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2023 Conference

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Conference

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COMBINED FIELD AND LABORATORY EVALUATION OF THE PERFORMANCE OF MULTIPLE BIORETENTION SYSTEMS IN RETAINING PHOSPHORUS IN URBAN STORMWATER

Source to Stream Conference | March 2023

Presented by: Amanda Pinto, P.Eng.



The Phosphorus Challenge



EVALUATE



IMPROVE DATA



OPTIMIZE

The Objectives

OBJECTIVE
How well are existing bioretention cells performing with respect to phosphorus removal?

01

OBJECTIVE
What factors affect phosphorus removal in bioretention systems?

02

OBJECTIVE

Can phosphorus removal improve by using Water Treatment Residual (WTR)-amendments?

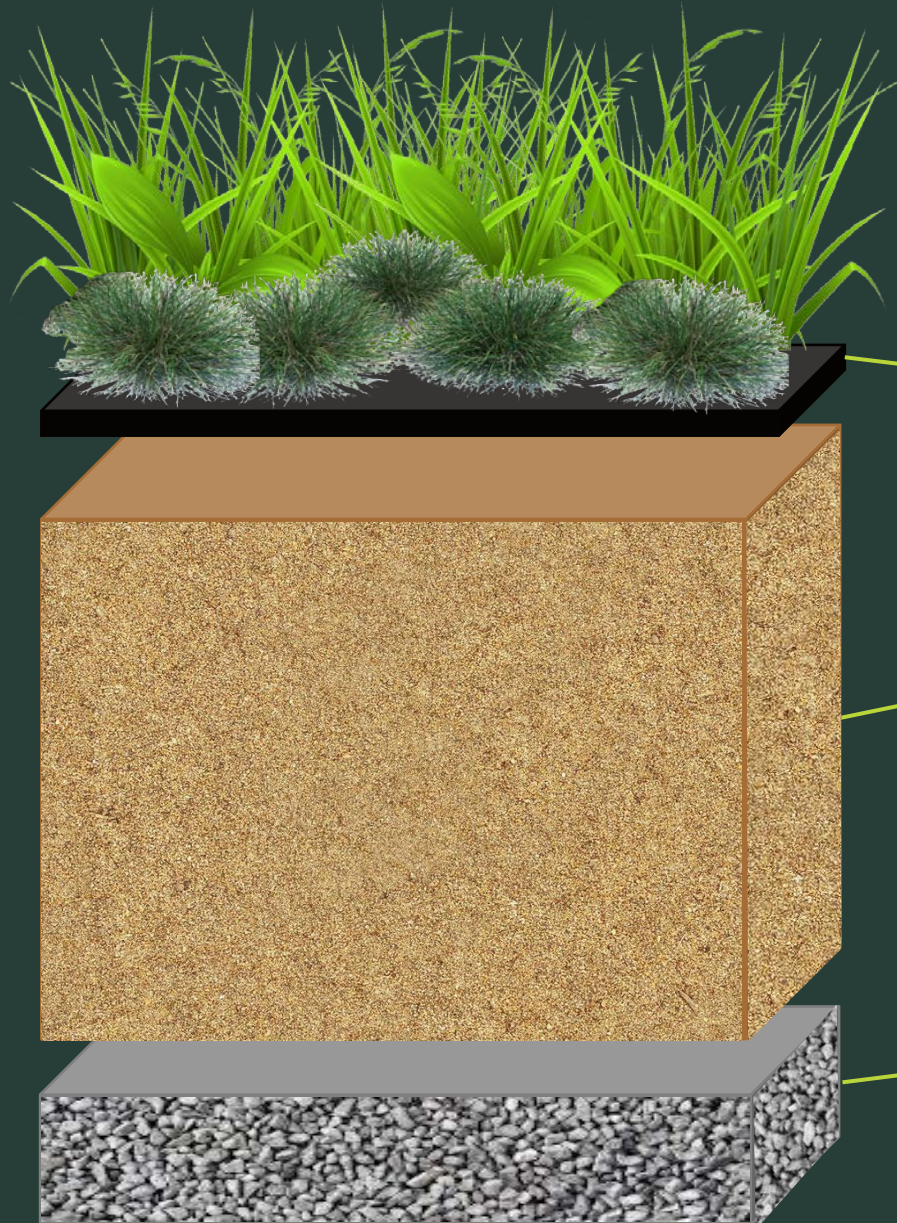
03

OBJECTIVE

What is the impact of winter road salt on phosphorus retention in bioretention systems?

04

Current Media Specifications (CVC)



