

Assessment of William & Mary Stormwater Management and Retention



**WILLIAM
& MARY**
CHARTERED 1693

Skye Auger '28 | Environment & Sustainability Program

First-Year Monroe Scholar Summer Research Grant

Mentored by Dr. Randolph Chambers, Keck Environmental Field Lab Director



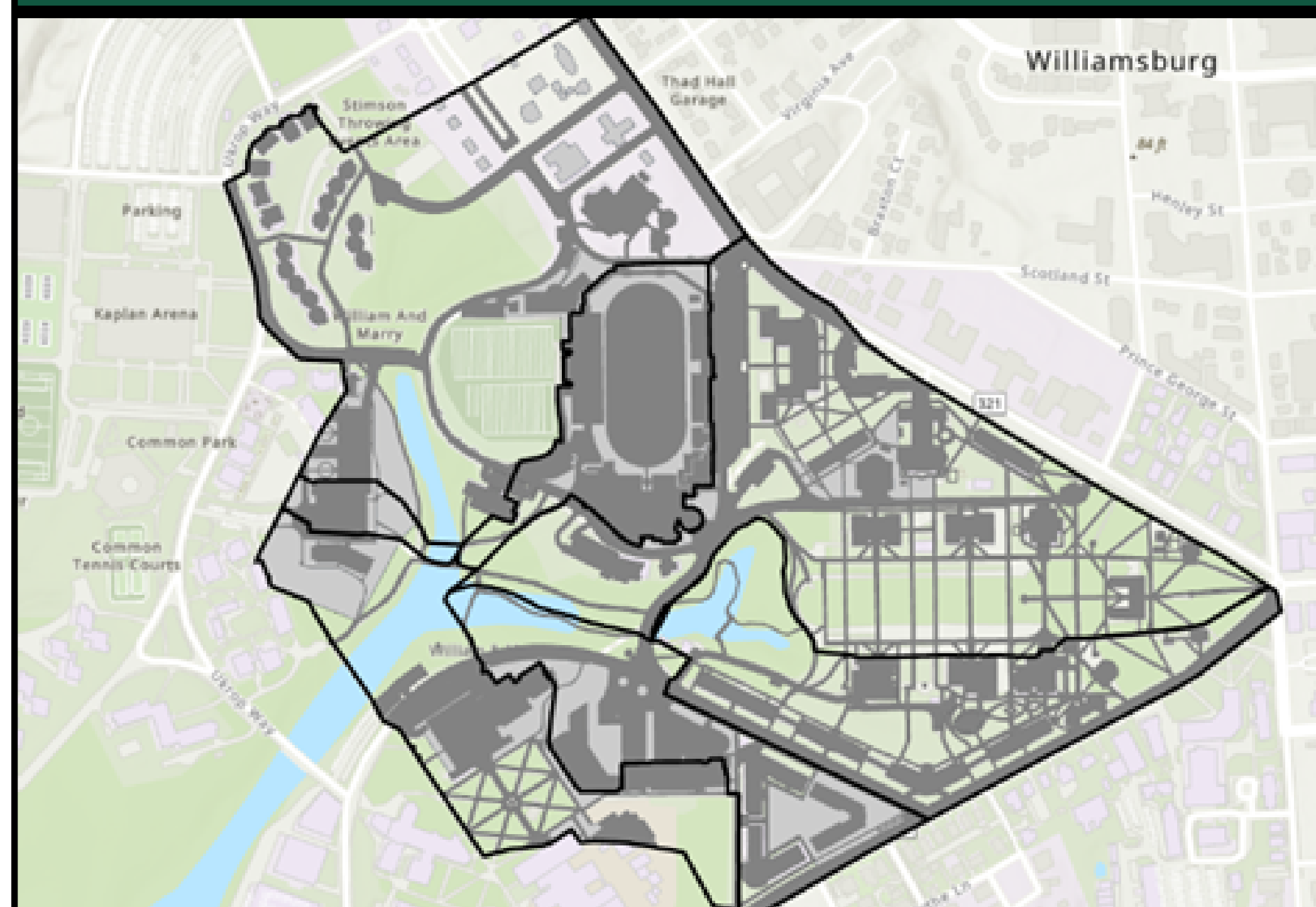
Background

- Crim Dell + Grim Dell (Upper Dell system)
 - → Swem Dell (Lower Dell)
 - → Lake Matoaka
- Jamestown Triangle, ISC4, West Woods 1
- BMPs: are they enough?

