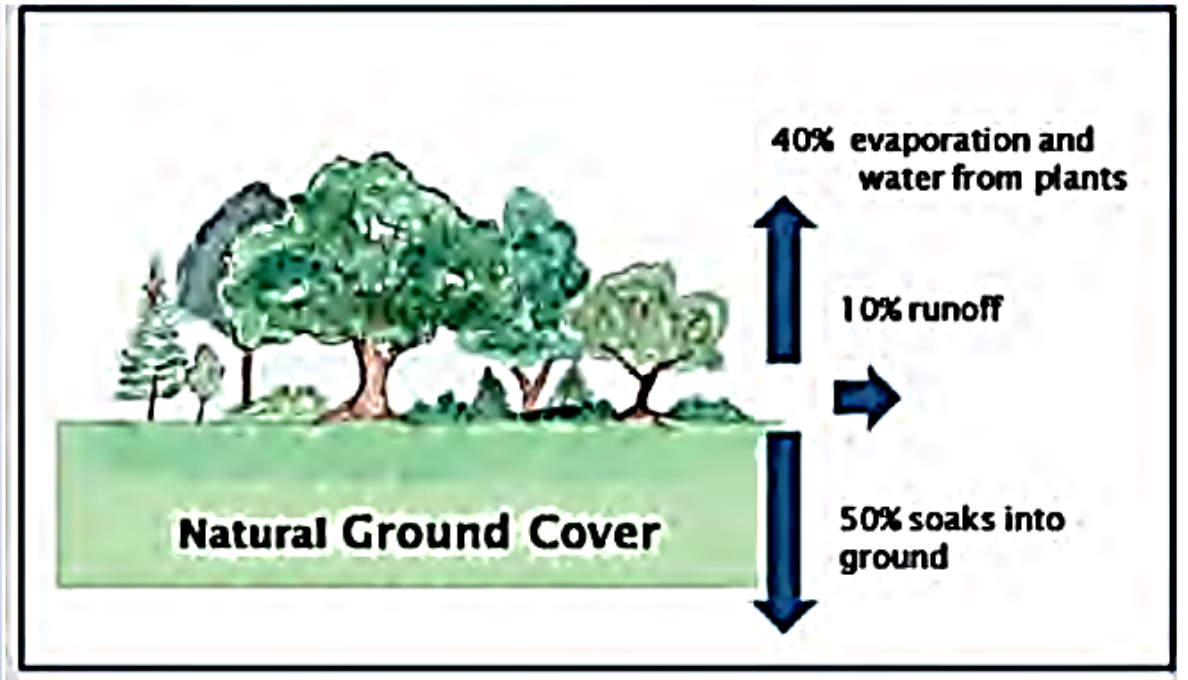
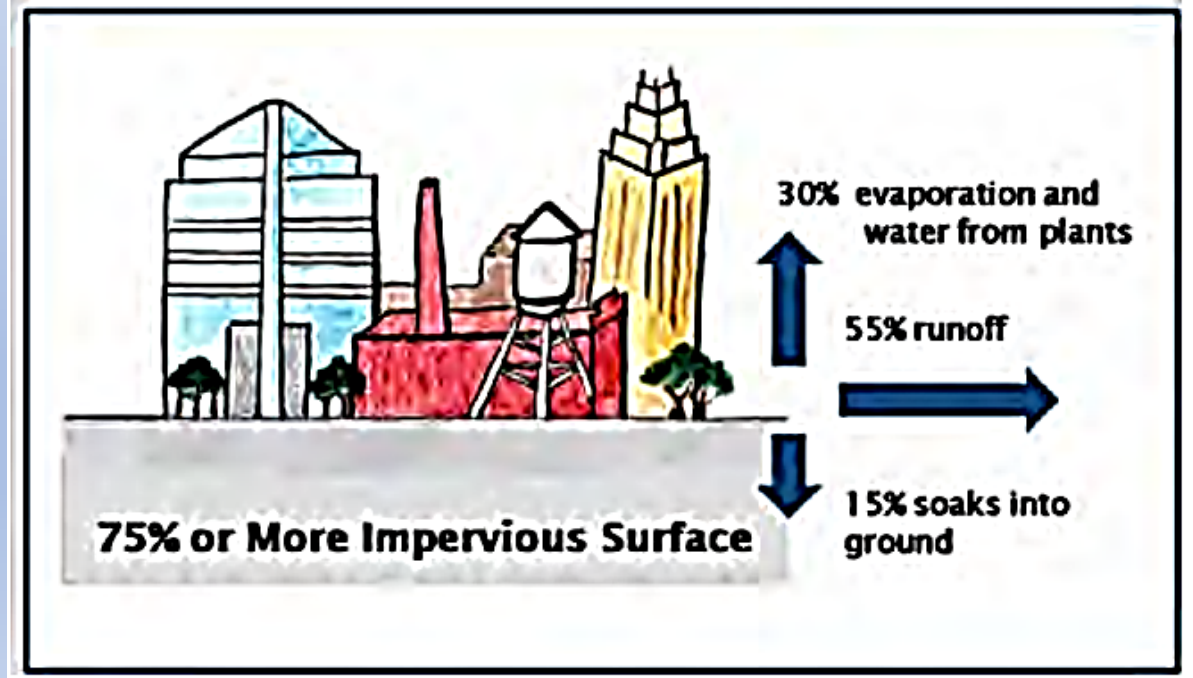


