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## Establishing deep benthic community reference stations in Puget Sound

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# Establishing deep benthic community reference stations



Wendy Eash-Loucks, King County Marine and Sediment Assessment Group



## Project Goal

Establish deep benthic reference stations for each of King County's Region Wastewater Treatment Plant outfalls.

## Introduction

Benthic fauna live in contact with the sediment and because of this association, are a useful indicator of overall environmental and sediment quality. King County routinely monitors benthic infauna near wastewater treatment plant (WWTP) outfalls in Puget Sound's Central Basin (Figure 1), concurrent with sediment chemistry monitoring. While chemical concentrations can provide information about potential impacts to biological communities, the species assemblage and abundances within the benthic community can provide an assessment of actual impacts and overall health of the sediments.

To assess the benthic community data, it is imperative to evaluate them against an appropriate reference station that is not impacted by anthropogenic input. This is necessary, as significant interannual variability of species composition and abundance are expected. In Puget Sound, depth and physical sediment characteristics, such as grain size and to a lesser extent organic carbon content, impact species composition. The State of Washington's Department of Ecology's current list of acceptable reference stations are not a good match for depth and sediment characteristics near the outfall. Therefore, this study is necessary to identify appropriate reference stations for future sampling events.

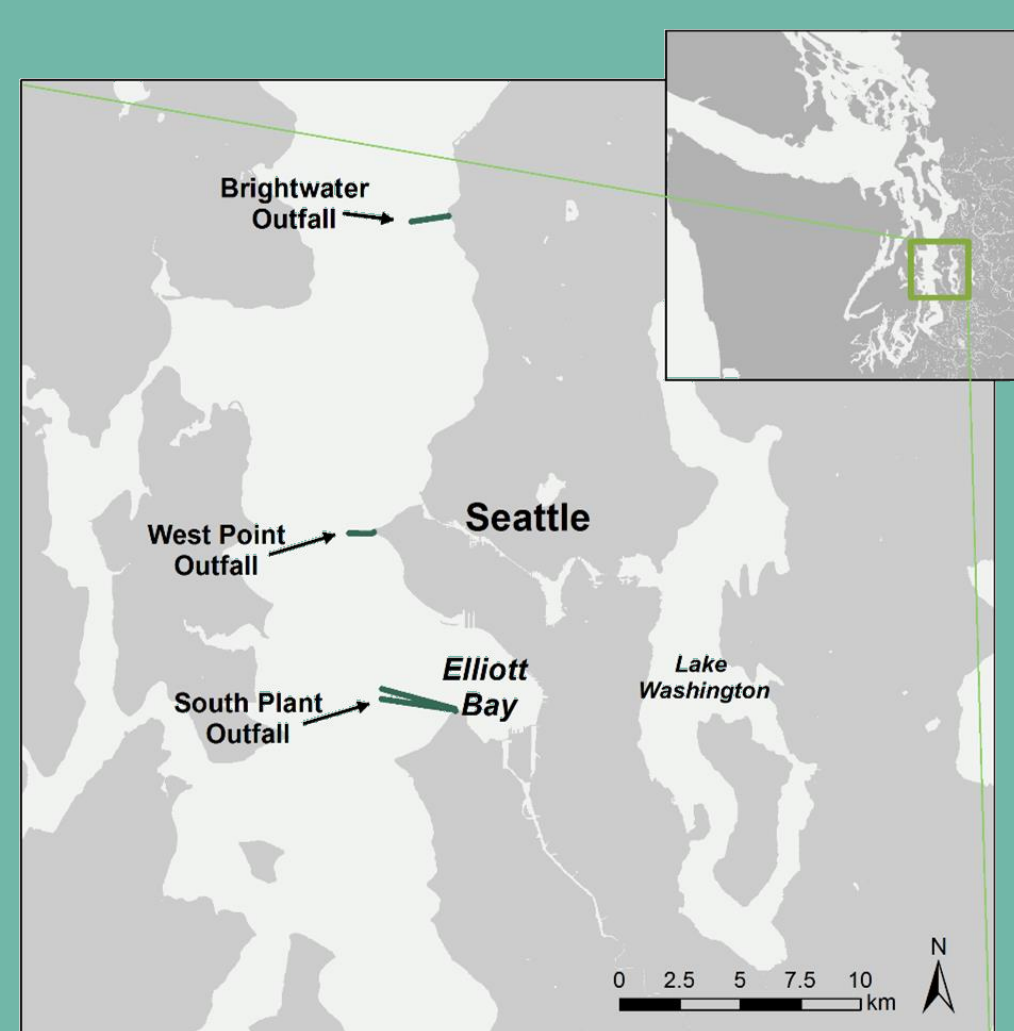


Figure 1. Location of King County's Regional treatment plant outfalls where benthic communities are monitored.

## What Makes a Good Benthic Reference Station?

### Sediment Quality

- Similar depth
- Similar percent fines
- Similar total organic carbon
- No apparent chemical toxicity

### Benthic Community

- Contains chemically sensitive species
- Absence of species indicative of disturbed conditions



Figure 2. King County sampling of benthic infauna and epifauna.

## Sample Collection

- Sediment chemistry and benthic taxonomy samples were collected in October 2017 via a tandem vanVeen 0.1 m<sup>2</sup> grab sampler (Figure 2)
- Analyzed for:
  - Physical and chemical parameters**
    - 1 composite sample per station
    - Top 10 cm (biologically active zone)
    - Particle size distribution (PSD)
    - Total organic carbon (TOC)
    - Other conventionals (ammonia, sulfides, solids, etc.)
    - Metals, PAHs, PCBs, phthalates, other base/neutral/acid SMS compounds
  - Benthic fauna (infauna and epifauna)**
    - 3 replicates per station
    - Full grab sample
    - Taxa identified and enumerated
    - Biomass of major taxonomic groups
- Benthos samples were sieved with a 1 mm sieve on deck and preserved with buffered formalin for identification
- All benthic taxonomy work was conducted by EcoAnalysts, with individuals being identified to the lowest practical taxonomic unit (usually to species)