Objective

This applied research report seeks to analyze the effect of campus construction on the campus creek system through observation of a stormwater retention pond corroborated with GIS mapping and on-site observations of planned and current construction progress on campus.

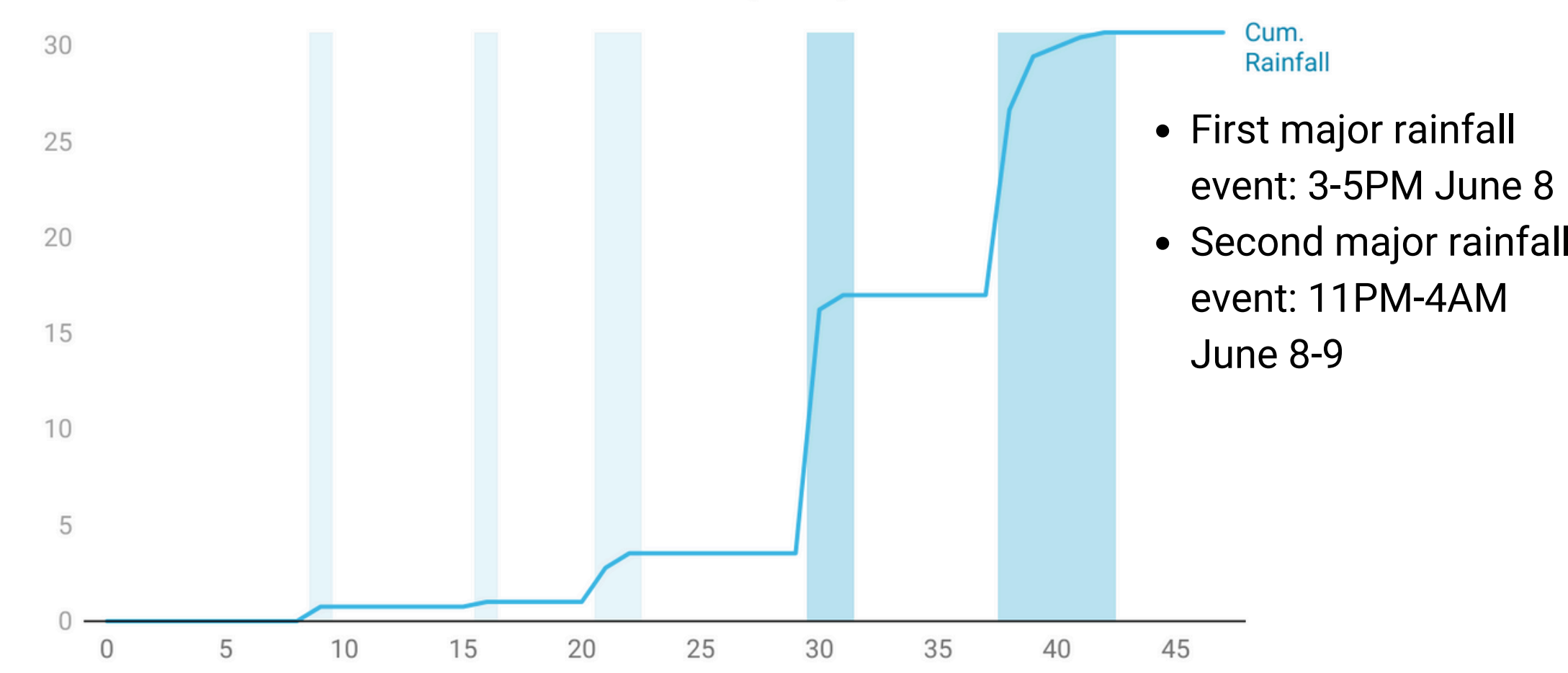
GIS Context