TOPSOIL / MULCH

- 85% SAND
- 10% FINES
- 5% ORGANIC MATTER

GRAVEL

- P index: 10-30 ppm
- Cation Exchange Capacity > 10 meq/100 g
- pH: 5.5 – 7.5

Study Sites



LONDON AREA SITES

- Oakridge
- Waterloo Street
- Dorchester
- Sarnia

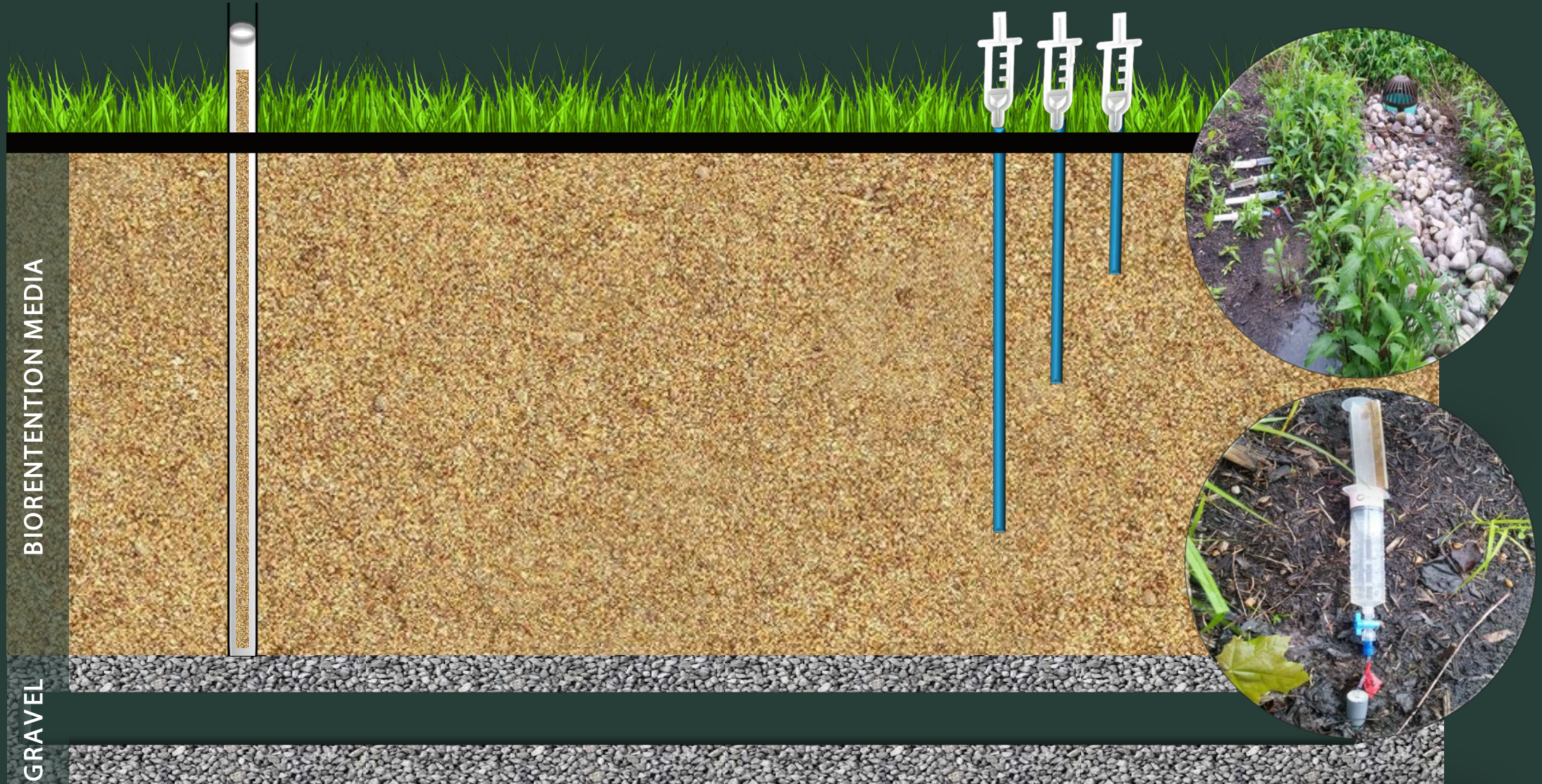


GREATER TORONTO AREA SITES

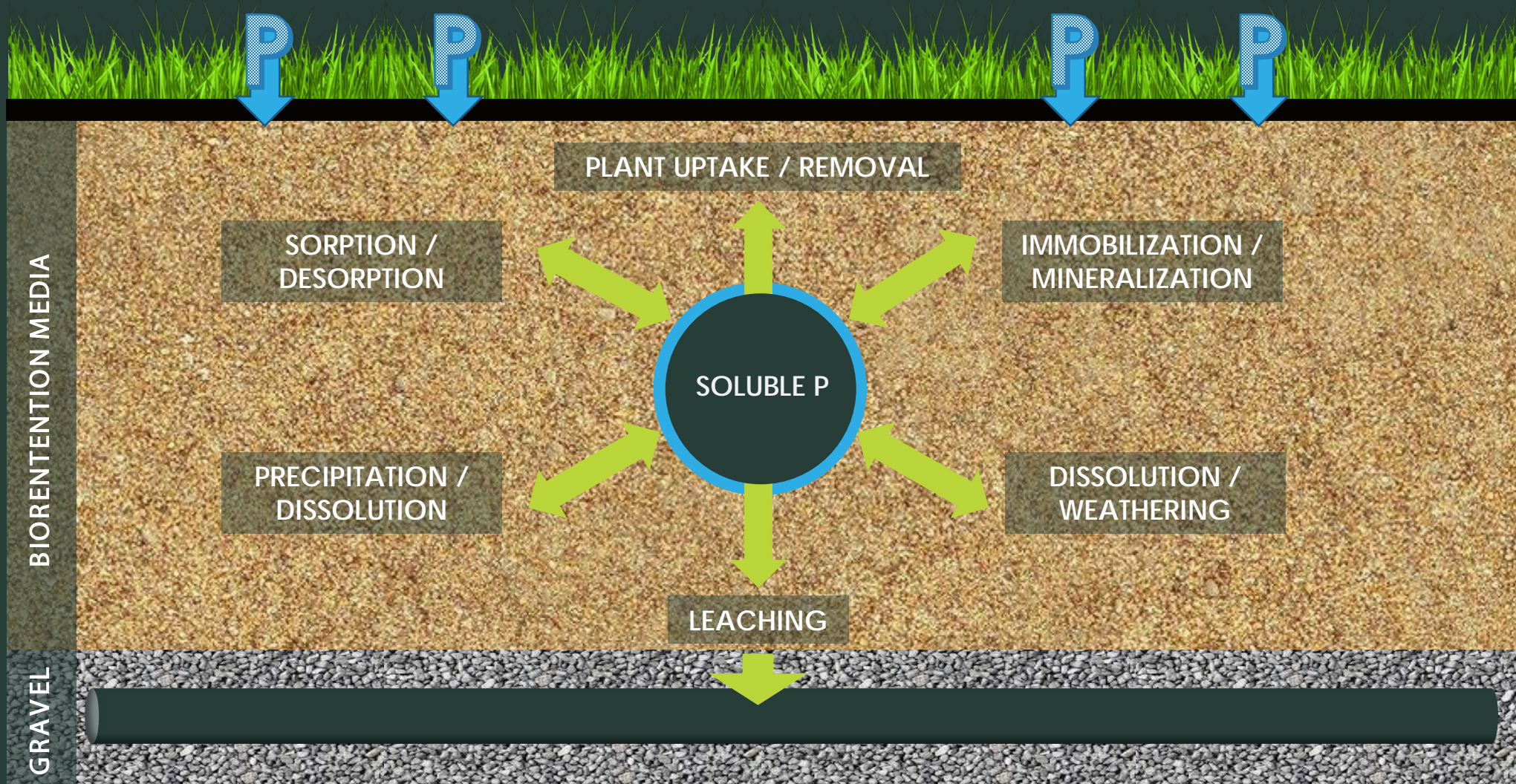
- Black Creek
- Dundas Street
- Kennedy Road