Figure 4.7. Land cover in the watershed, 2009.





https://cleancoast.texas.gov/documents/2022-sustainable-stormwater-drainage-cleancoasttexas.pdf

Lower Cypress Creek Pilot Project:

E. coli and Optical Brighteners

Objectives:

- Conduct intensive *E. coli* monitoring to discern potential sources of bacteria.
- Conduct *E. coli* monitoring targeting different times of the week/month.
- Conduct optical brightener “tampling” monitoring as a pollution screening tool to detect presence/absence of optical brighteners associated with wastewater contamination.
- Conduct fluorometry measurements alongside “tampling” monitoring to quantify optical brighteners

What are *E. coli* Bacteria and Optical Brighteners?

***E. coli* Bacteria:**

- Originate in the digestive tract of endothermic organisms
- Found in feces of warm-blooded animals
- Freshwater indicator of potential pathogen contamination
- Indicator bacteria for determining support/non-support of contact recreation use

Optical Brighteners:

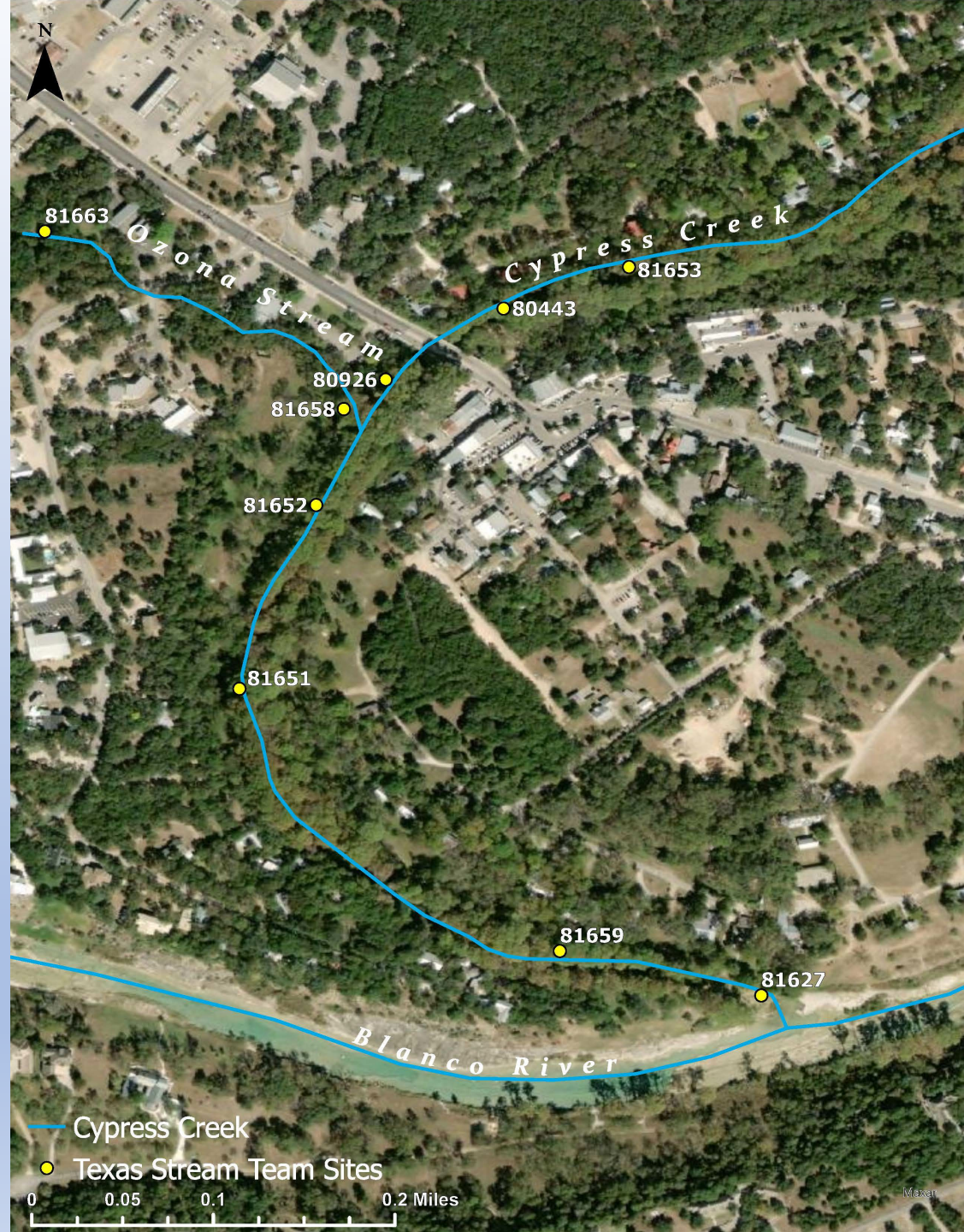
- Chemical compounds or dyes added to laundry detergents, cleaning agents, textiles, synthetic fibers and many kinds of paper including toilet paper
- Used as a surrogate of wastewater contamination from illicit discharges in storm drains and failing septic systems
- Adsorb to cotton
- Fluoresce under ultraviolet light
- Where fecal contamination is known to occur, optical brighteners can assist in pollution screening and source identification
- Photodecay when exposed to ultraviolet light

