BMP Performance Assessment Based on California State-Wide Monitoring Data

Commission Meeting

06 March 2020

The Issue

- Stormwater dischargers are choosing Alternative Compliance Pathways
  - Using watershed models for Reasonable Assurance Analysis (RAA)
- Some RAA assess model accuracy for current conditions
  - Rarely assess accuracy of future predictions
- Assessing accuracy of future model predictions complicated by uncertainty in BMP effectiveness

Goal of This Project

- Currently, most BMP performance information comes from the International BMP Data Base
  - A small fraction from California, most ≥15 years old
- Our goal was to compile as much data as possible on California specific BMP performance
  - Include most recent information
- Quantify BMP performance
  - Calculate uncertainty

Focus on Flow-Thru BMPs and Common Pollutants

- Media filters
- Dry pond
- Wet pond
- Constructed wetland
- Vegetated swale
- Bioretention with underdrain
- Permeable pavement

- Flow
- Bacteria
  - *E.coli*
  - *Enterococcus*
- Trace metals
  - Copper (total and dissolved)
  - Lead (total and dissolved)
  - Zinc (total and dissolved)
  - Mercury (total)
- Nutrients
  - Nitrate
  - Phosphorus
- PCBs

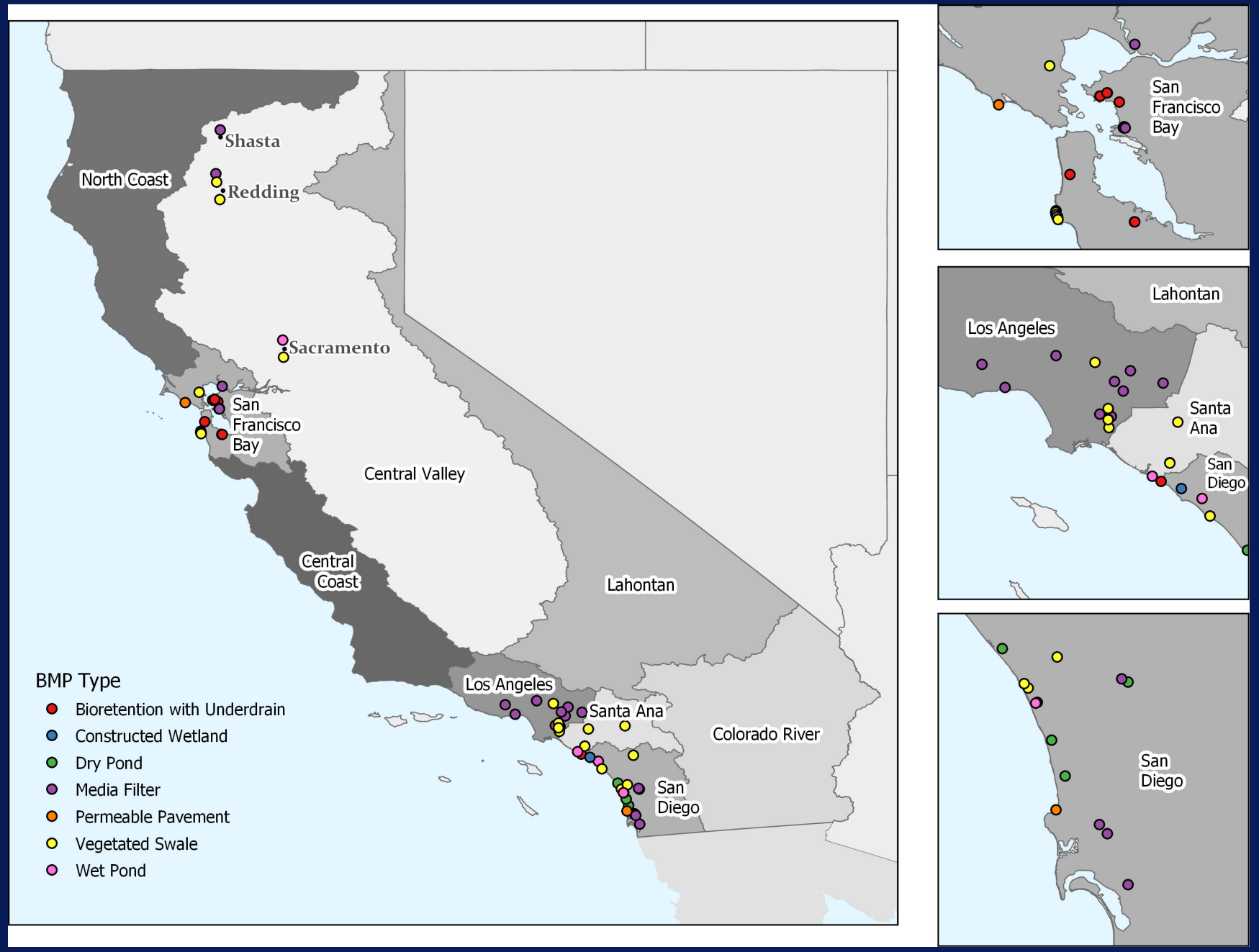
Queried 45 Different Data Generators

- Municipalities
- Consultants
- Non-profits
- Caltrans
- Stormwater Associations
- Sewer Districts
- Water Agencies

Inventory of BMP Data from Across California

Type of BMP	Number of BMPs		Number of Storm Events
	Background Info	Water Quality Data	
Vegetated Swale	45	27	380
Media Filter	65	28	366
Dry Pond	7	6	99
Wet Pond	48	5	125
Constructed Wetland	5	2	657
Permeable Pavement	22	2	2
Bioretention System w/ Underdrain	23	13	71
Total	**214**	**81**	**1,700**

BMPs With Available Water Quality Data



Summary of Inventory

- Double the number of BMPs and storm events in the International BMP Database
- Half the data is now < 10 years old
- 4 out of 7 BMPs with sufficient data
- 8 out of 14 pollutants with sufficient data

Estimating BMP Performance

- There is no standard way to quantify performance
  - All currently used methods have limitations
- We evaluated a new approach
  - Quantile Regression
- Estimates probability of success

Turning Data Into Information: The Web App

- Select your BMP type
- Pick your pollutant
- Input your influent concentration
- Output is the predicted effluent concentration
  - Your probability of achieving this concentration

Go to:
https://sccwrp.shinyapps.io/bmp_eval/

California BMP effectiveness calculator (v1.2.0)

Overview | Analyses | Raw data

Select bmp:

media filter

Select influent concentration (for es

0.2 13

0.2 20 40 60 80

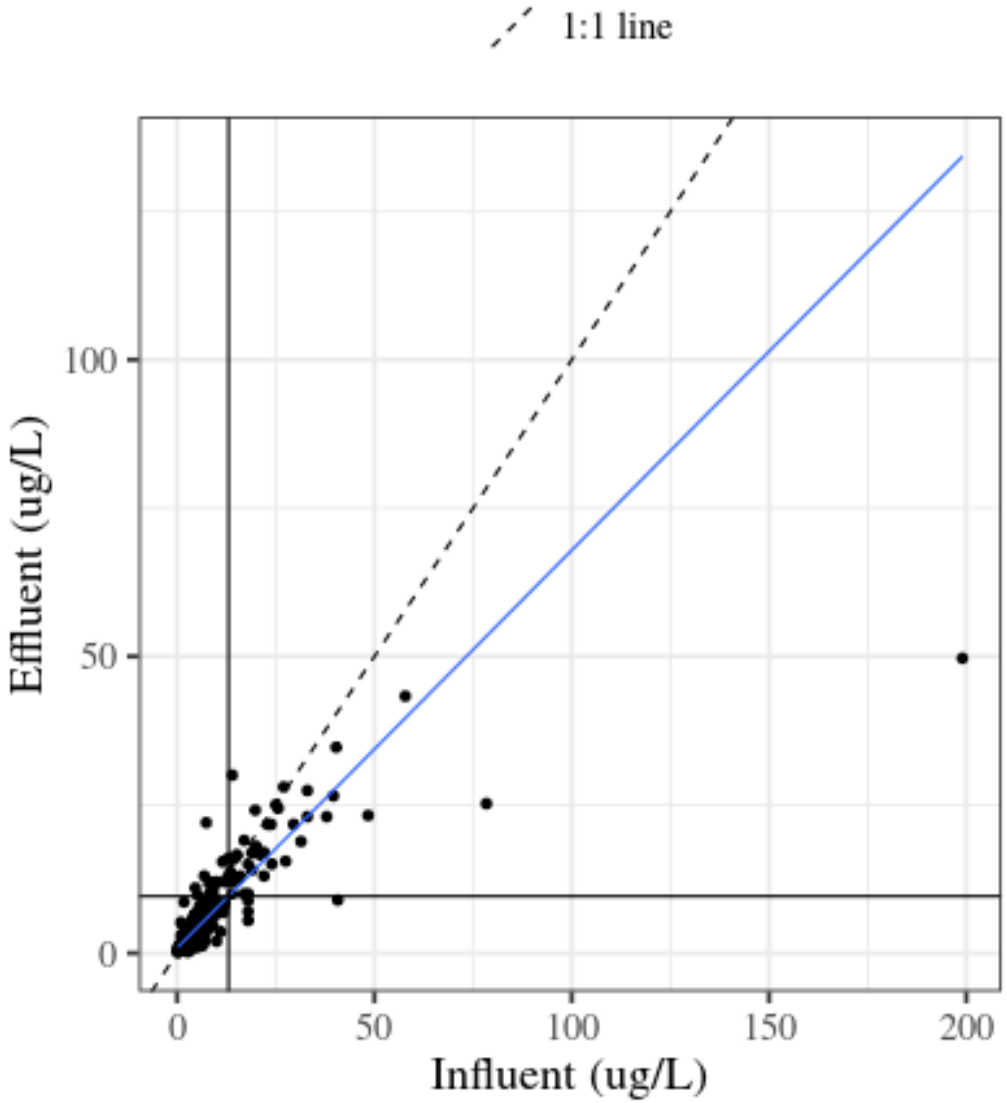
Quantile regression | Linear regression

This tab shows results for the selected BMP/a
Estimated effluent concentration (95% con
fitted quantile regression model and the pred
r-squared value for the selected quantile and
for the selected BMP/analyte pair. The left plo
for the selected influent concentration. The ri
(including the 50th percentile). Both plots pro
value.

Select quantile:

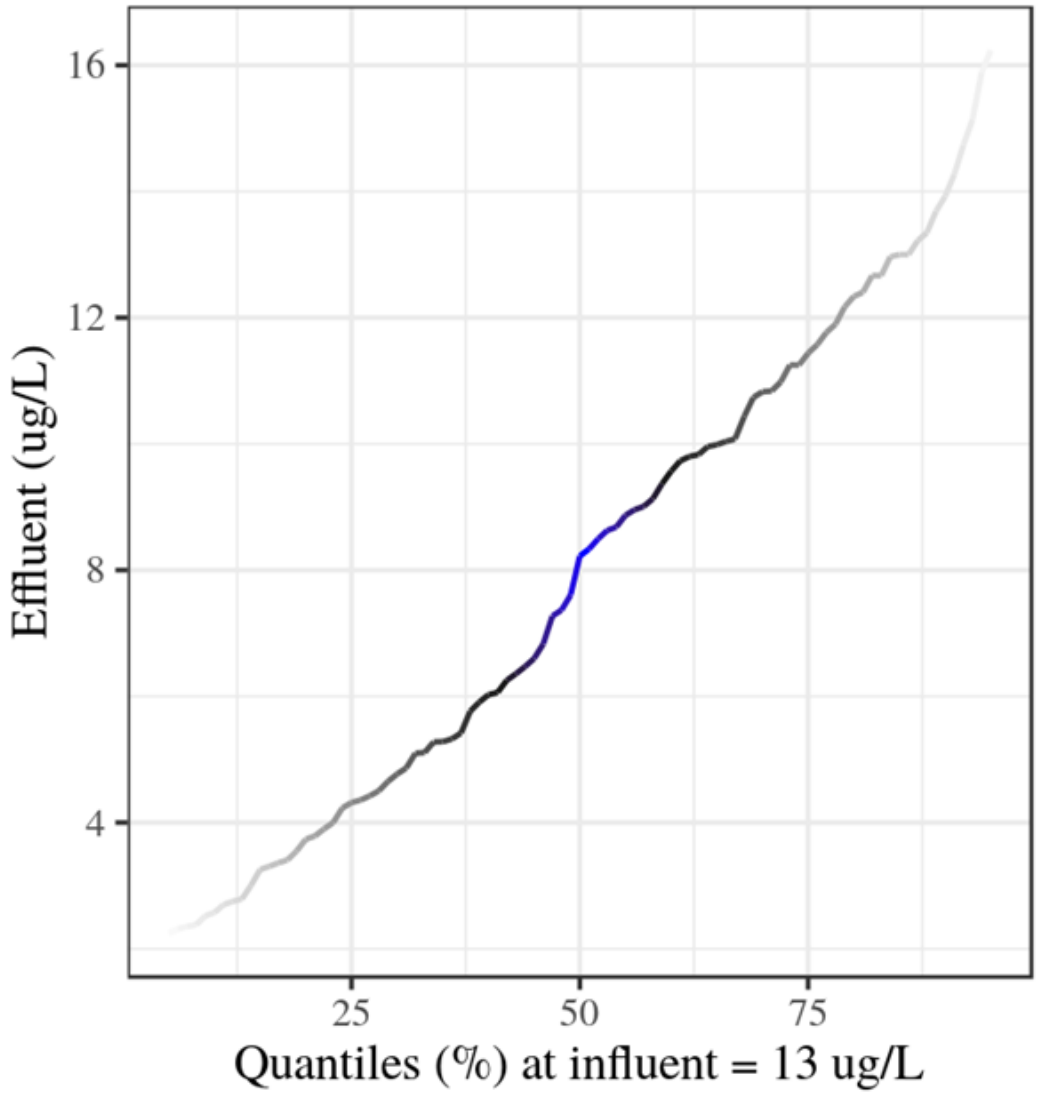
0.5

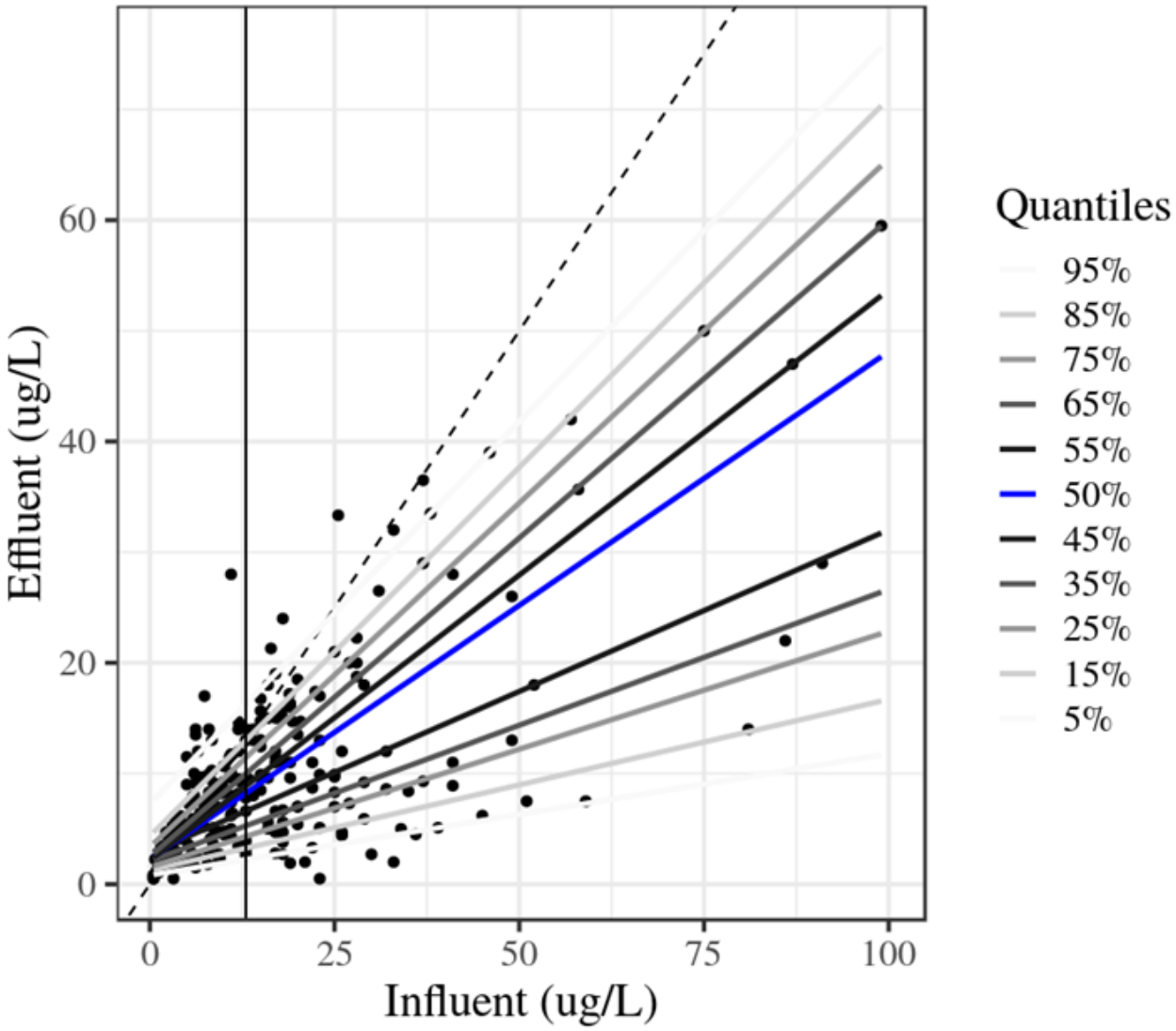
Estimated effluent:9.6 (8.2, 11) ug/L