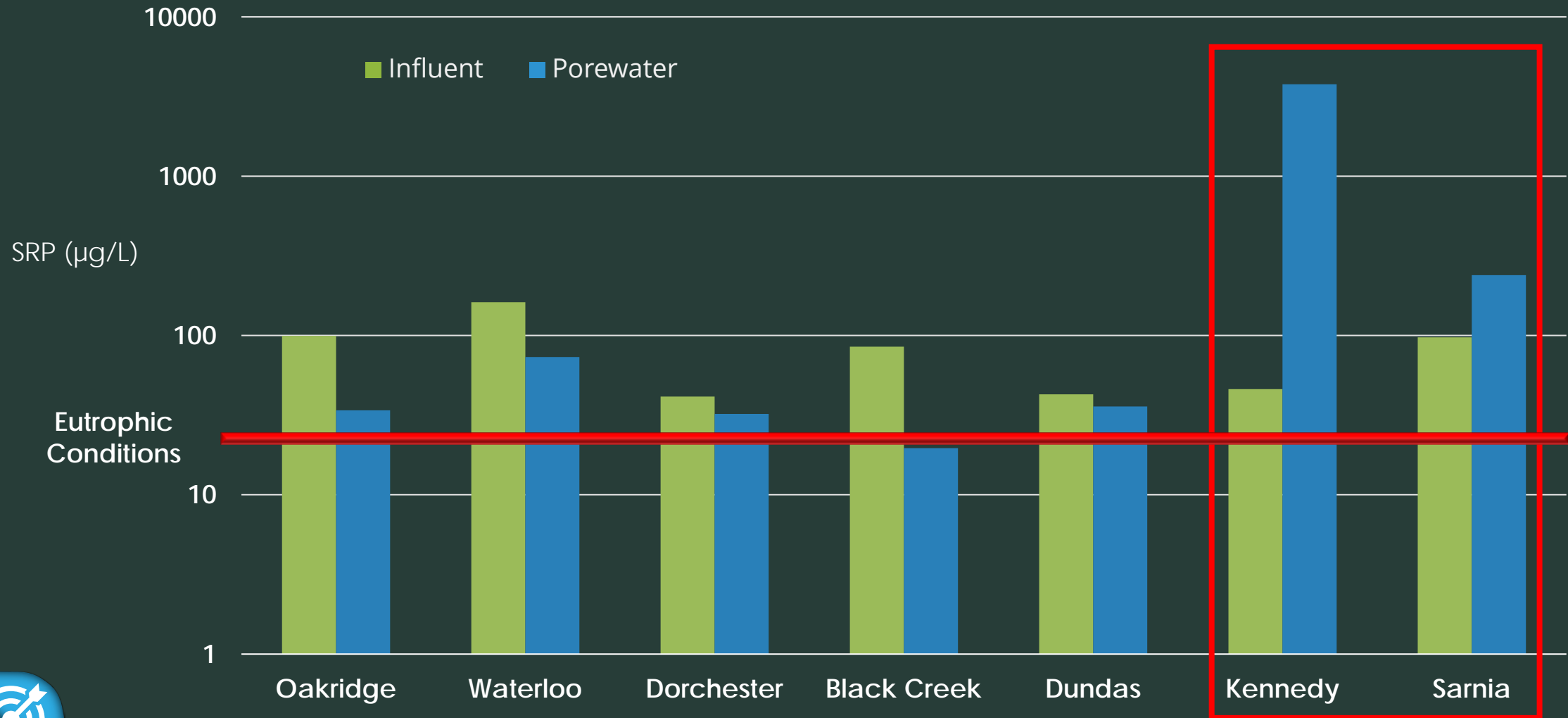
Field Methodology



Phosphorus in Bioretention Cells



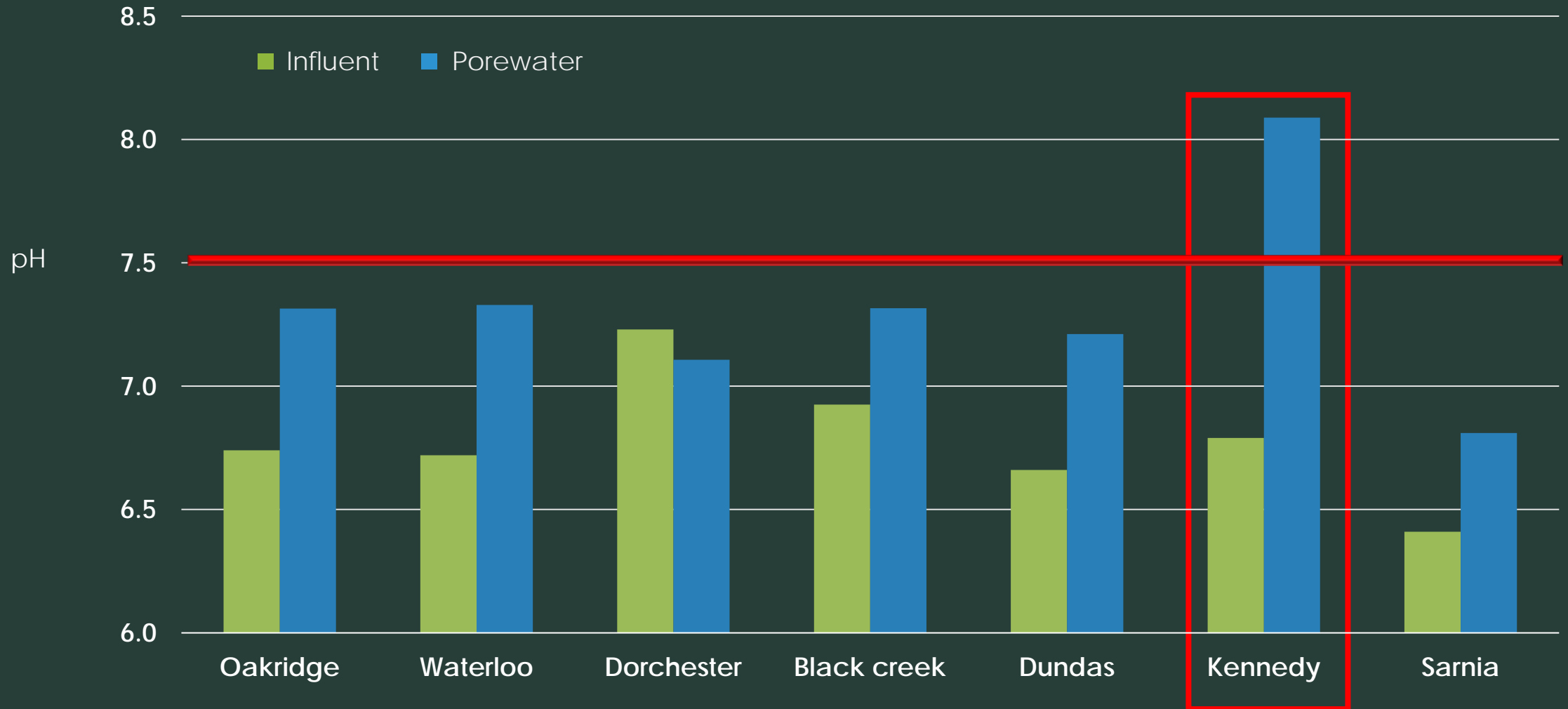
Results: Overall Performance of Field Systems