Lower Cypress Creek Pilot Project:

E. coli and Optical Brighteners

Project phases:

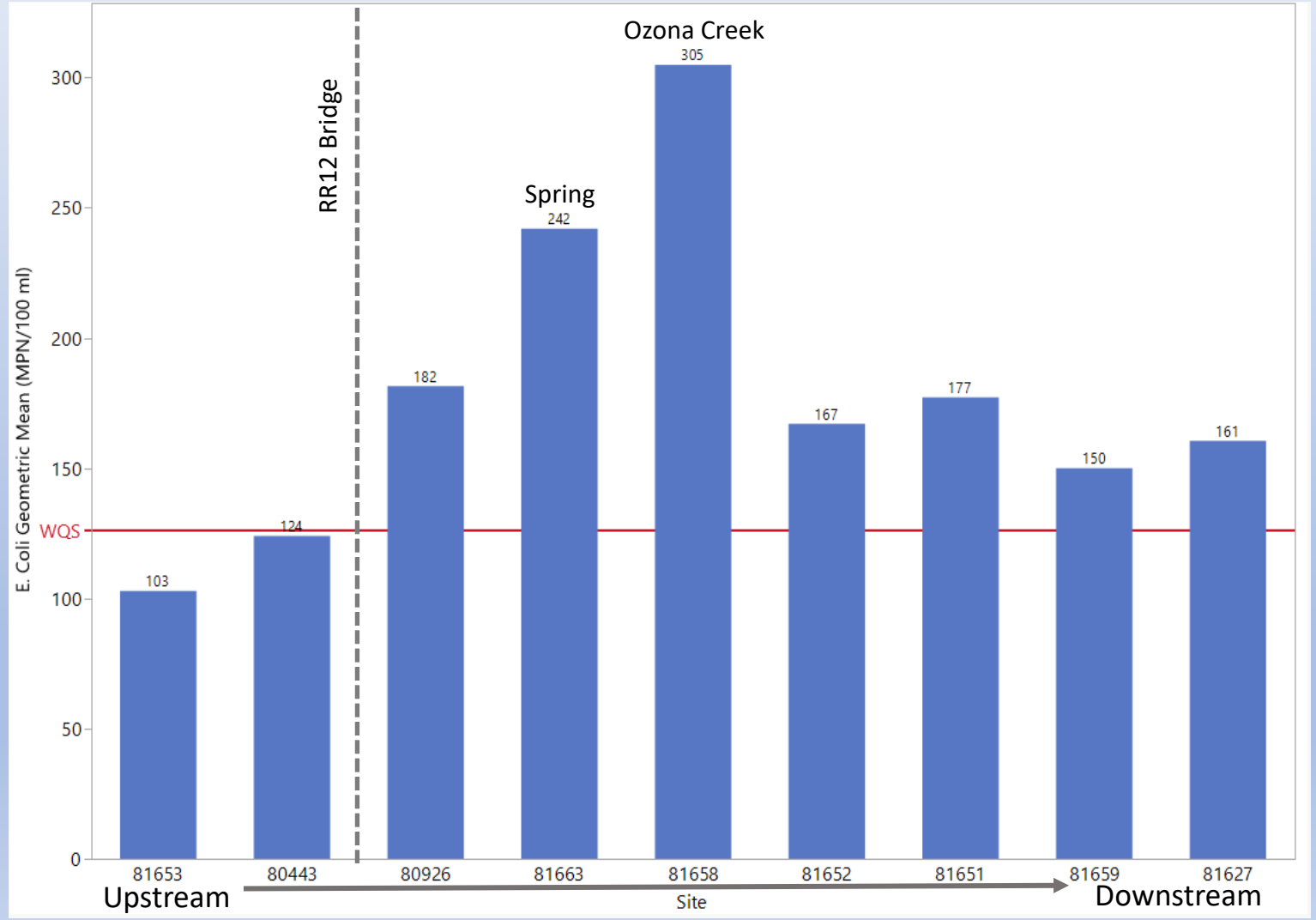
- Phase I: June – September 2021
  - Six sites
  - Sampled twice a week (Sunday and Thursday)
- Phase II: September 2021 – March 2022
  - Eight sites + one spring site (81663)
  - Sampled once a week (Thursday)
  - Suspended “tampling” monitoring
- Phase III: April 2022 - present
  - Eight sites
  - Sampling every other week (Thursday)
  - Reinstated “tampling” in August 2022
  - Developed and implemented protocol for fluorometric analysis of optical brighteners in field and lab