California Vegetated Swale Performance

Dissolved Copper, N=258

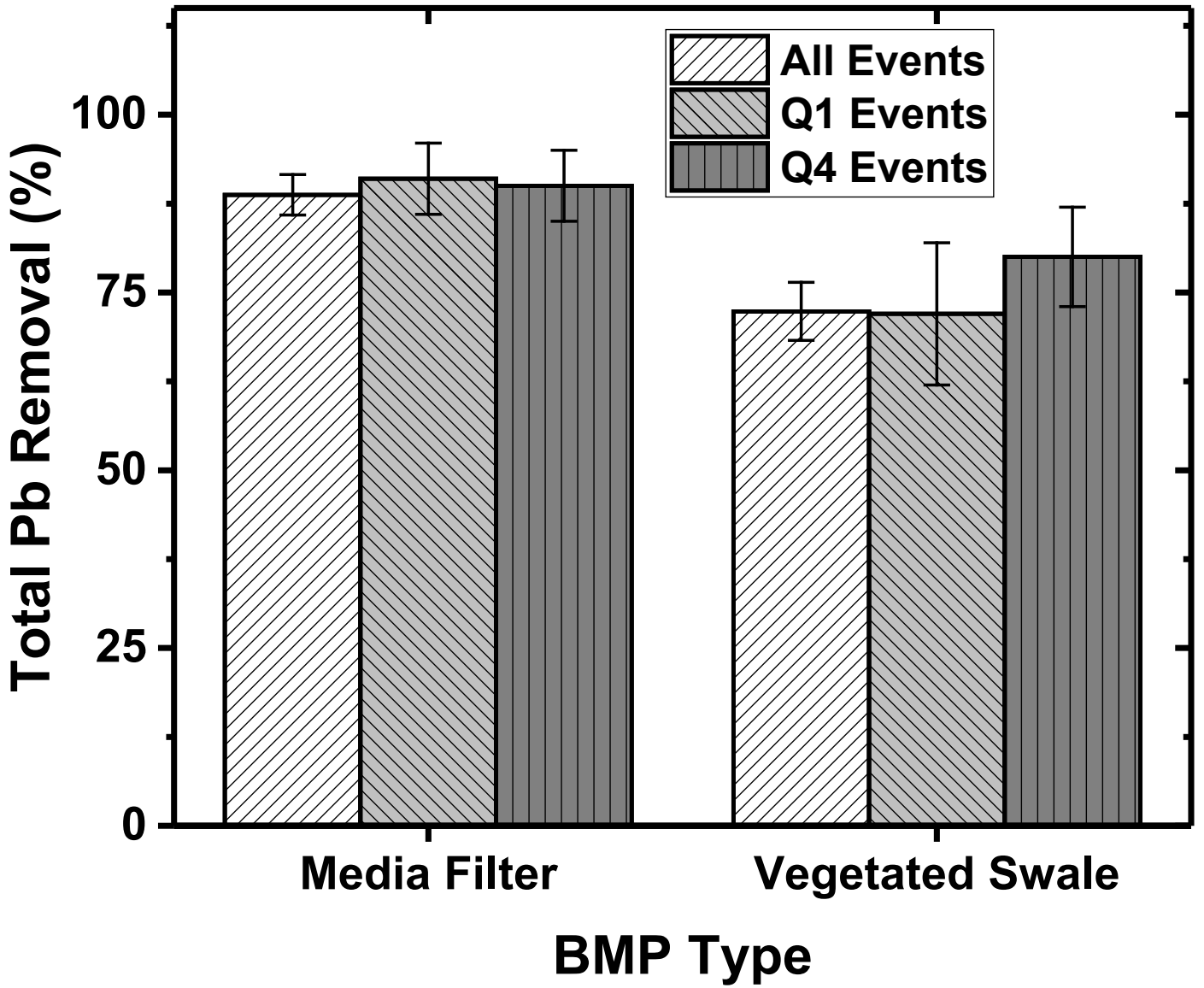




Exploring the Performance Data

- Differences due to rainfall?
- Differences due to geography?
- Differences due to maintenance?