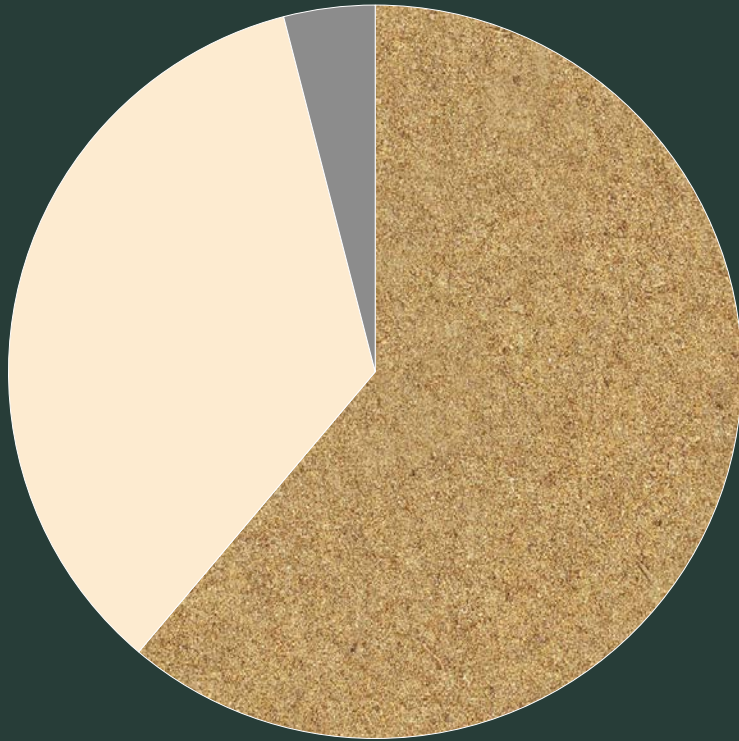
Results: SRP Depth Profiles



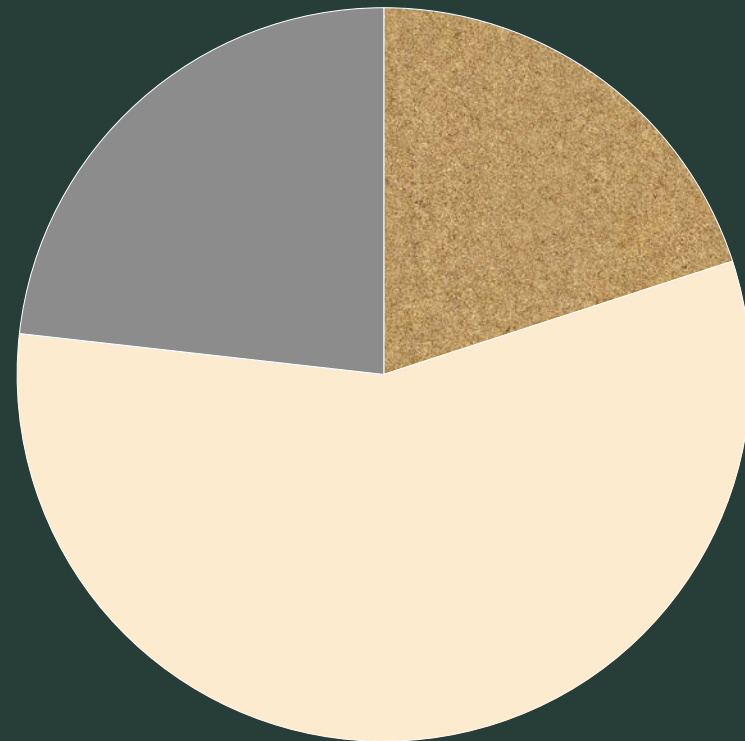
Results: pH Influence on SRP Removal



Results: Sediment Composition



DORCHESTER



KENNEDY

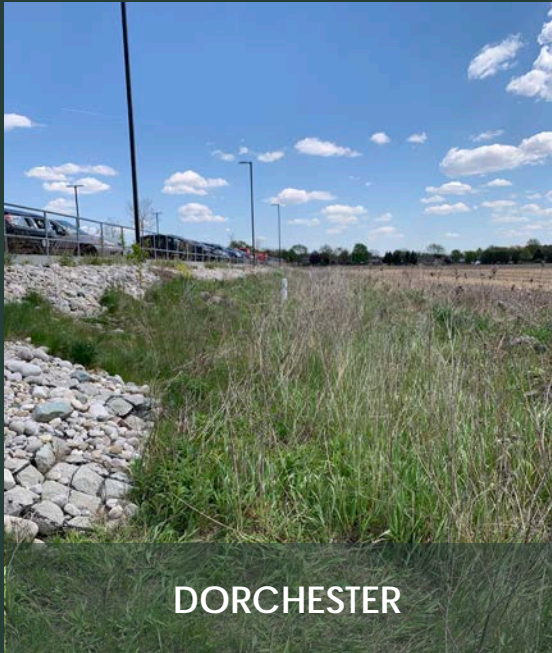


■ Coarse to Medium Sand

■ Fine Sand

■ Silt or Clay

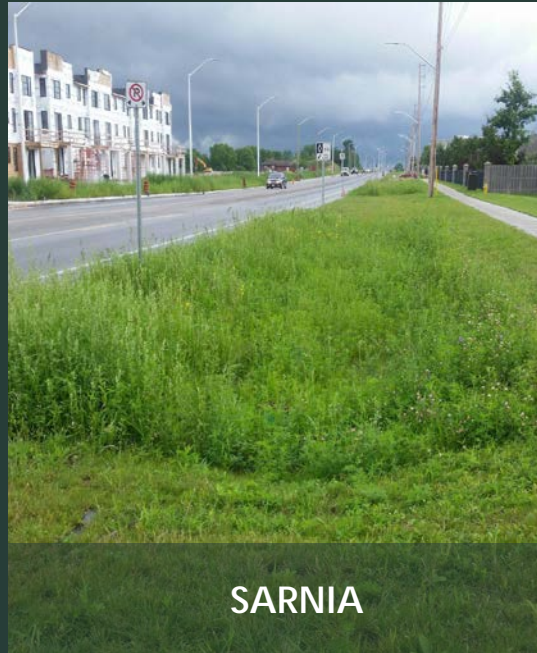
Field Sites & Columns



DORCHESTER



DUNDAS



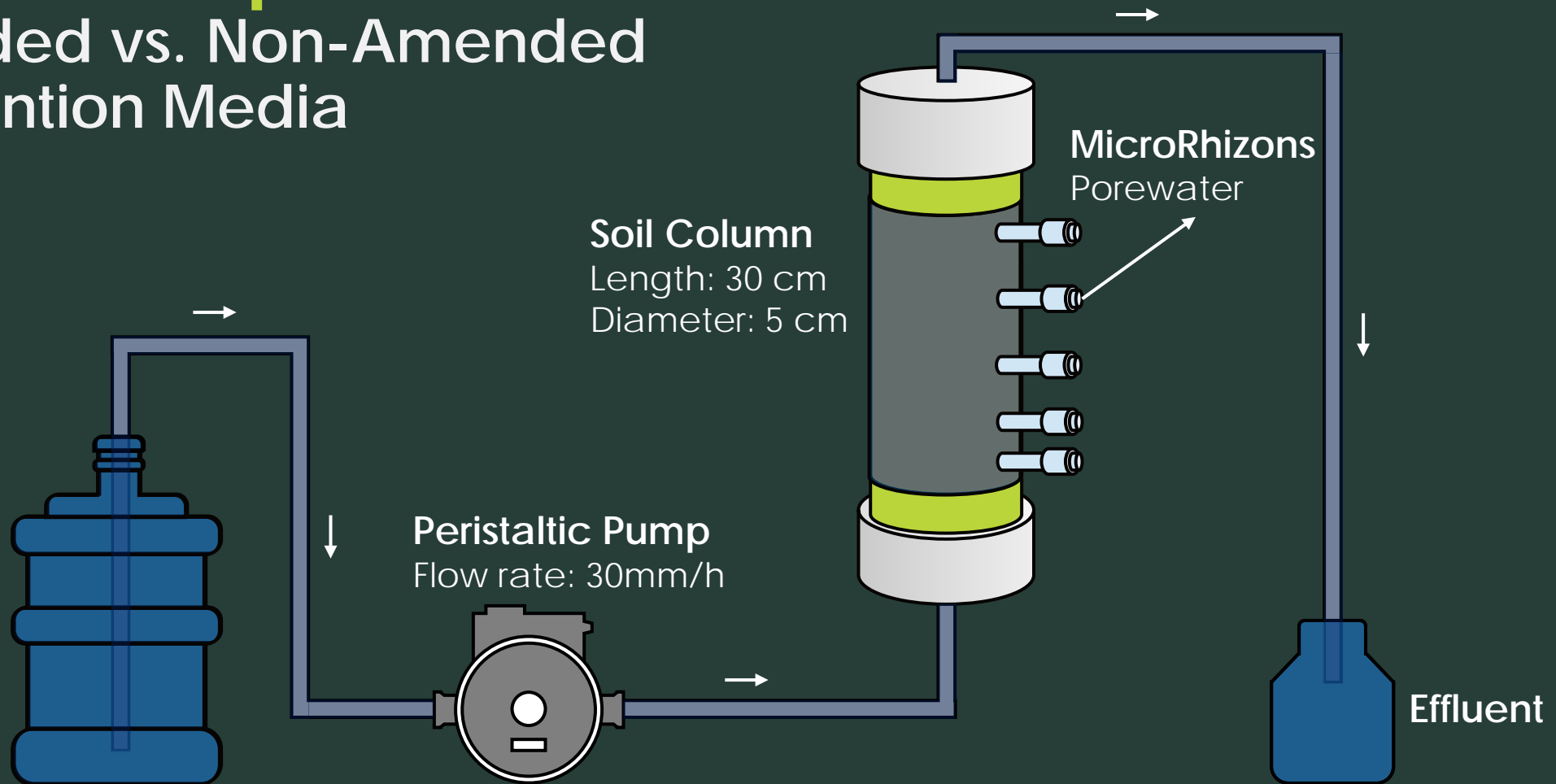
SARNIA



COLUMN TESTS

Column Experiments

Amended vs. Non-Amended
Bioretention Media

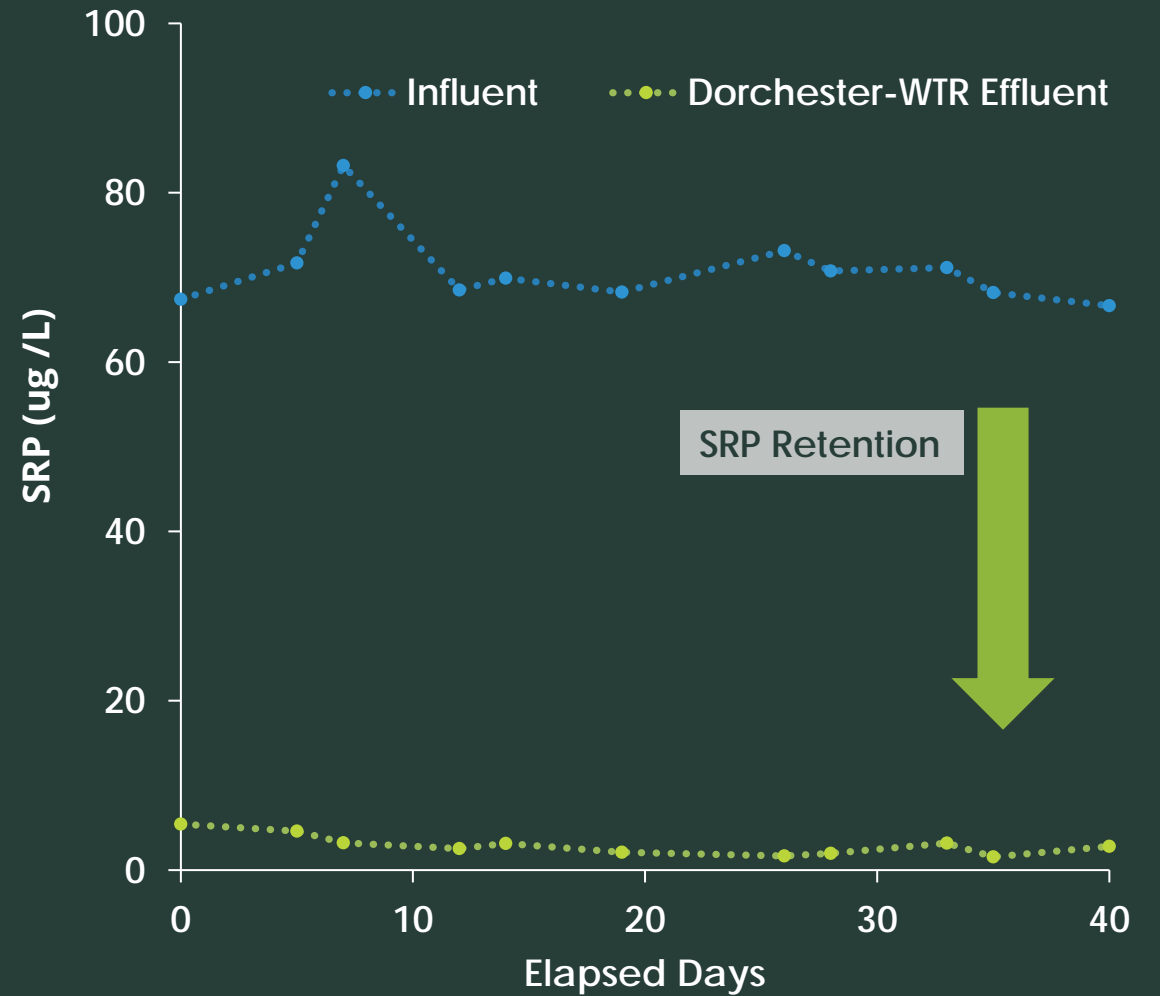
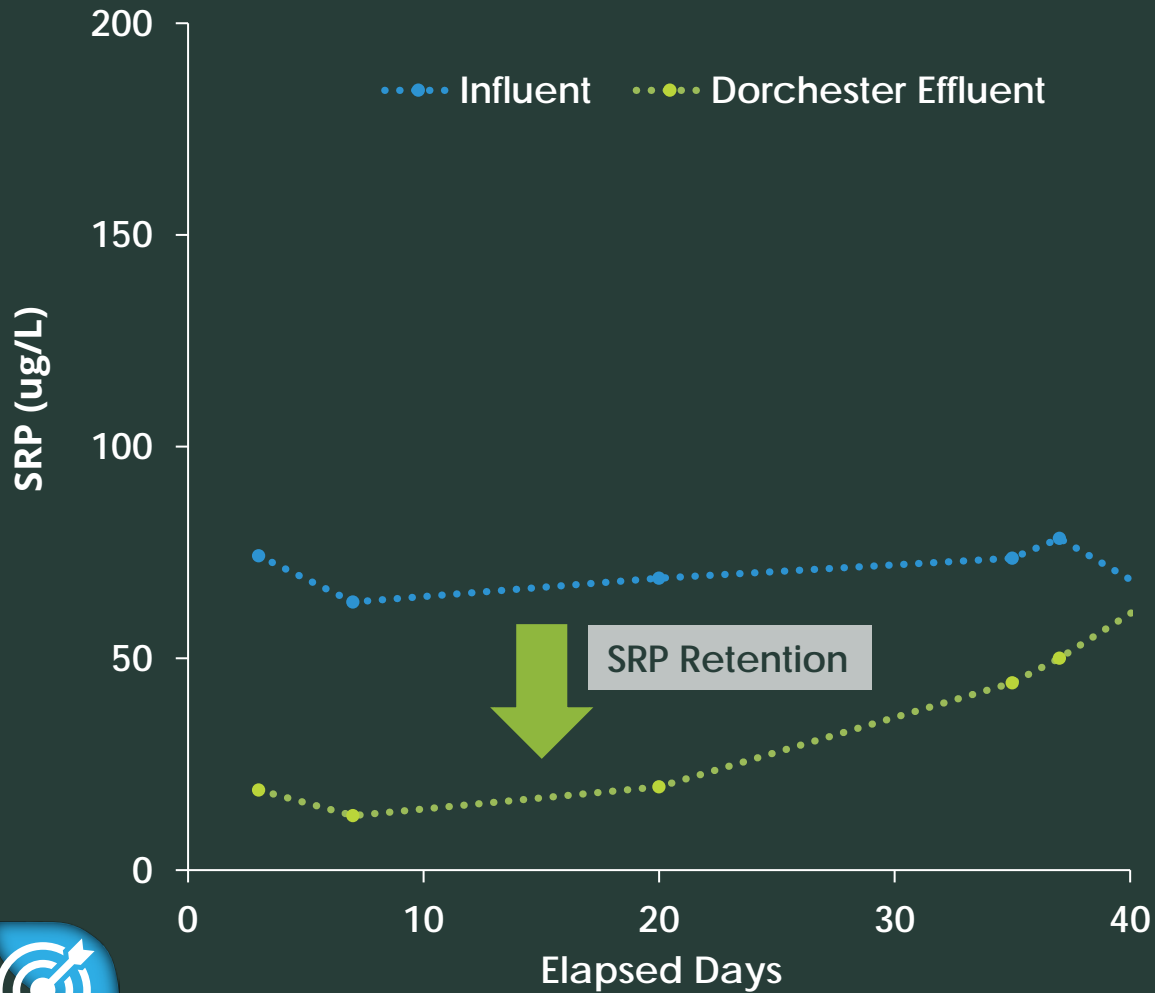