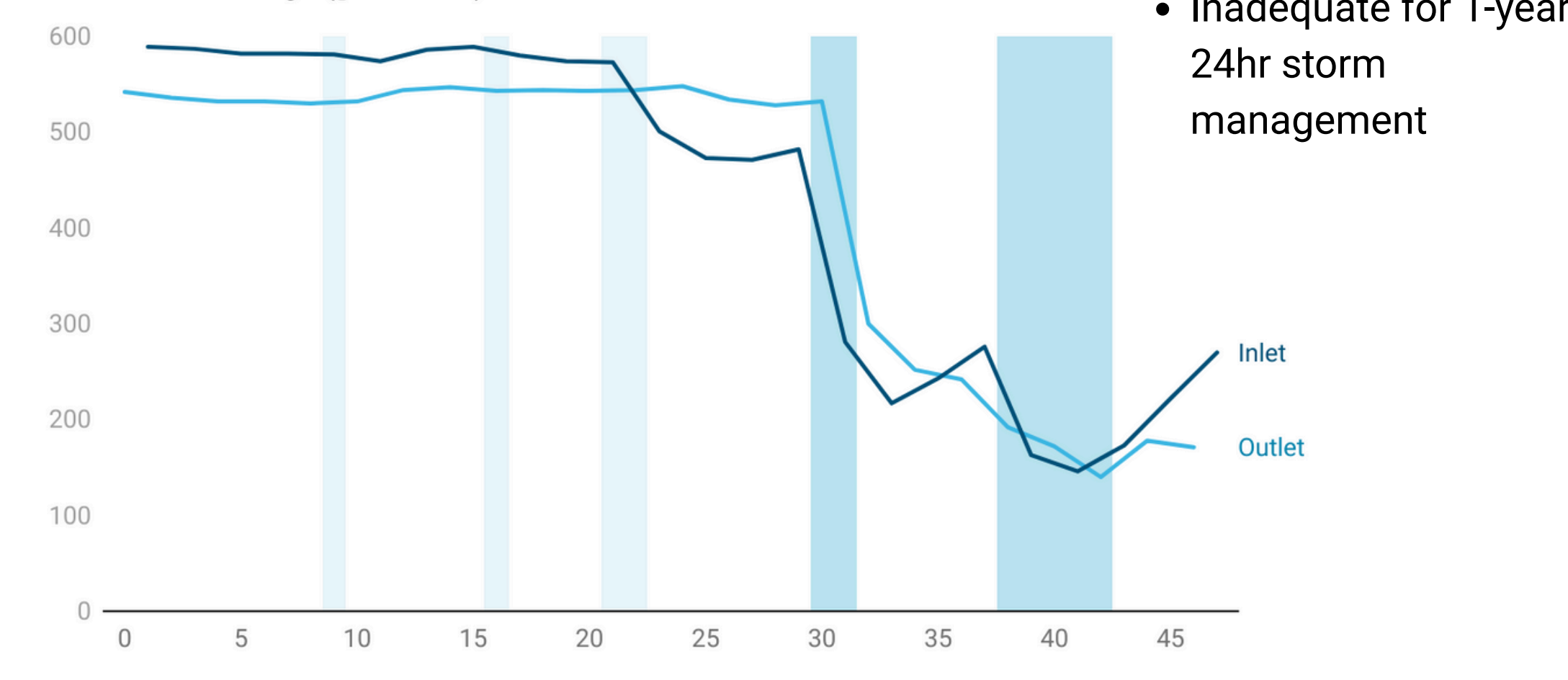
Field Methods

- Stormwater Sampling
 - Swem Dell - inlet and outlet
 - ISCO automated water samplers
 - Collected 500mL every 2hr for 48hr period
 - 10:00AM June 7 - 8:00AM June 9
- Water Quality Analysis
 - Conductivity
 - Vacuum filtration - TSS and Particulate P.
 - UV-Vis Spectroscopy