Lower Cypress Creek Pilot Project Results

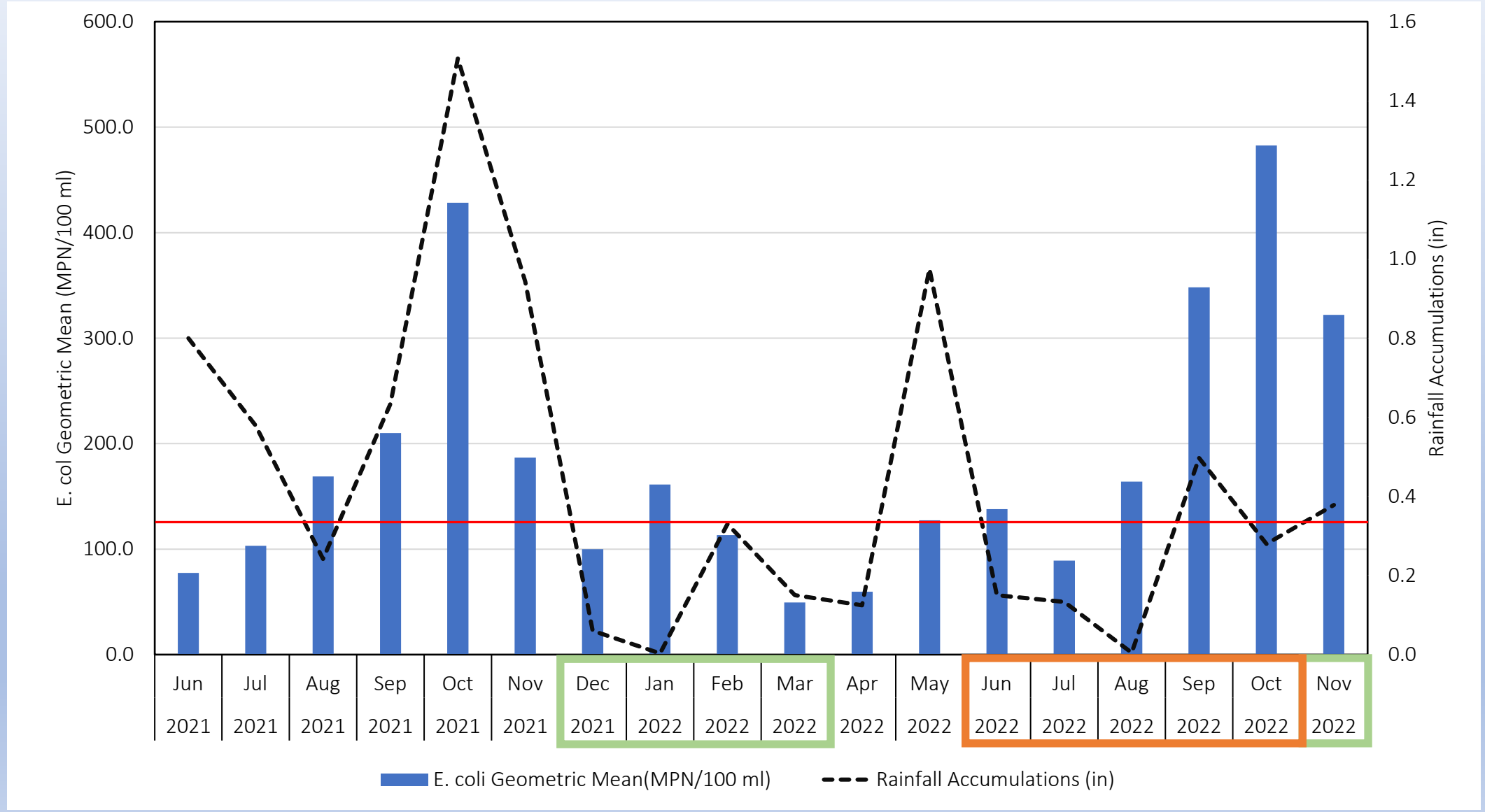
(June 27, 2021 – November 22, 2022)

Site	N	E. Coli (MPN/100 ml) Geo Mean
81653 – upstream	62	103
80443 – upstream	62	124
80926 – midstream	62	**182**
81663 –Spring	5	**242**
81658 – Ozona Creek	40	**305**
81652– midstream	61	**167**
81651– midstream	63	**177**
81659– downstream	50	**150**
81627– downstream	62	**161**