Influent

1. Synthetic stormwater

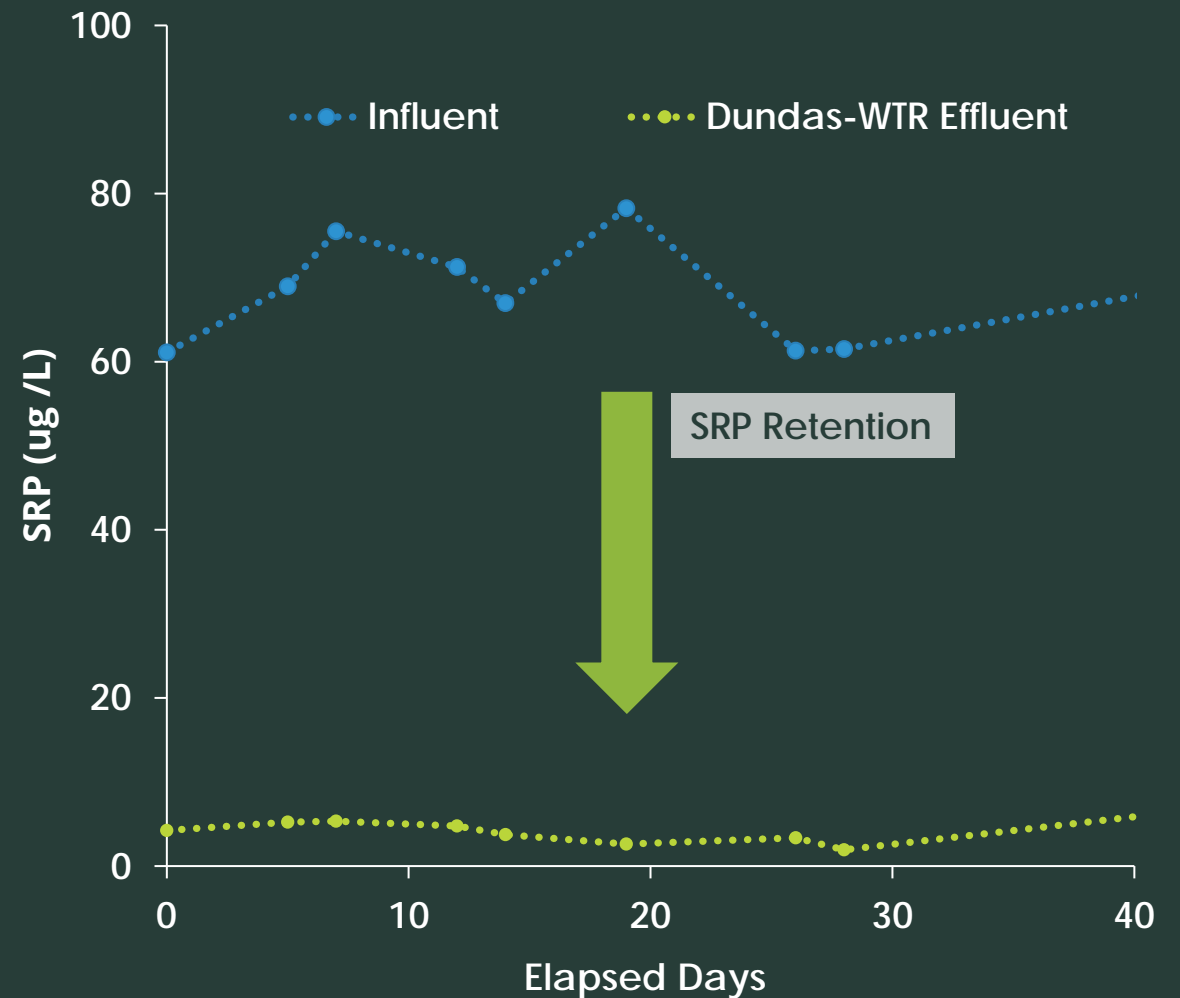
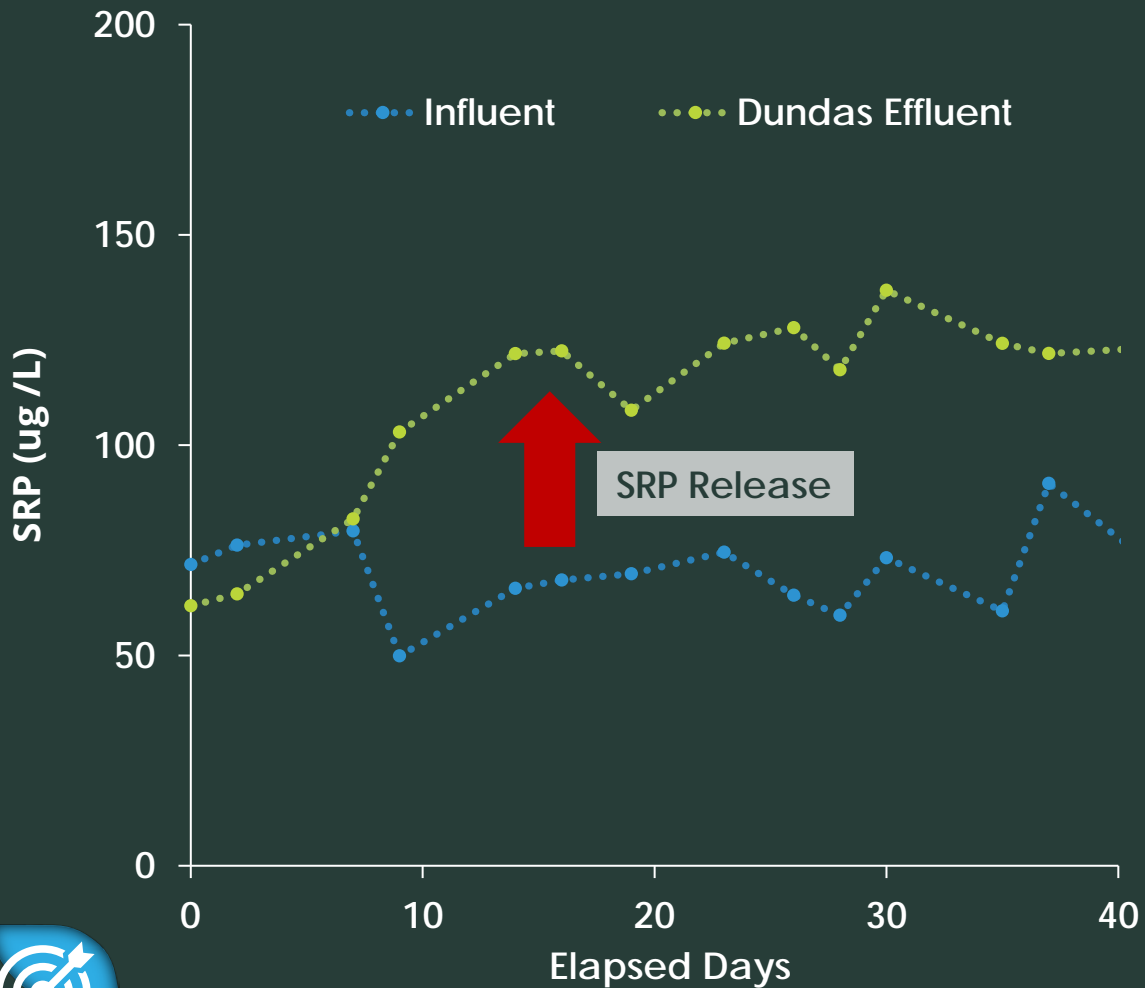
Results: Comparison of Amended and Non-Amended Media