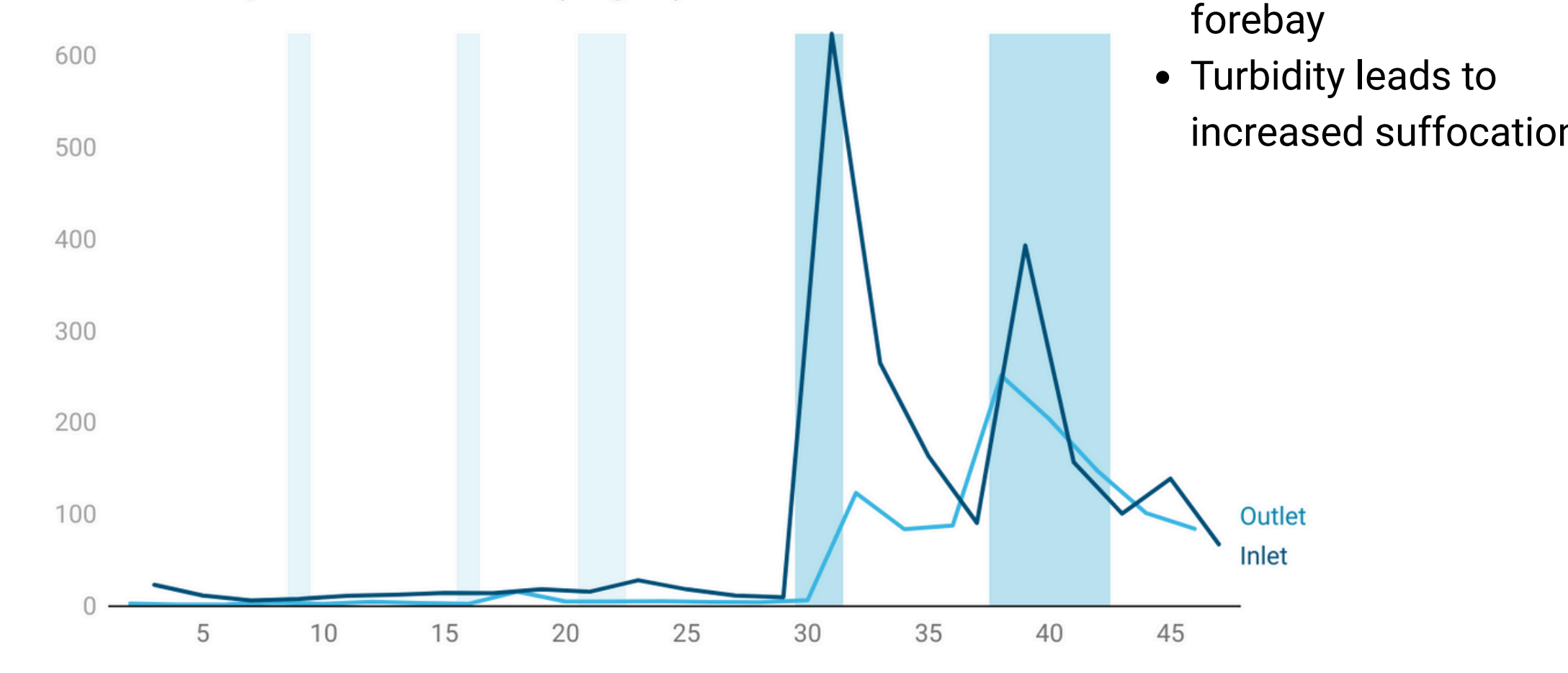
48hr Intermittent Rainfall Period (mm)