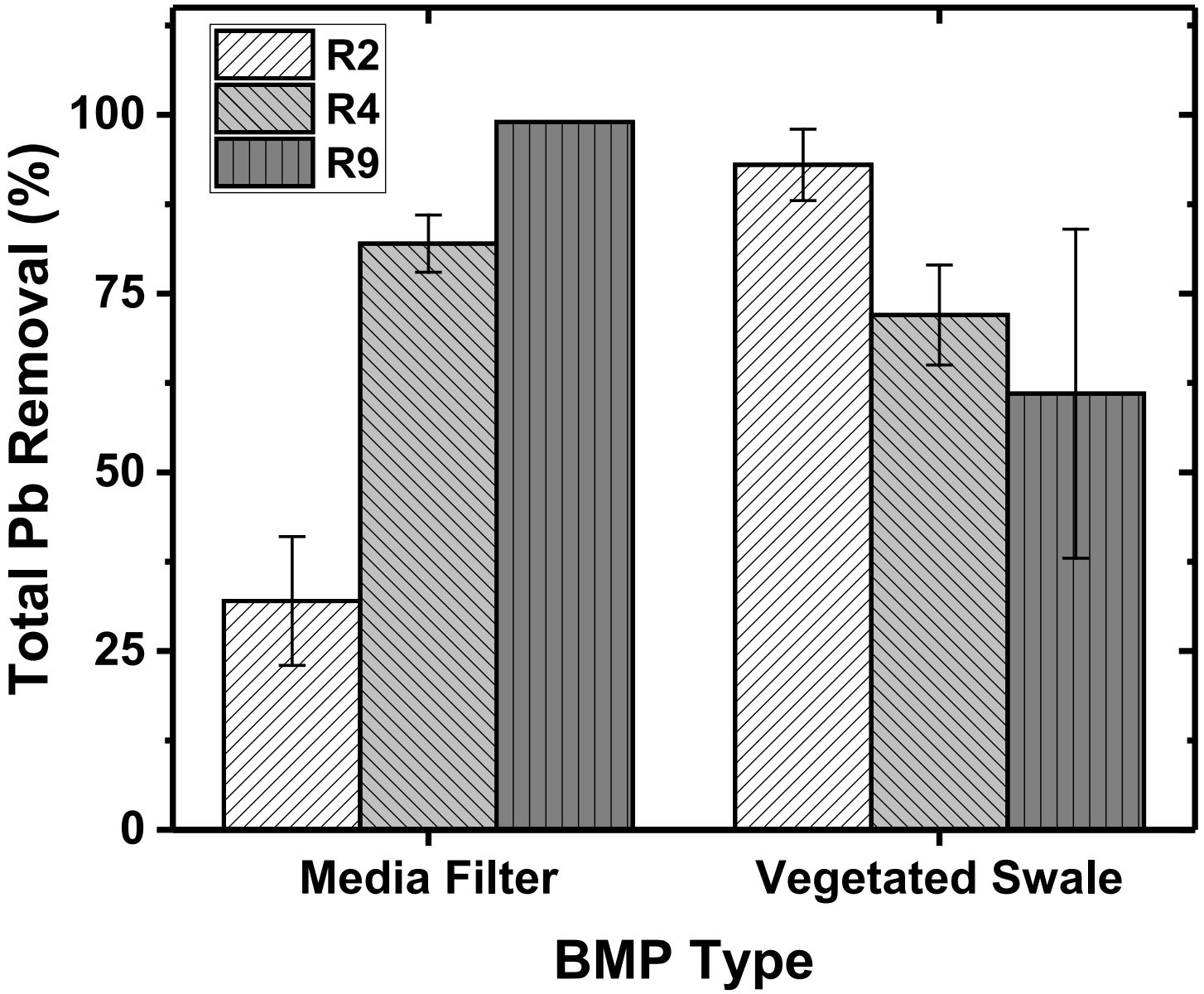
BMP Performance Among Differing Storm Sizes