Site: *Dorchester*



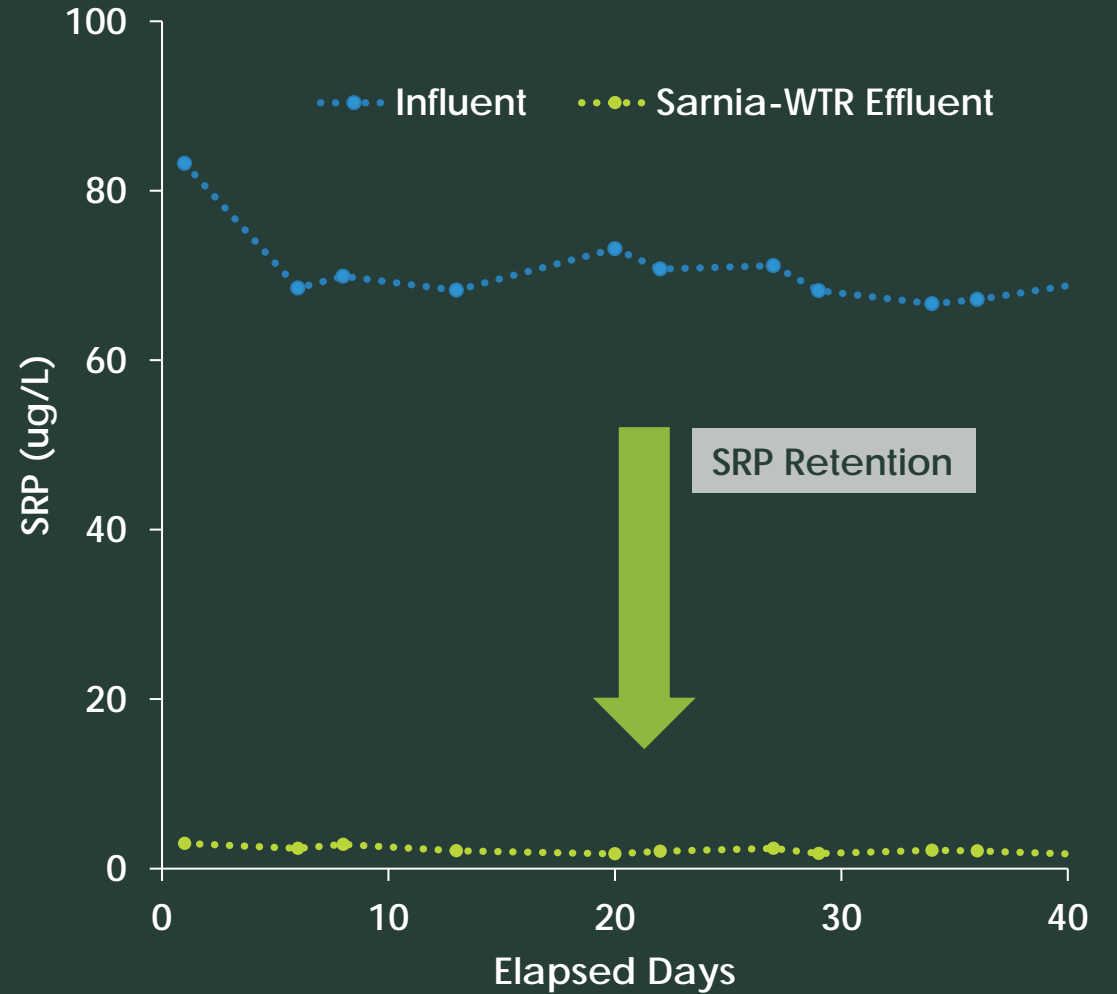
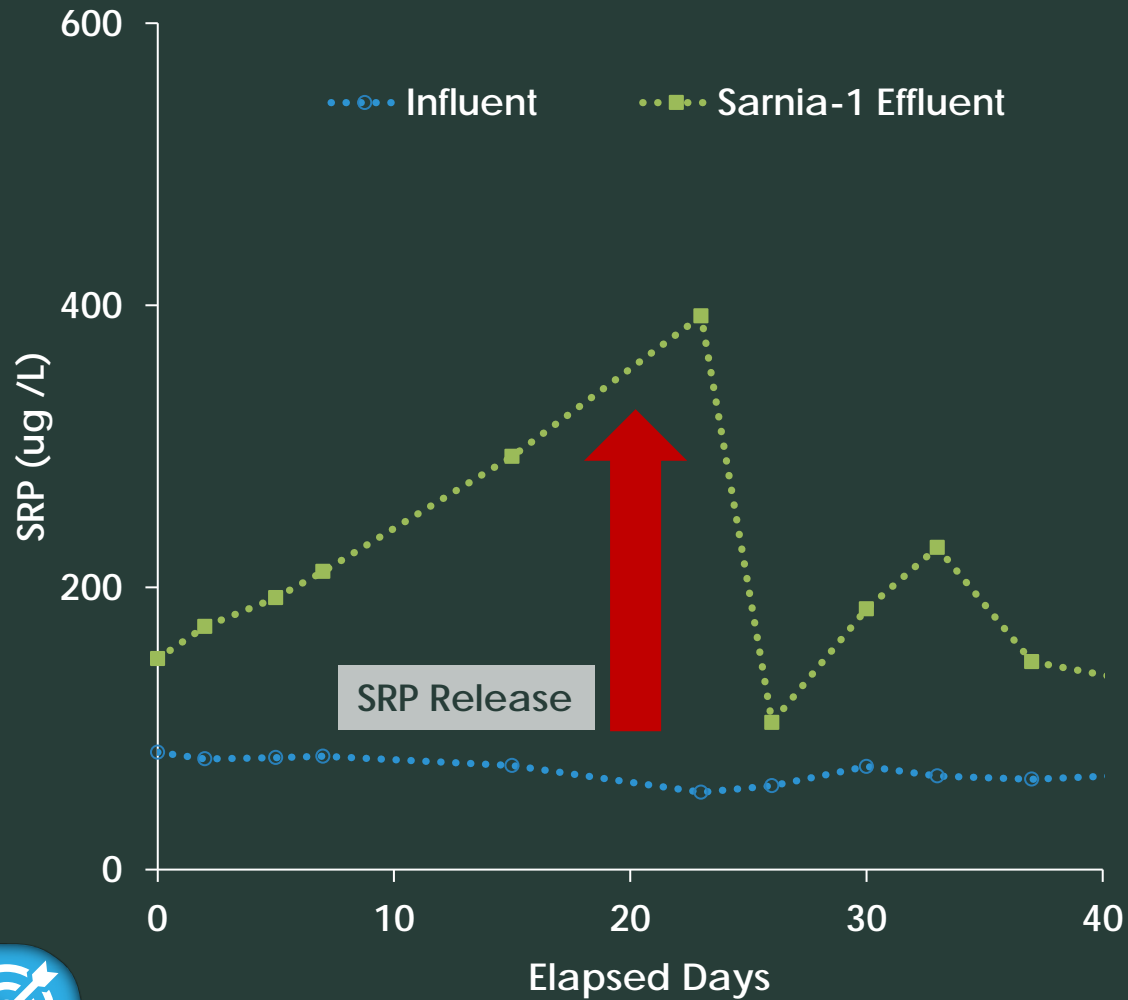
Results: Comparison of Amended and Non-Amended Media