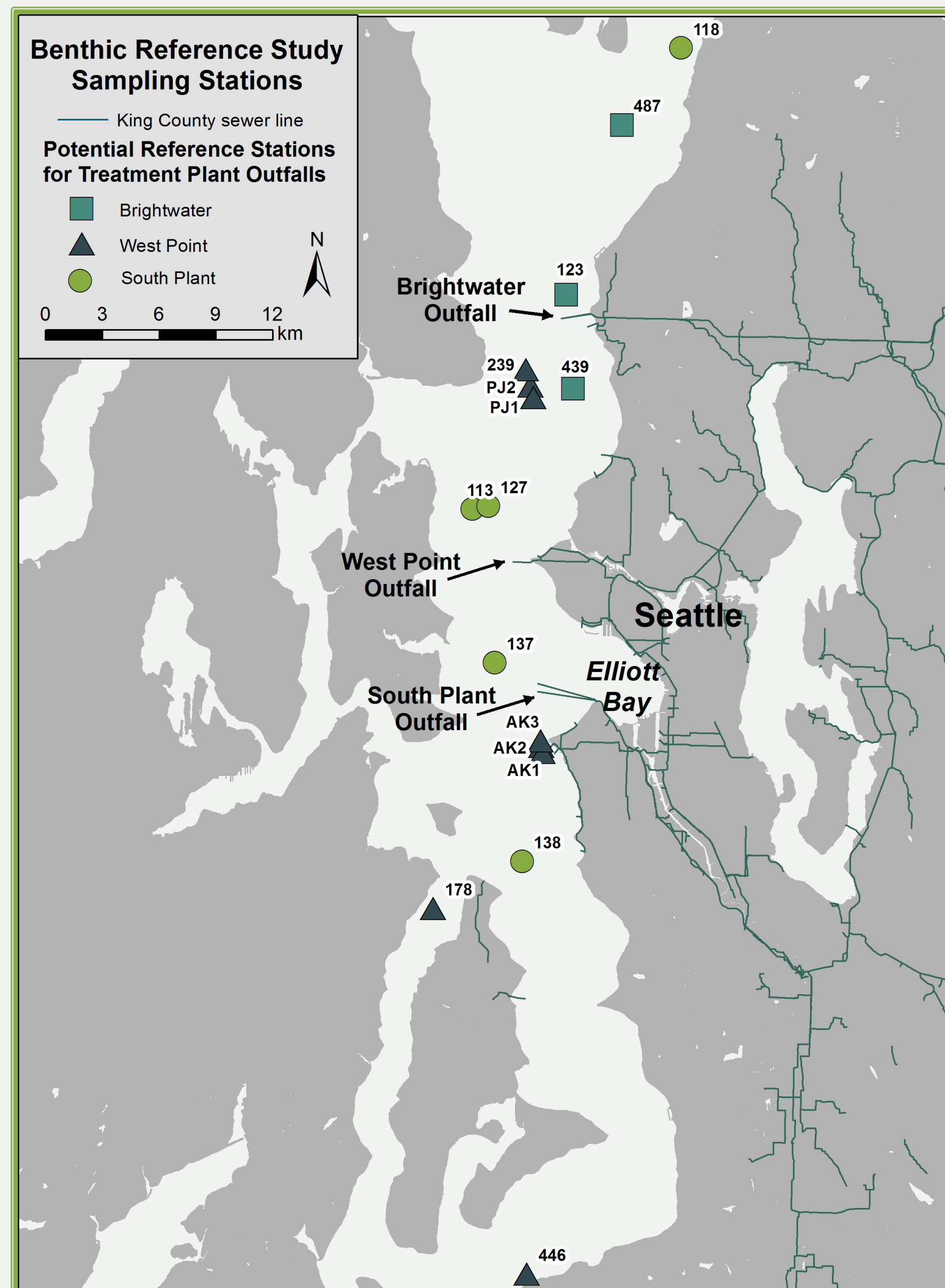


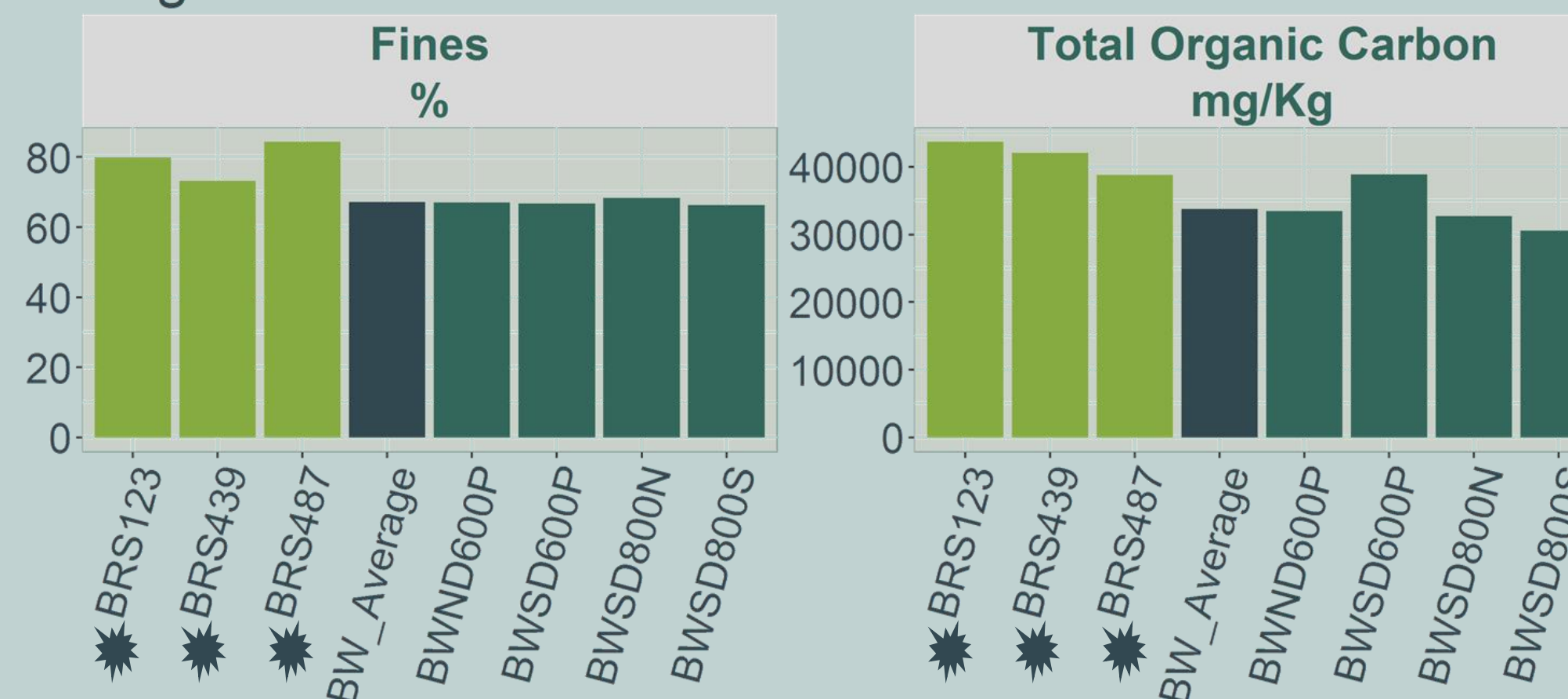
Figure 3. Targeted potential benthic reference stations.