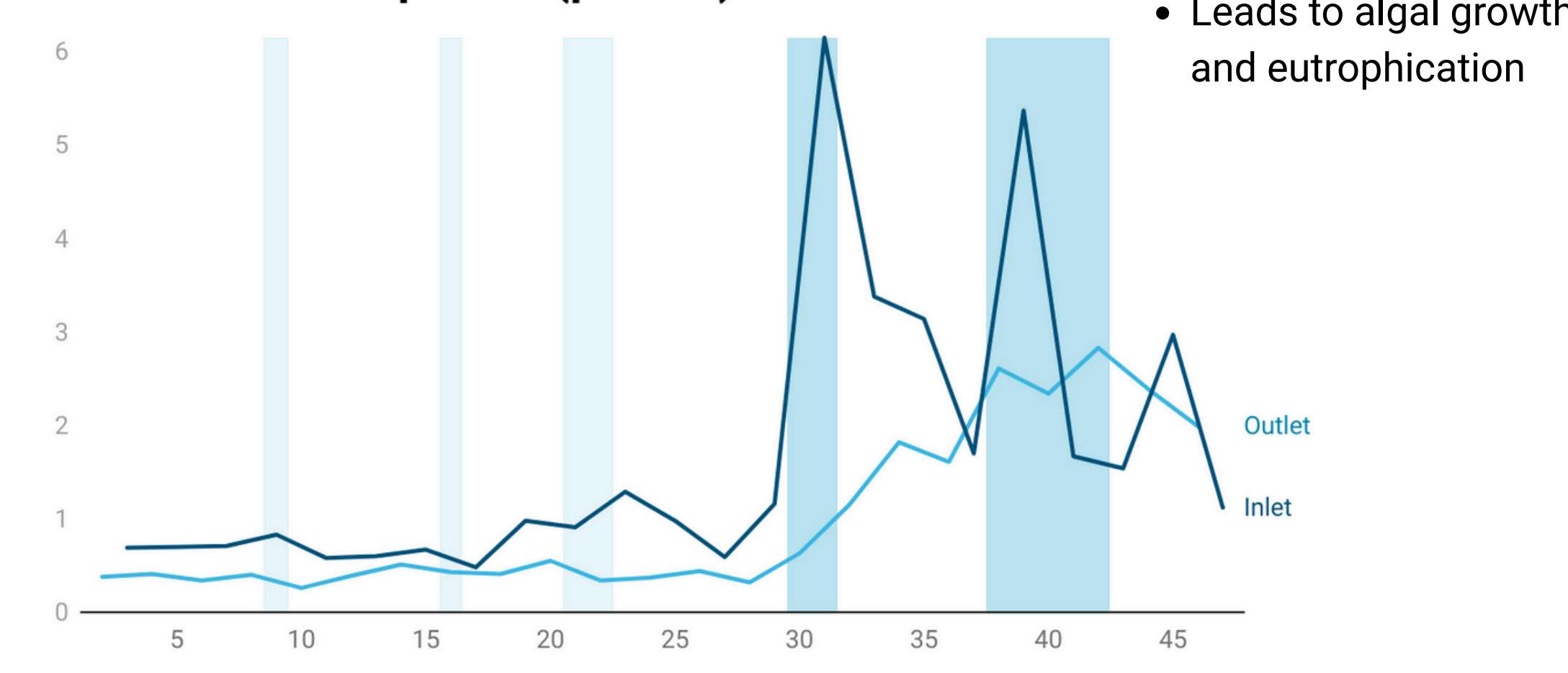
Conductivity ($\mu\text{S}/\text{cm}$)



Total Suspended Solids (mg/L)



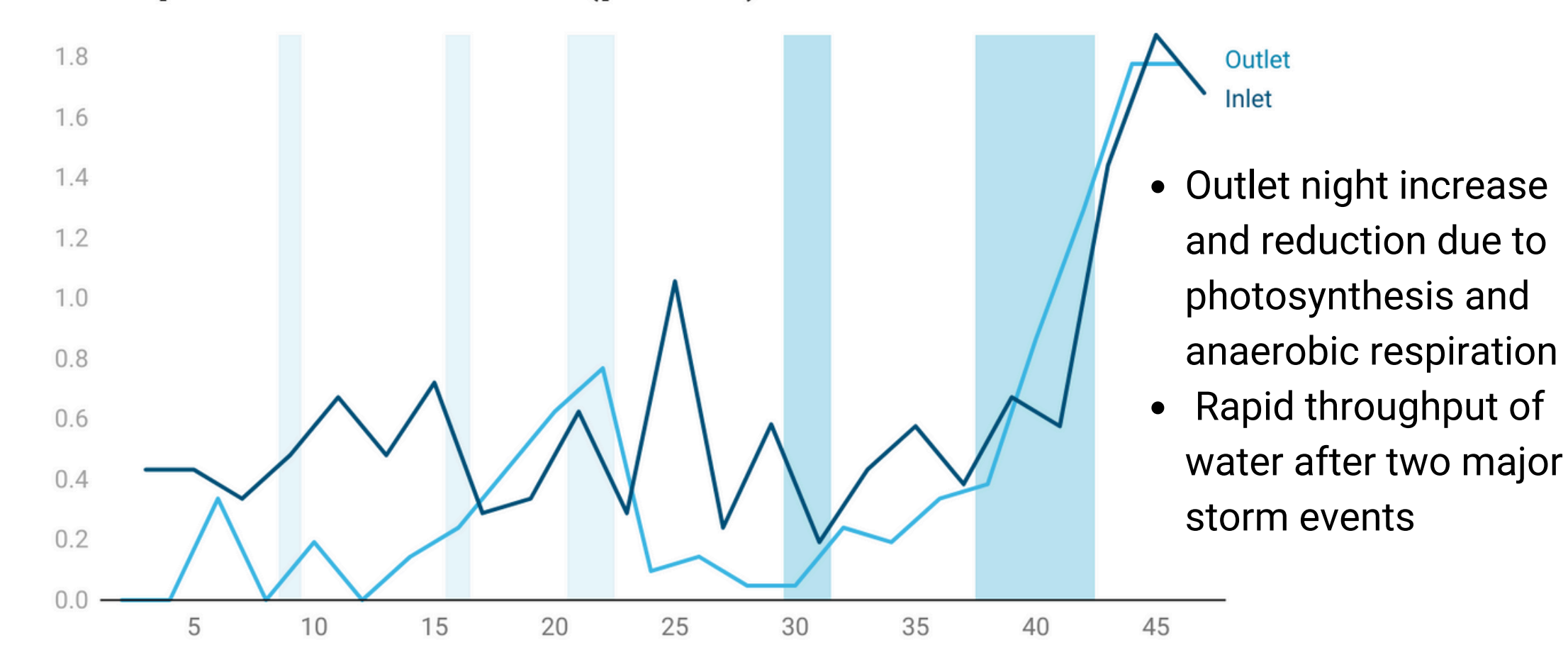
Particulate Phosphorus ($\mu\text{mol}/\text{L}$)