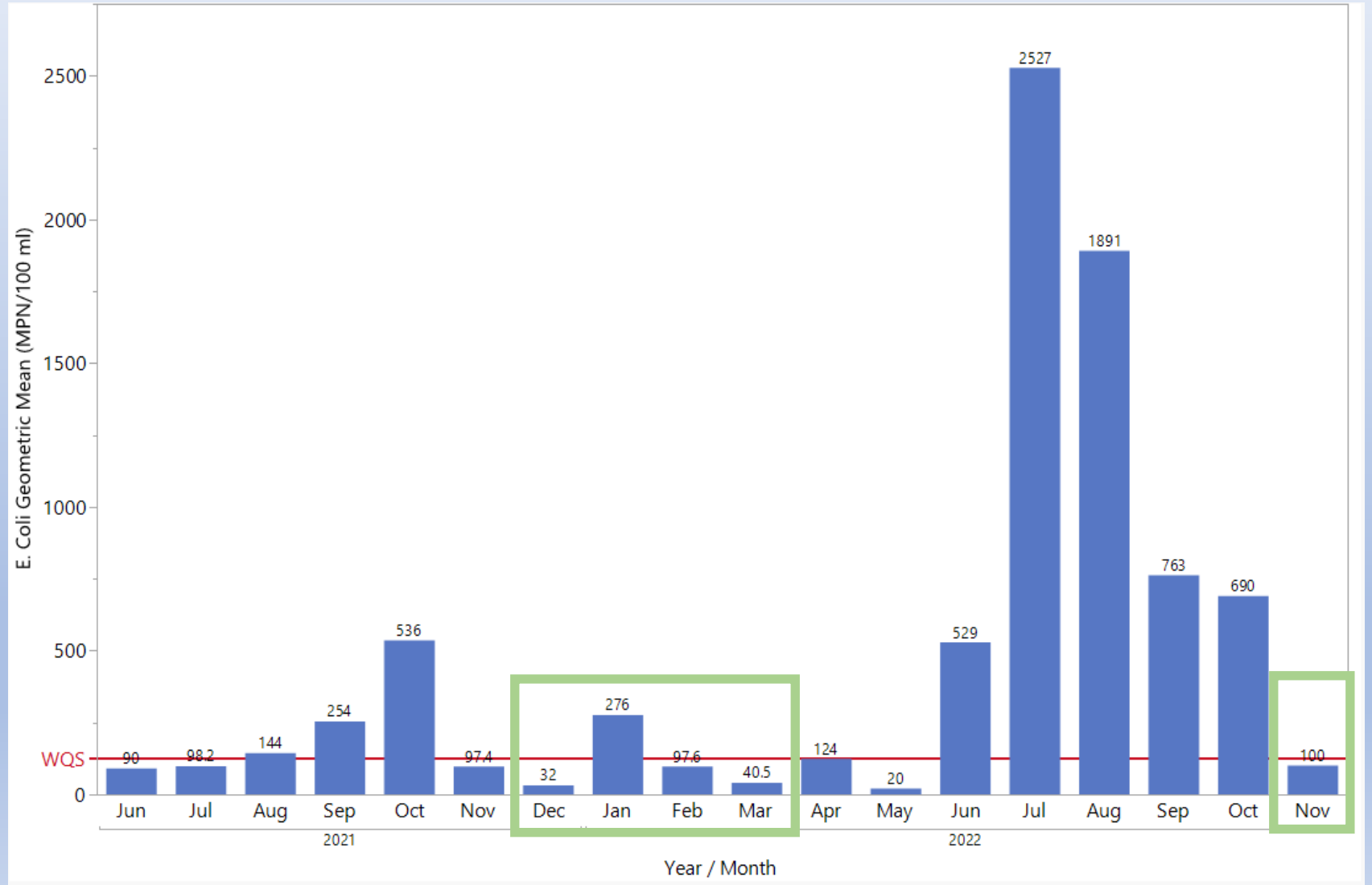
Lower Cypress Creek Pilot Project Results

(June 27, 2021 – November 22, 2022)



Temporal Effect of Bat Colony

- E. coli geometric mean for site 80926 – below RR12 bridge
- Bats migrate away from area from about November to March



Optical Brightener "Tampling" Sampling
(August – December 2022)