## Preliminary Results

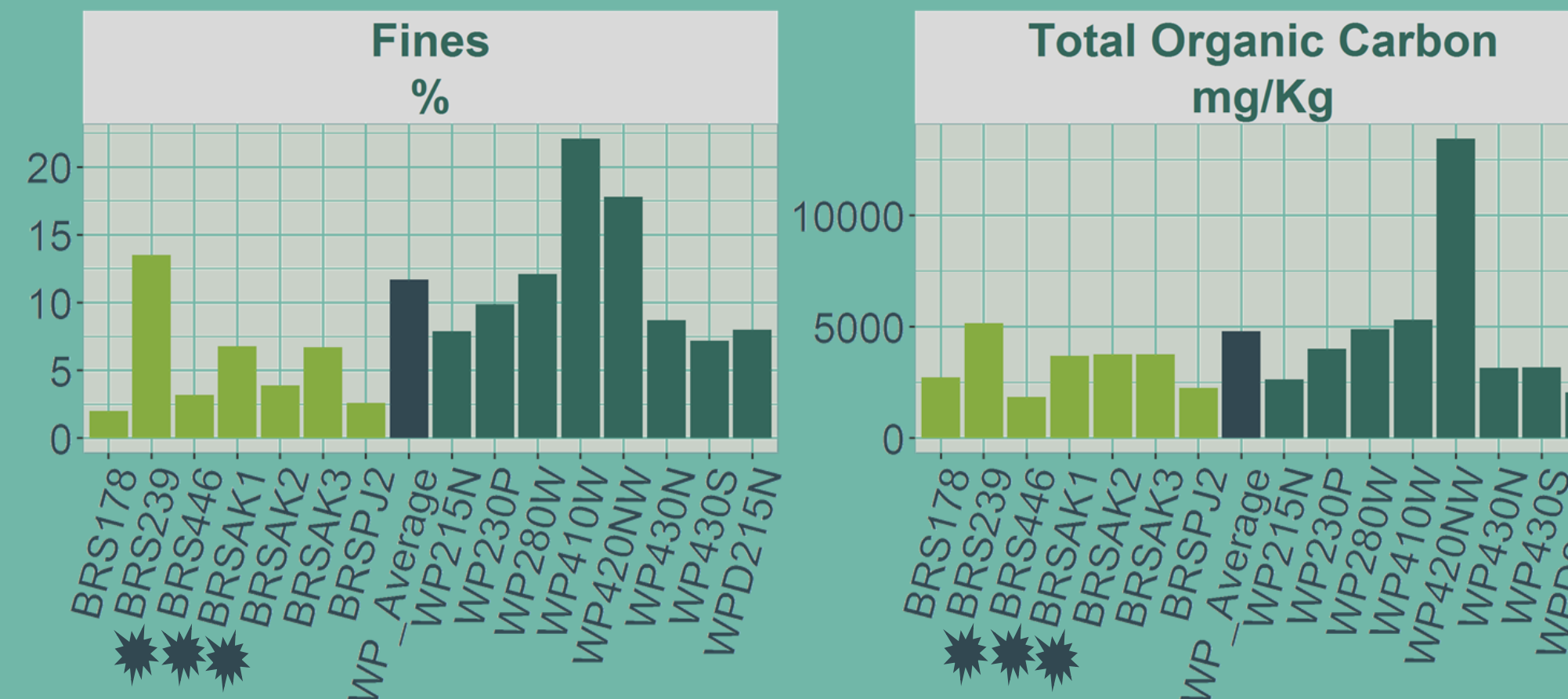
- All but one (15 of 16) stations were sampled (Figure 3)
- All samples had concentrations below applicable Washington State Sediment Management Standards
- The three best potential reference stations for each outfall (9 total samples) were selected for benthic taxonomy analysis based on:
  - Low concentration of chemicals in relation to standards (those near criteria, even though not exceeding, were eliminated)
  - Similarity of conventionals to near-outfall samples collected the same year (Figure 4). Importance of characteristics were as ordered:
    - % Fines
    - Overall PSD
    - Depth
    - Total Organic Carbon
    - Low Ammonia and Total Sulfides