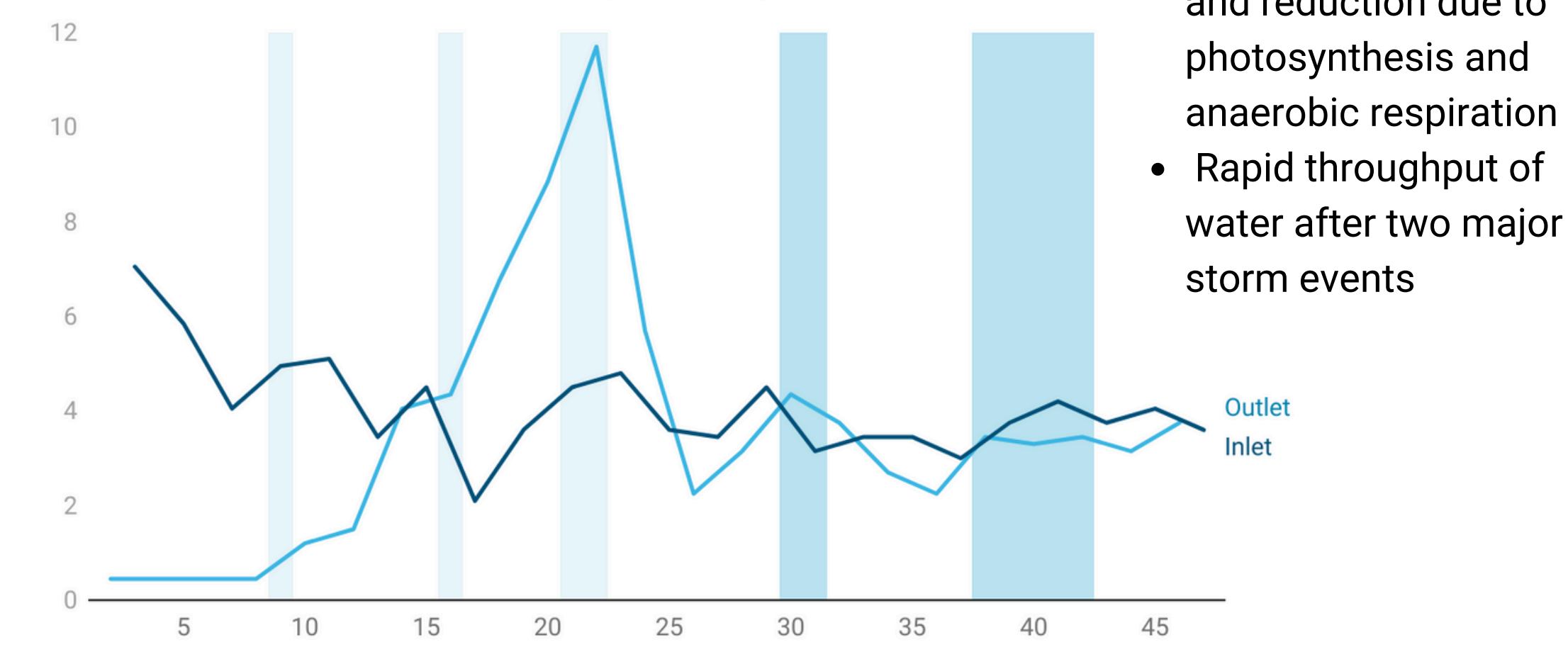
Physical and Chemical Properties

- High sediment retention and decent response, but high inlet quantity indicates erosion from construction sites, loose soil, dead vegetation
- Dissolved nutrients showed minimal reduction, indicating short retention time
- Spikes in outlet ammonium indicate respiration activity from microbes, aiding with nutrient cycling, but not enough to reduce excess nitrogen