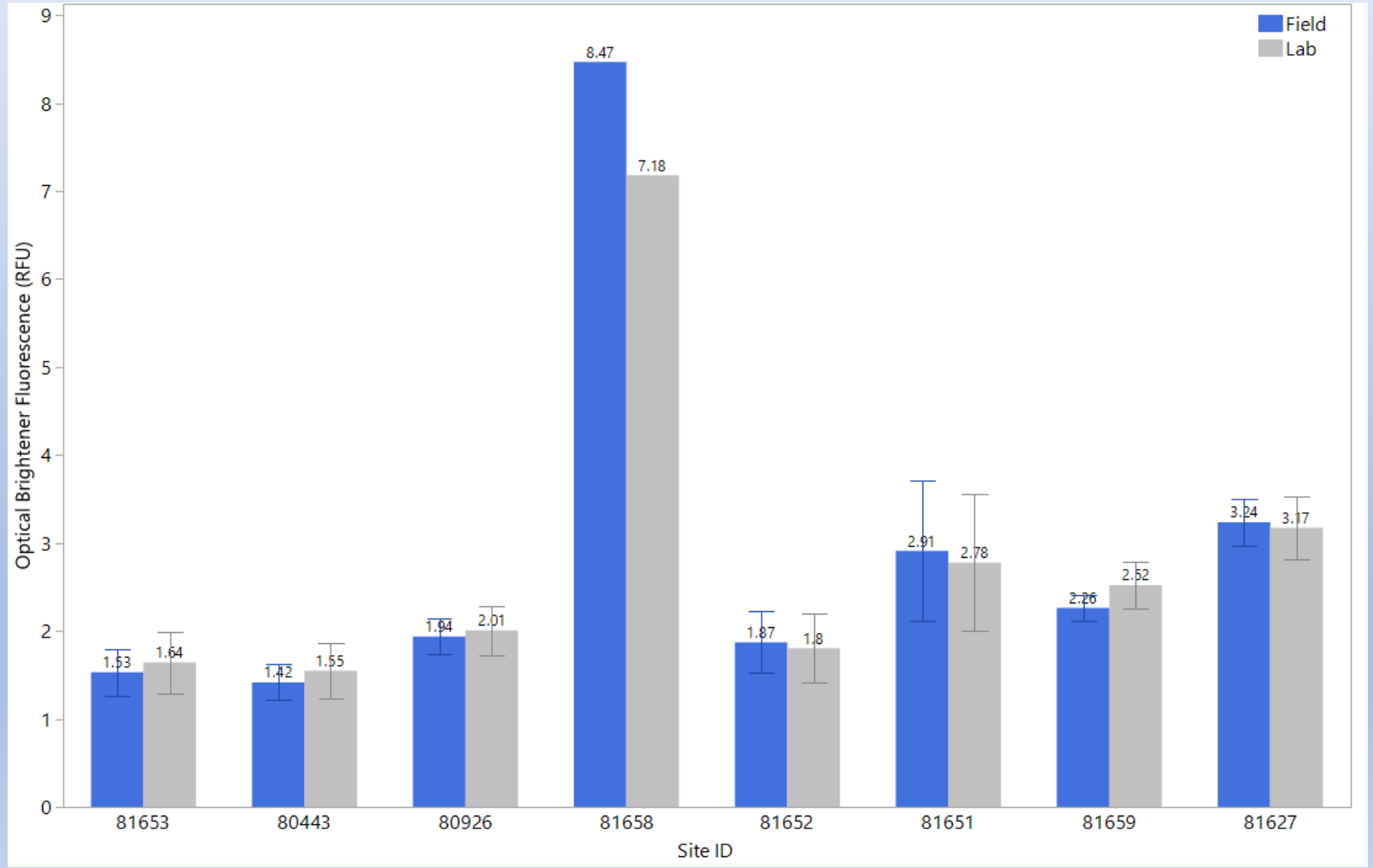
Statistic	Lab	Field
Number of Samples	64	64
Mean Optical Brightener Fluorescence (RFU)	0.65	0.67
Std. Error	0.07	0.07