## Brightwater



## West Point



## South Plant

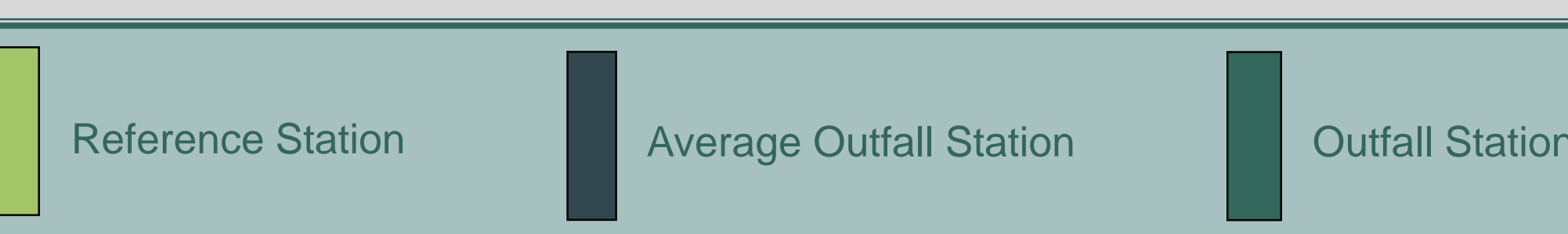
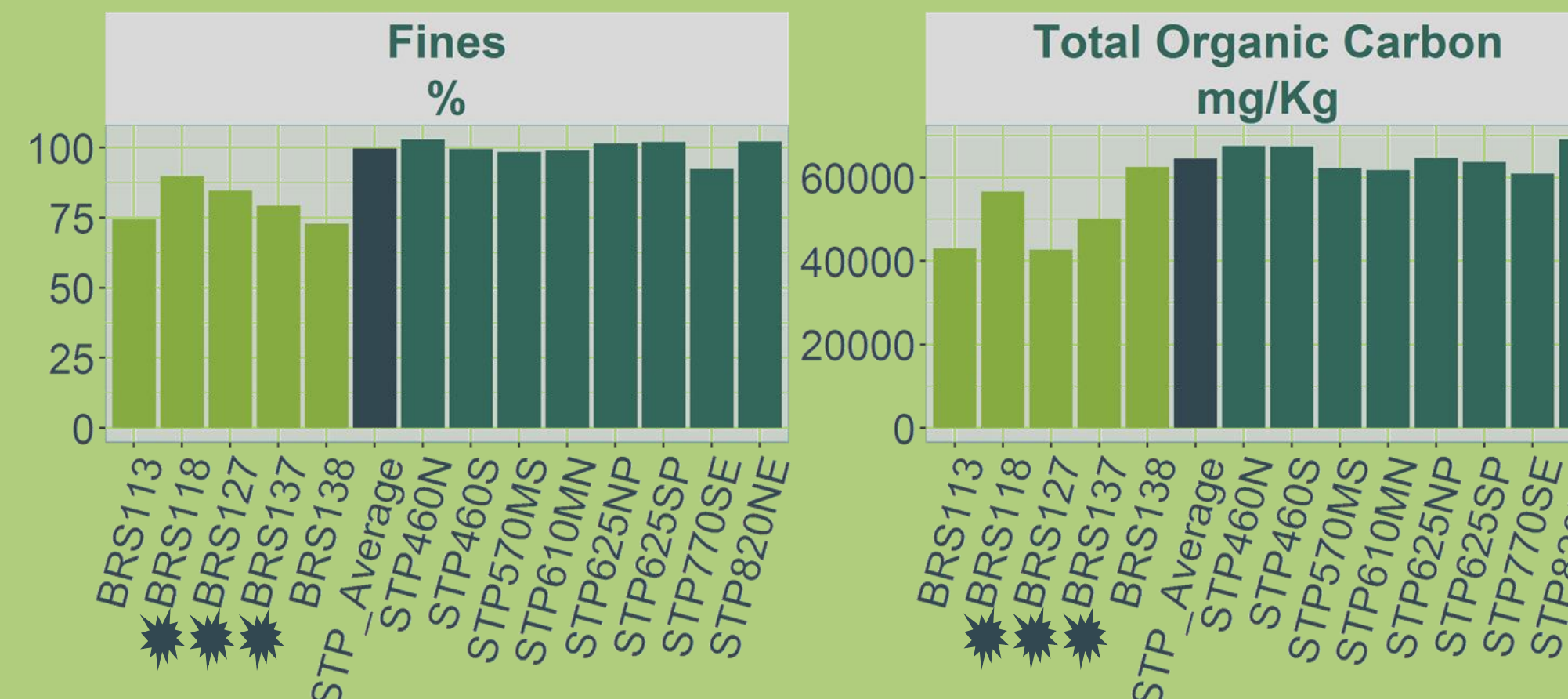


Figure 4. Percent fines and total organic carbon at potential reference stations and outfall monitoring stations. \* = Selected for benthic taxonomy analysis.

## Next Steps

- Analyze benthic taxonomy samples
- Analyze biomass data to be analyzed
- Analyze benthic community samples analyzed for:
  - Indexes: abundance, richness, diversity, evenness, etc.
  - Presence of sensitive/tolerant species
- Evaluate conventionals, chemistry, and benthic community data to determine best-fit reference station for each outfall



## Summary

- Physical sediment properties and the composition of the benthic community are key in determining an appropriate reference station
- Reference stations could be used by others in the region for comparison to other deep, potentially disturbed sites with similar physical characteristics

## Acknowledgements

King County Environmental Laboratory for collecting sediment samples and analyzing conventional and chemical parameters  
 Jeff Stern & Jeff Lafer – King County Wastewater Treatment Division for assistance with project development  
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