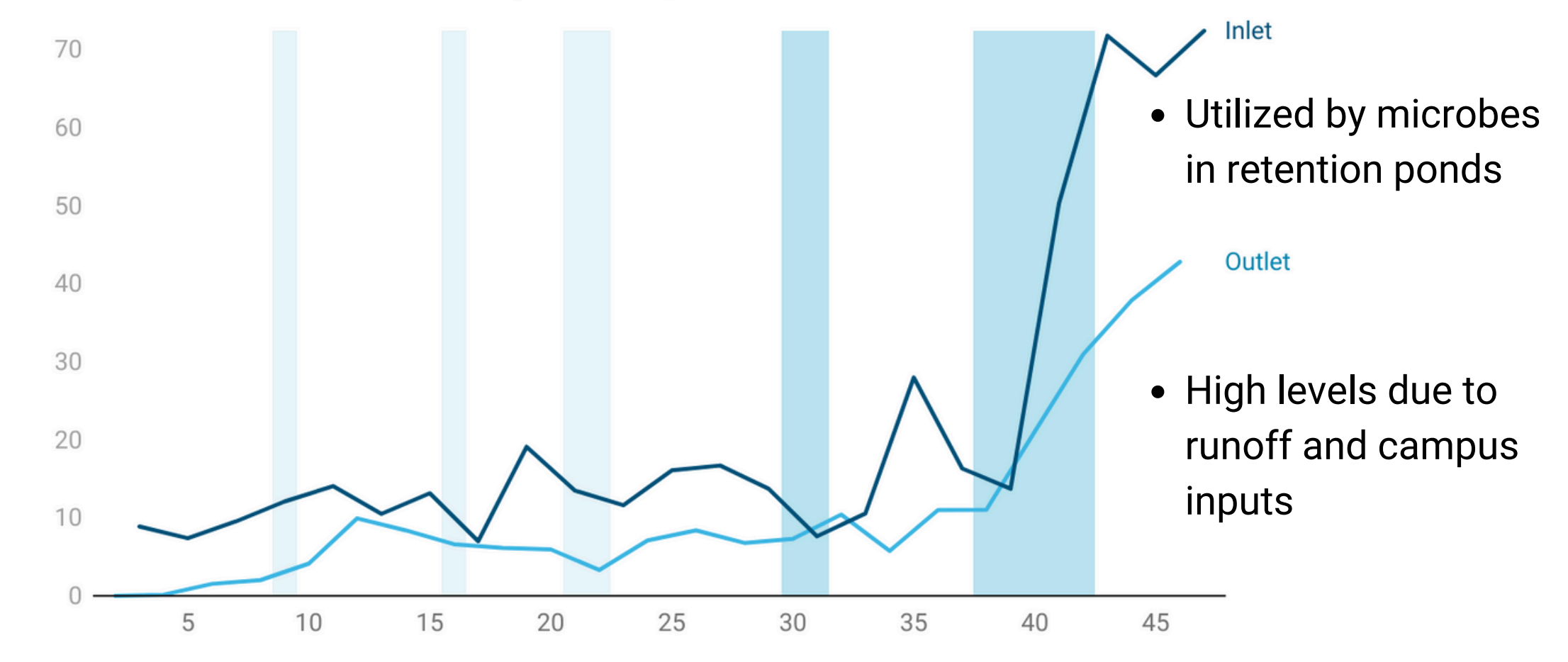
Phosphate Concentration ($\mu\text{mol}/\text{L}$)