Tampling

- Presence detected at all sites/events

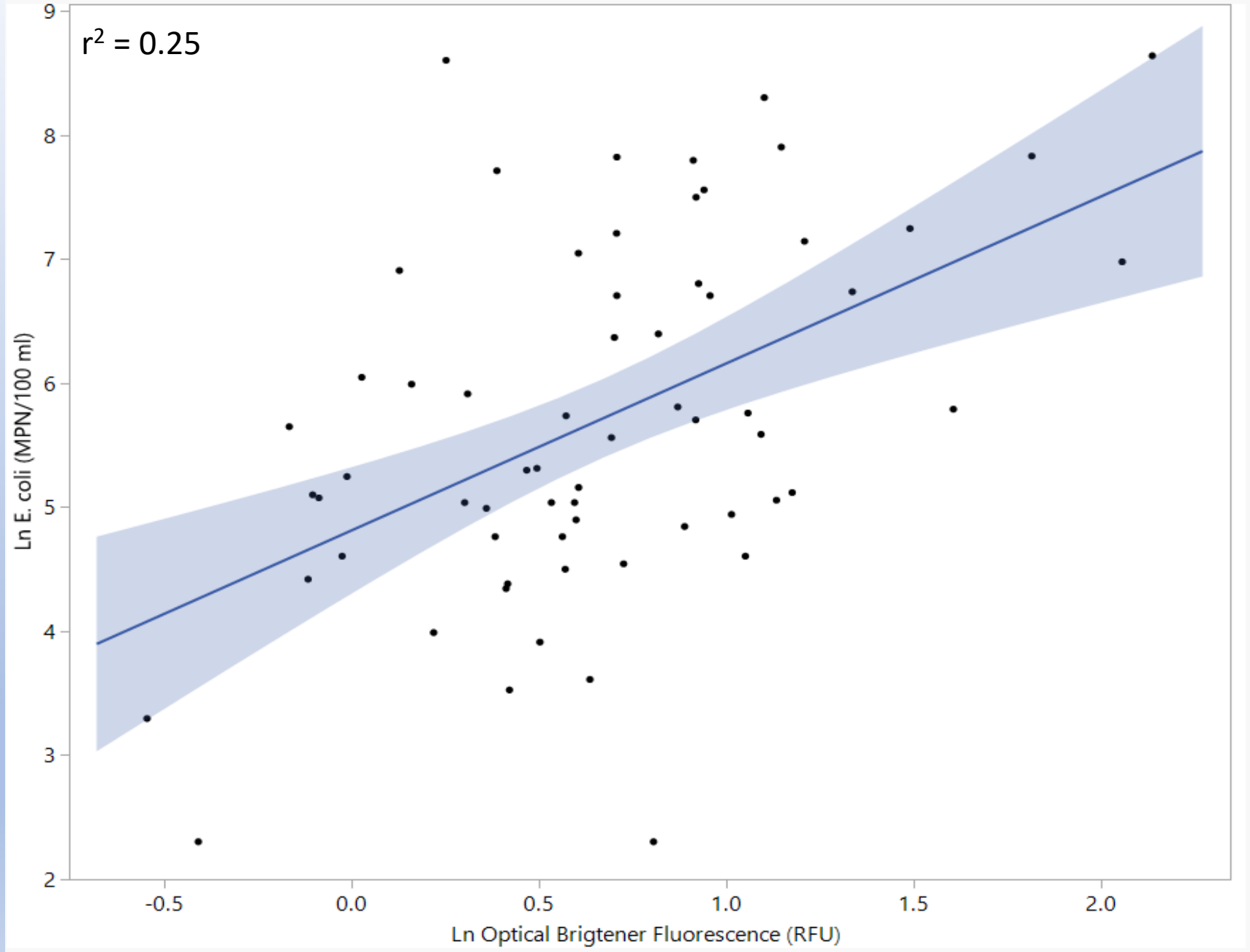
Fluorometric measurements

- Aquafluor Handheld Fluorometer
- All measurements conducted in triplicate
- Only have results from one monitoring event (11/22/2022) at 81658 because of flow conditions at that site
- All other sites had 9 monitoring events
- Why did we measure in field and lab?
  - OBs photo decay
  - Conducted experiment to determine difference between lab/field analysis



Optical Brightener UV Light Exposure Treatment in Lab

- Measurements taken:
  - Initial Value
  - 5 min. exposure
  - 10 min. exposure
- Relative percent difference (RPD)
- Ratio of RPDs
- Differentiates between OB and organic fluorescence



Wimberley Centralized Wastewater Collection Hookups
(May 2022)