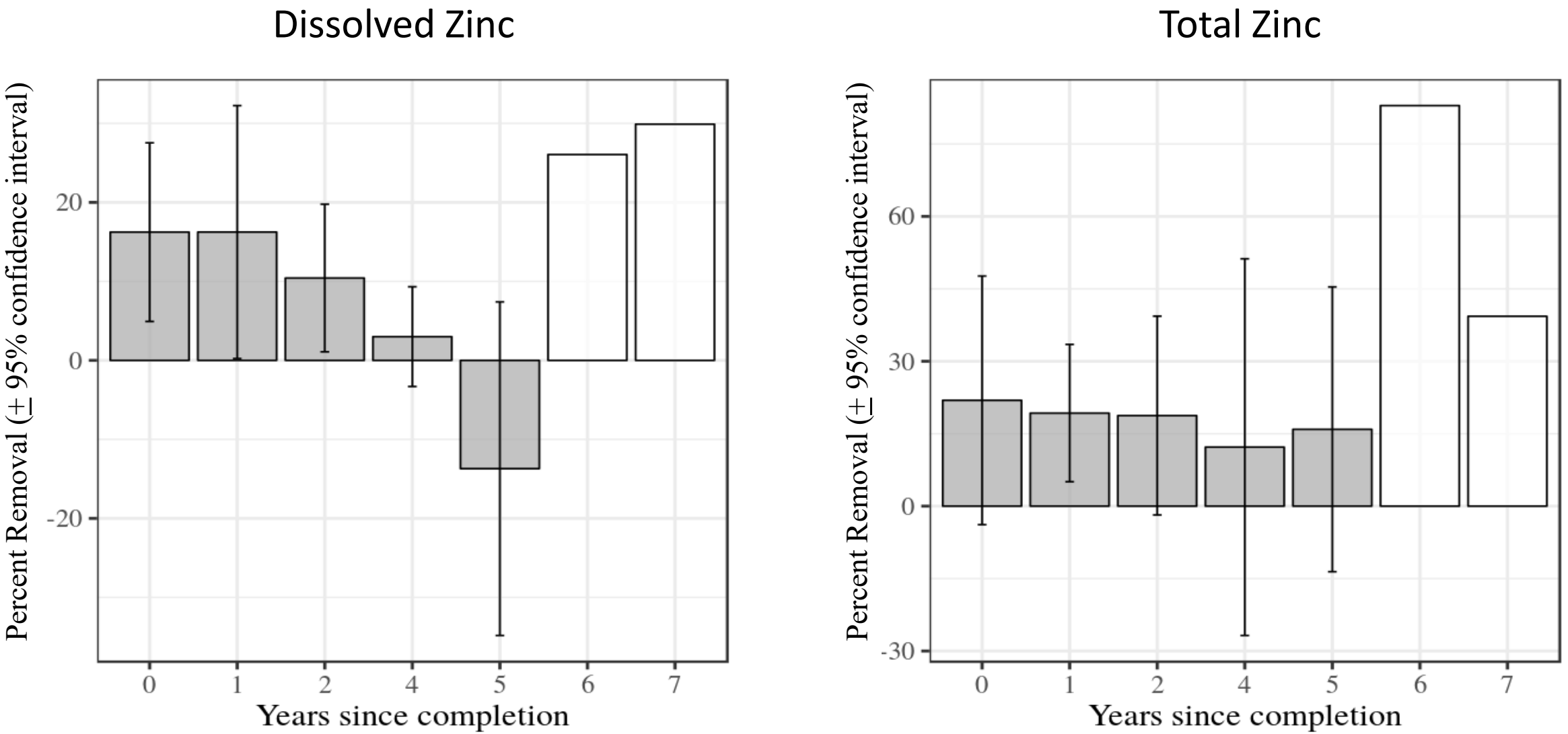
Quartile 1 = smallest storms

Quartile 4 = largest storms

BMP Performance Among Regional Boards



Estimating Average BMP Effectiveness Over Time – Media Filters



How Can This Project Improve Your Life?

- Upgrades the International BMP Database
  - Doubles the number of California flow-thru BMPs and site events
- You can use the web app for estimating BMP effluent concentrations based on your influent concentrations
- You can use the uncertainty estimates for assessing probability of success
  - Sensitivity boundaries for Reasonable Assurance Analysis (RAA)