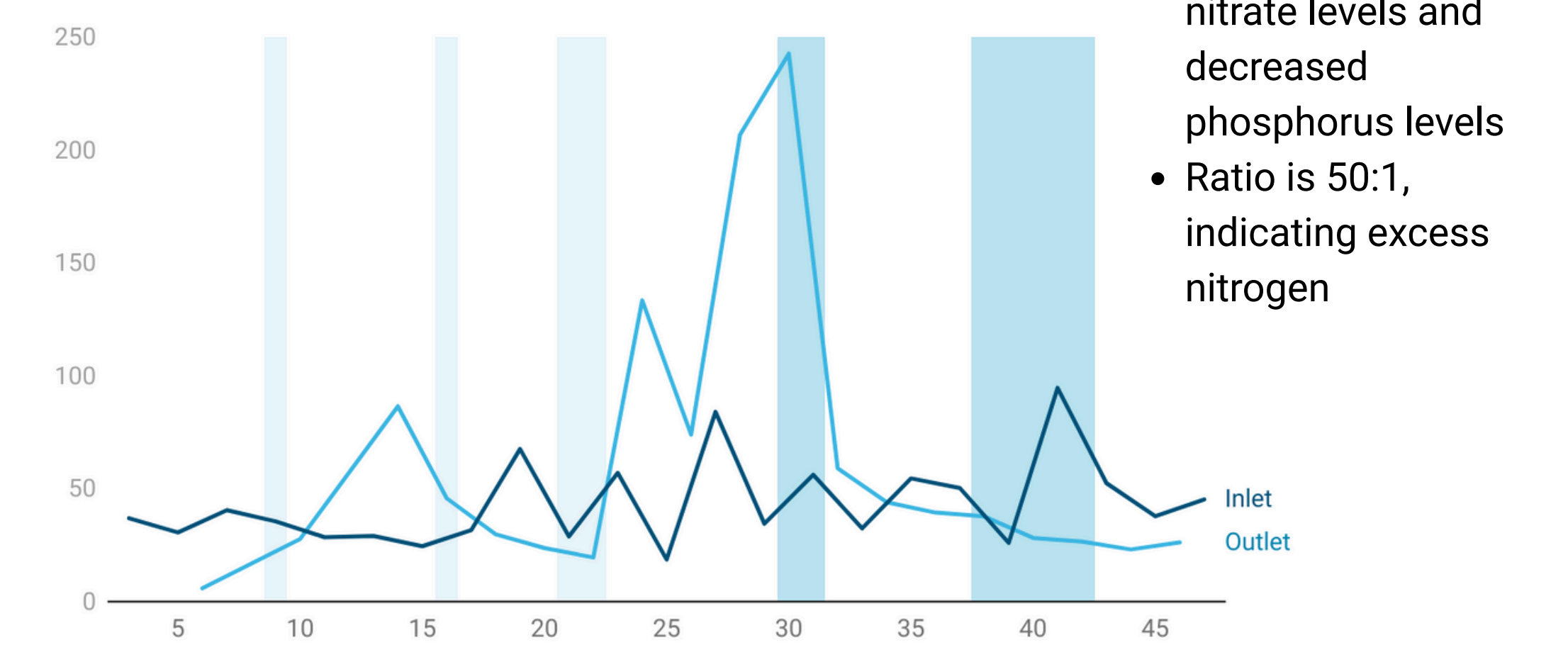
Ammonium Concentration ($\mu\text{mol}/\text{L}$)



Nitrate Concentration ($\mu\text{mol}/\text{L}$)



N:P Ratio



Context of Construction and Impermeable Surfaces on Campus

- Majority of impermeable surfaces run off to Upper Dell
- Stormwater management system uses direct inlets into the campus creeks, bypassing vegetation filtration to deliver runoff rapidly and unfiltered into Crim Dell and Swem Dell
- 8-9% of the watershed temporarily impermeable due to construction
- 40% of the watershed is permanently impermeable

Recommendations

- Add sediment traps, nutrient filters, or vegetation to or outside of existing storm drains
- Increase vegetative buffers around creek and pond banks, restore dead and flooded West Woods/Sadler woods land (do not neglect because of the sky bridge)
- Add bioswales or similar around construction sites, and/or collect/filter runoff sediment
- Increase maintenance of BMPs around construction sites

Future Directions

- Comparative studies in Crim Dell and Grim Dell
- Assessing the respiration within the pond or broader biological activity in the context of storm events
- Flow models of storm drains, runoff, etc.

Acknowledgments

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Resources



W&M Stormwater Management



Keck Weather Station