Site: Dundas



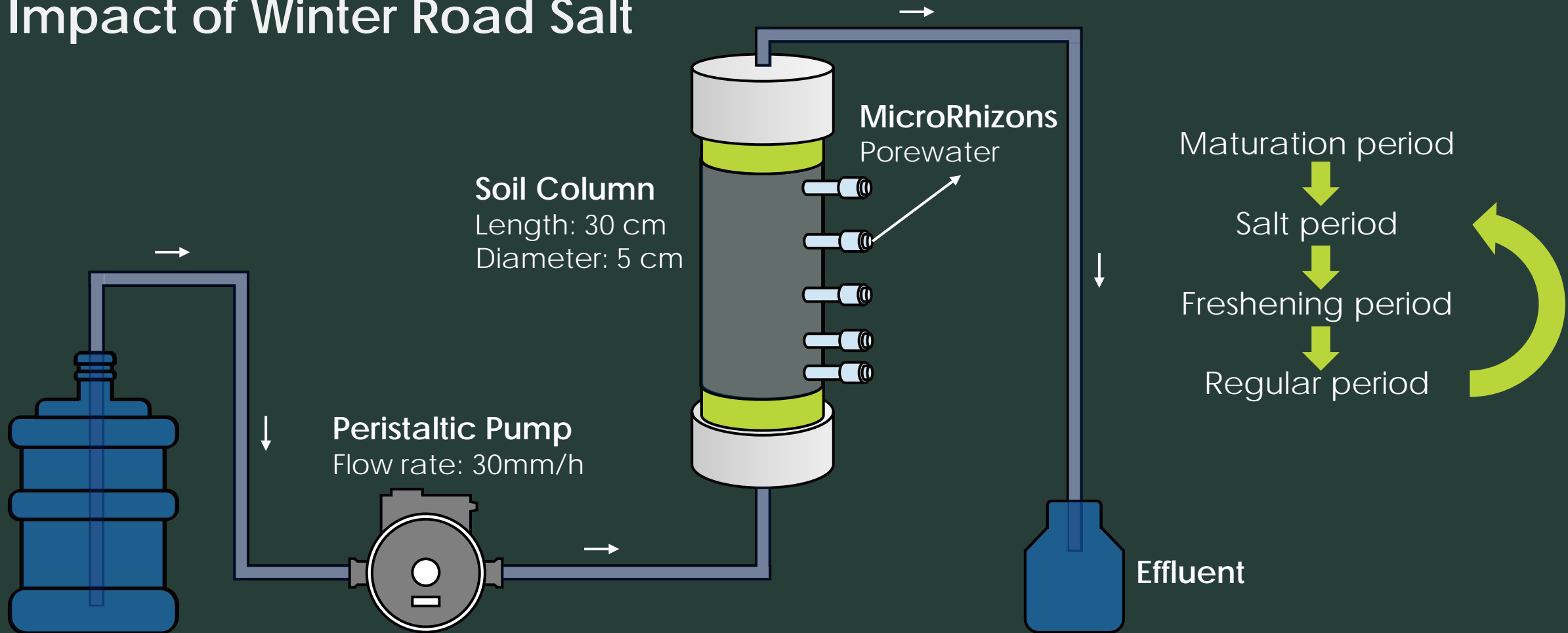
Results: Comparison of Amended and Non-Amended Media