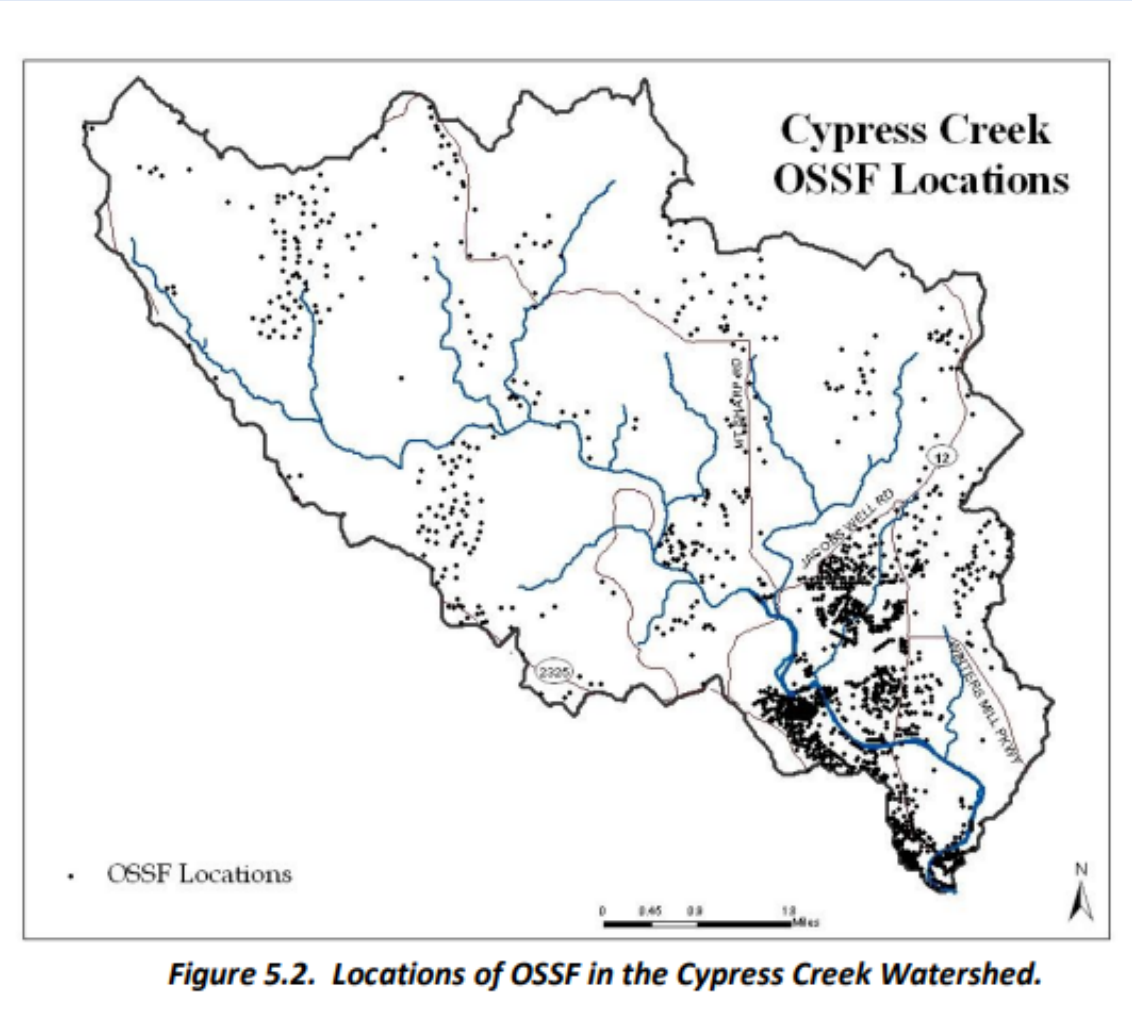
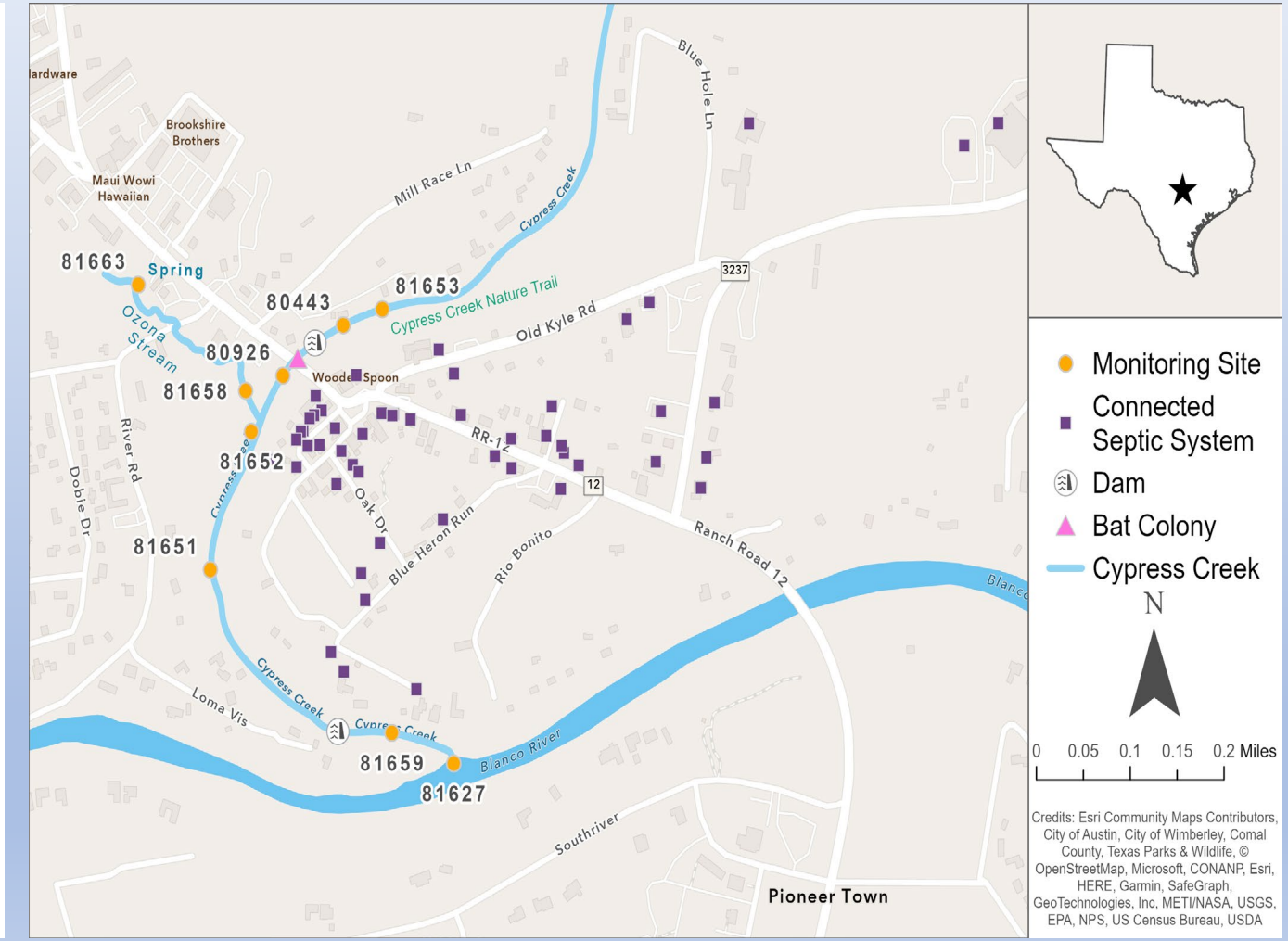


Figure 5.2. Locations of OSSF in the Cypress Creek Watershed.



Overall Observations

Bacteria geometric means were:

- Higher downstream of RR12 bridge than upstream
- Highest at 81658 – Ozona Creek
- Lowest at 81653 – most upstream site

Bacteria values:

- Fluctuated monthly – highest in October 2022, lowest in March 2022
- Values correspond to bat migration and precipitation

Tampling sampling resulted in:

- Presence of optical brighteners detected at all sites and events
- Fluoremetric measurements increase from upstream to downstream with highest value measured at Ozona Creek

Next Steps

- Conclude biweekly sampling in December 2022
  - Monitor rainfall events when feasible
- Continue to track connections to central collection system
- Continue to investigate ways to discern bacteria sources such as:
  - Analyze fluorometer exposure experiment results
  - Develop mixing model
  - Conduct dye study to identify failing septic systems
  - Update 2009 land cover analysis
  - Delineate sub watersheds and conduct field reconnaissance to identify malfunctioning septic systems

Thank you!

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The Meadows Center for Water and the Environment

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Texas Stream Team