Site: Sarnia



Column Experiments

Impact of Winter Road Salt

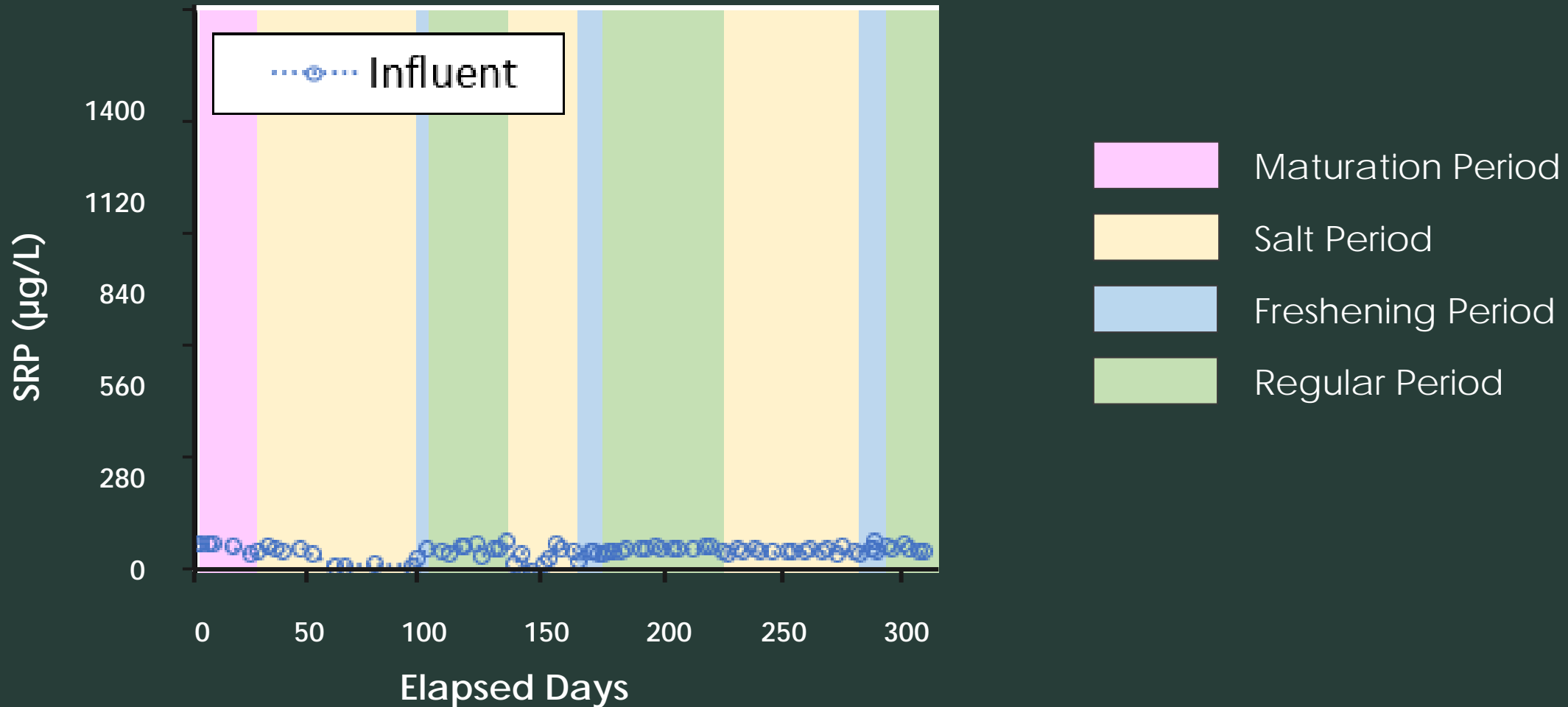


Influent

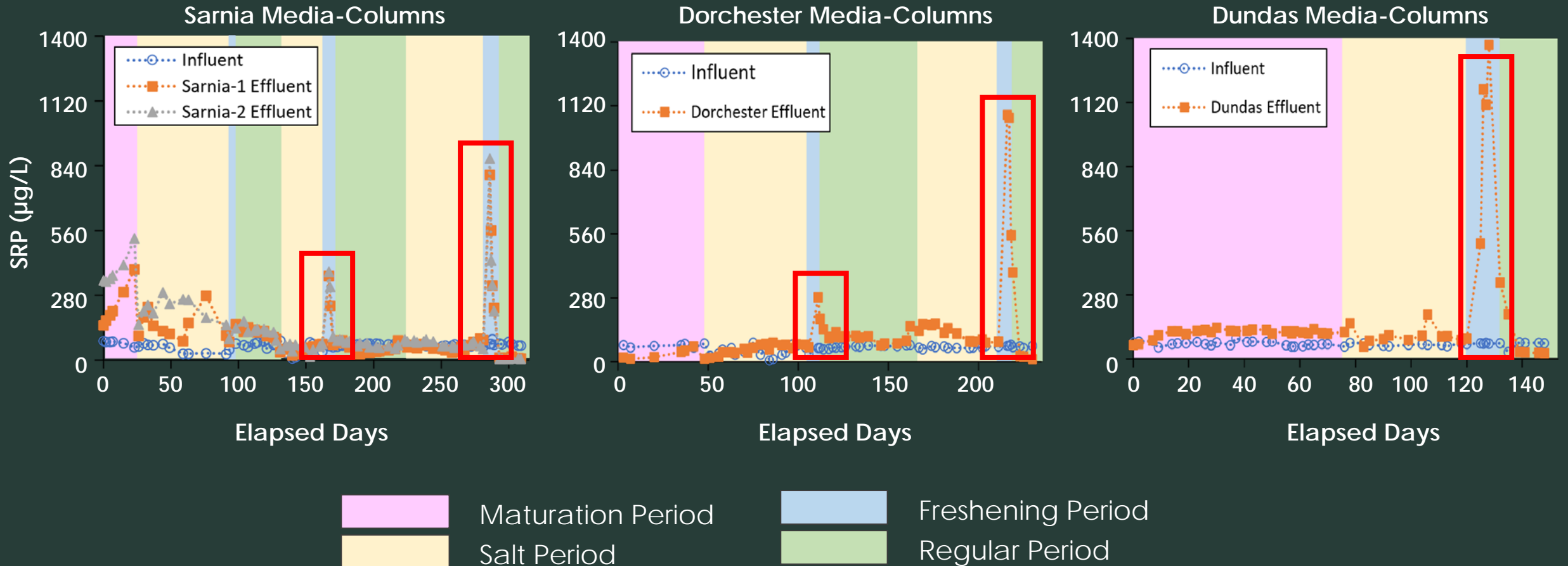
1. Synthetic stormwater
2. Synthetic stormwater + NaCl

Results: Non-Amended Field Bioretention Media

Sarnia Media-Columns



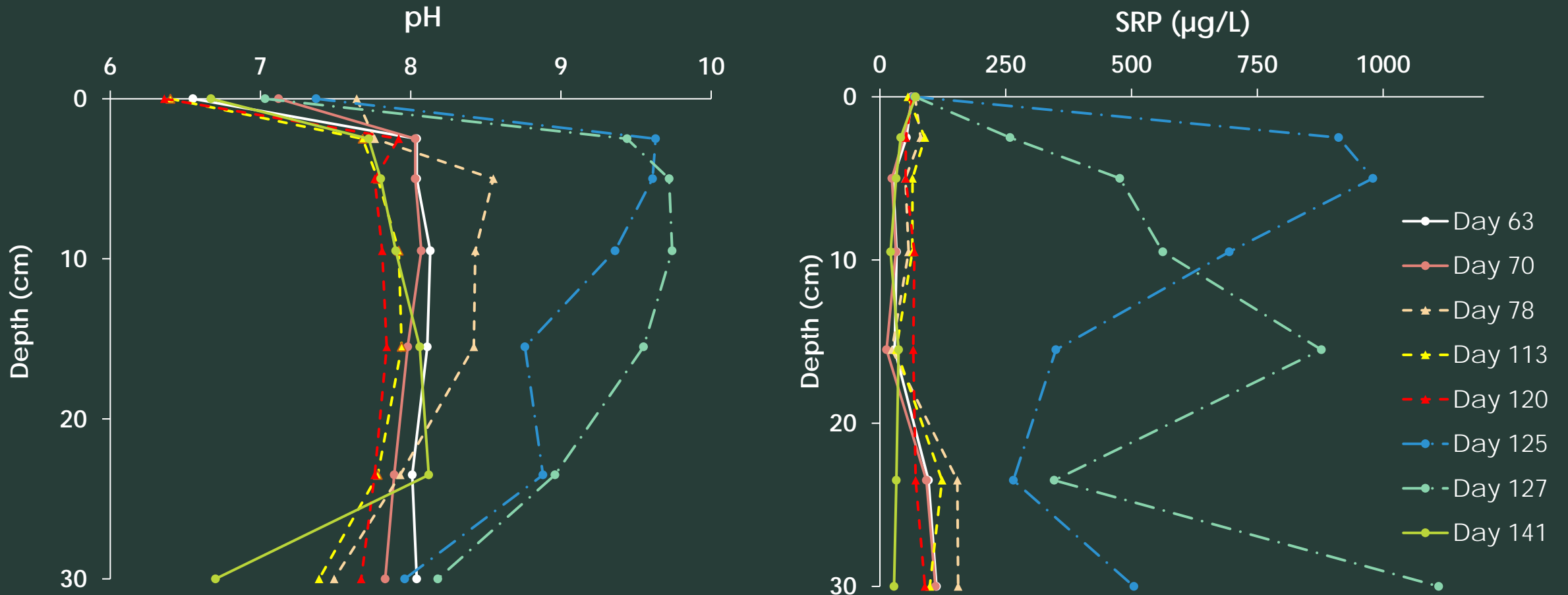
Results: Non-Amended Field Bioretention Media



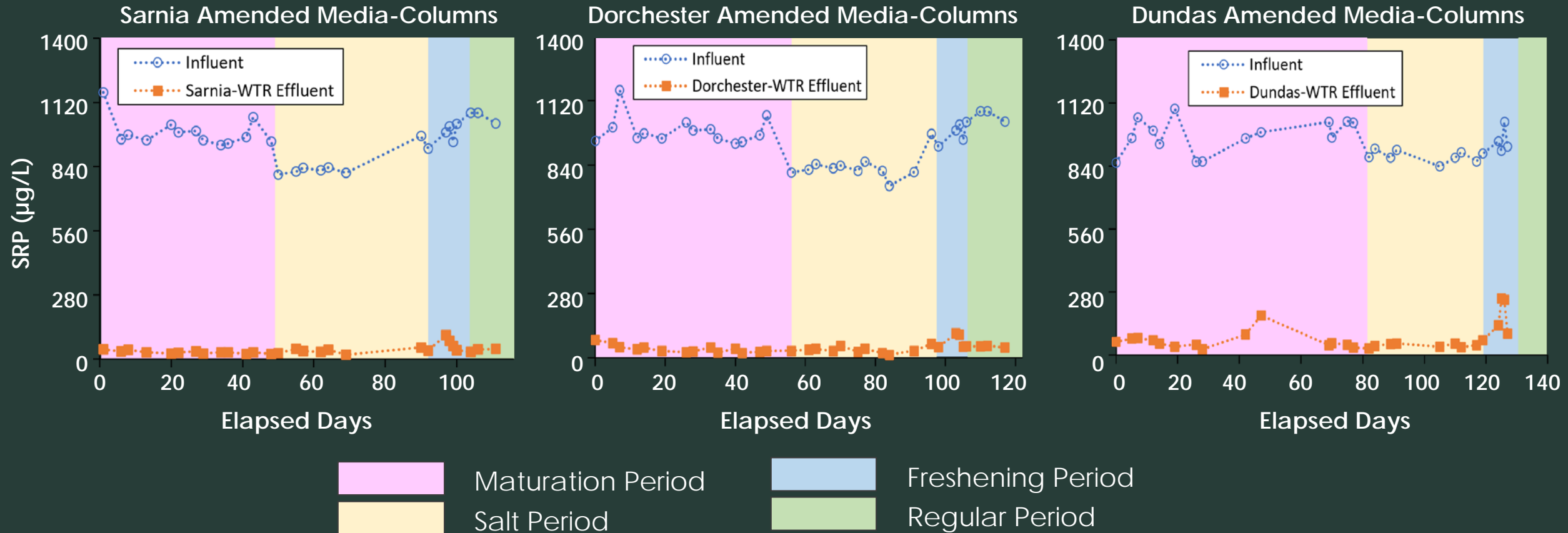
- Large release of SRP during freshening periods for all bioretention media



What Causes High SRP Release During Freshening Periods?



Results: WTR-Amended Bioretention Media



- High SRP retention for WTR-amended bioretention media columns
- Minor increase in SRP effluent concentrations during freshening periods but no net release of SRP

Concluding Remarks

Low permeability media promotes high release of SRP

1



Further oversight required in selection of soil media in field-scale bioretention systems

2



WTR-amended bioretention media greatly improves phosphorus retention

3



Road salt impacts water quality performance of bioretention systems with potential high phosphorus release during spring freshening period

4



Contact Us

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