



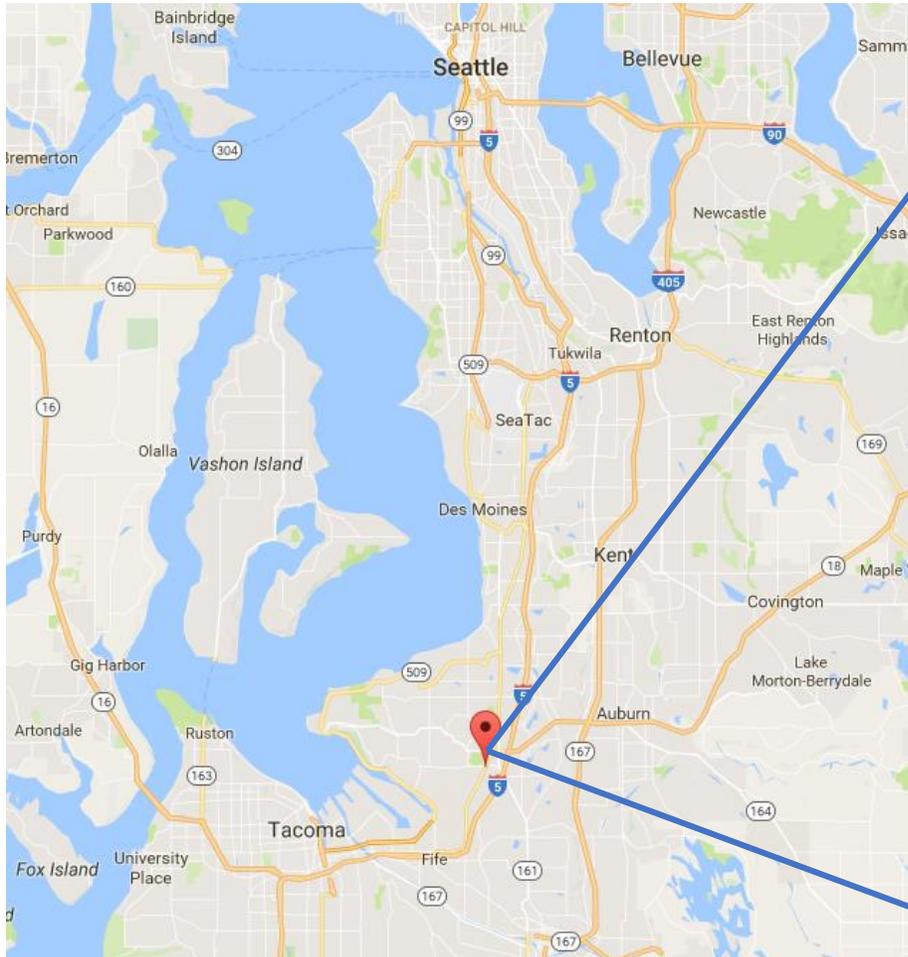
Federal Way S. 356th Street Project: Effectiveness of Retrofit and Expansion

Kate Macneale, King County Water and Land Resources
with

Fei Tang and Theresa Thurlow, City of Federal Way
King County Environmental Laboratory

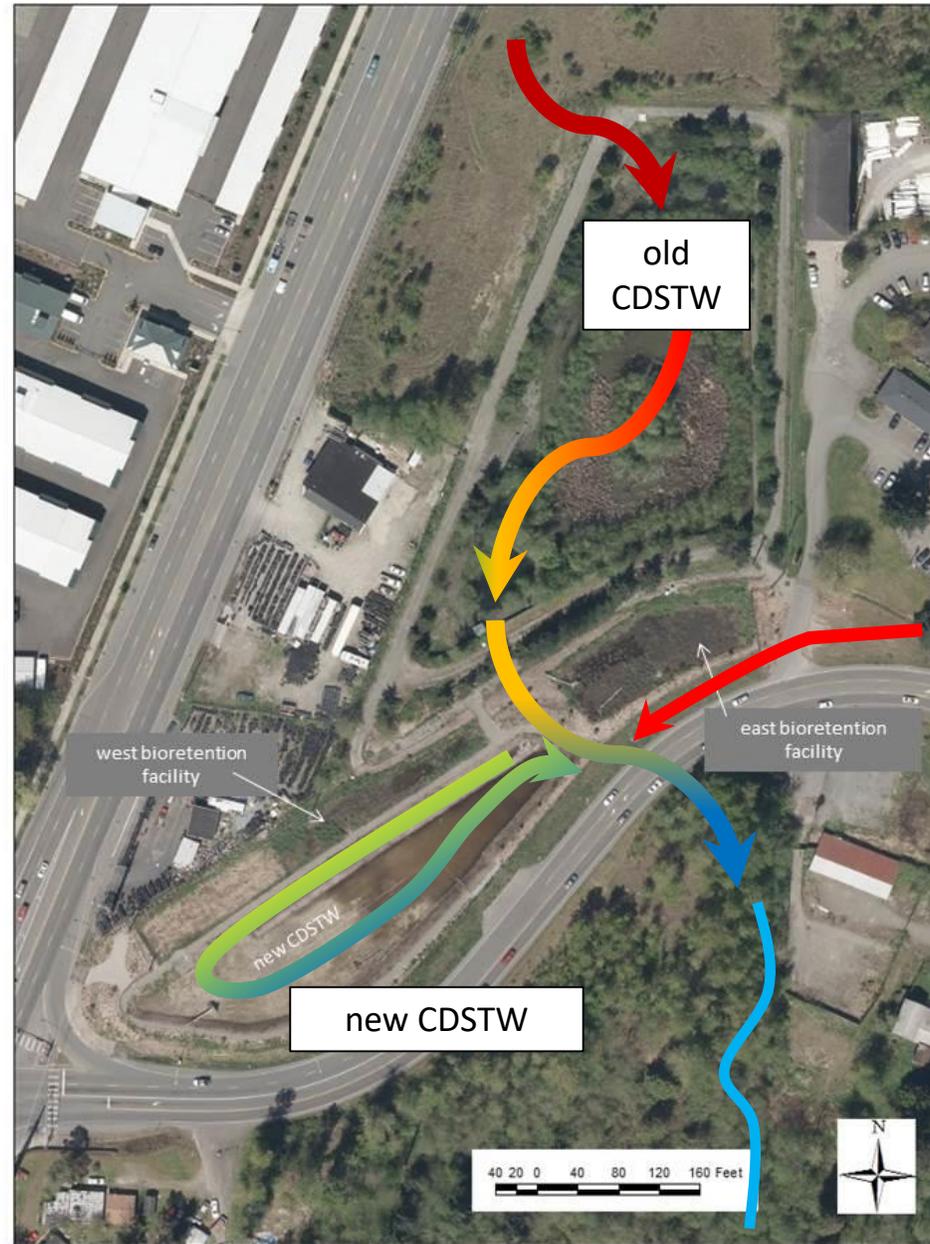


Did retrofit and expansion improve flow control and treatment?



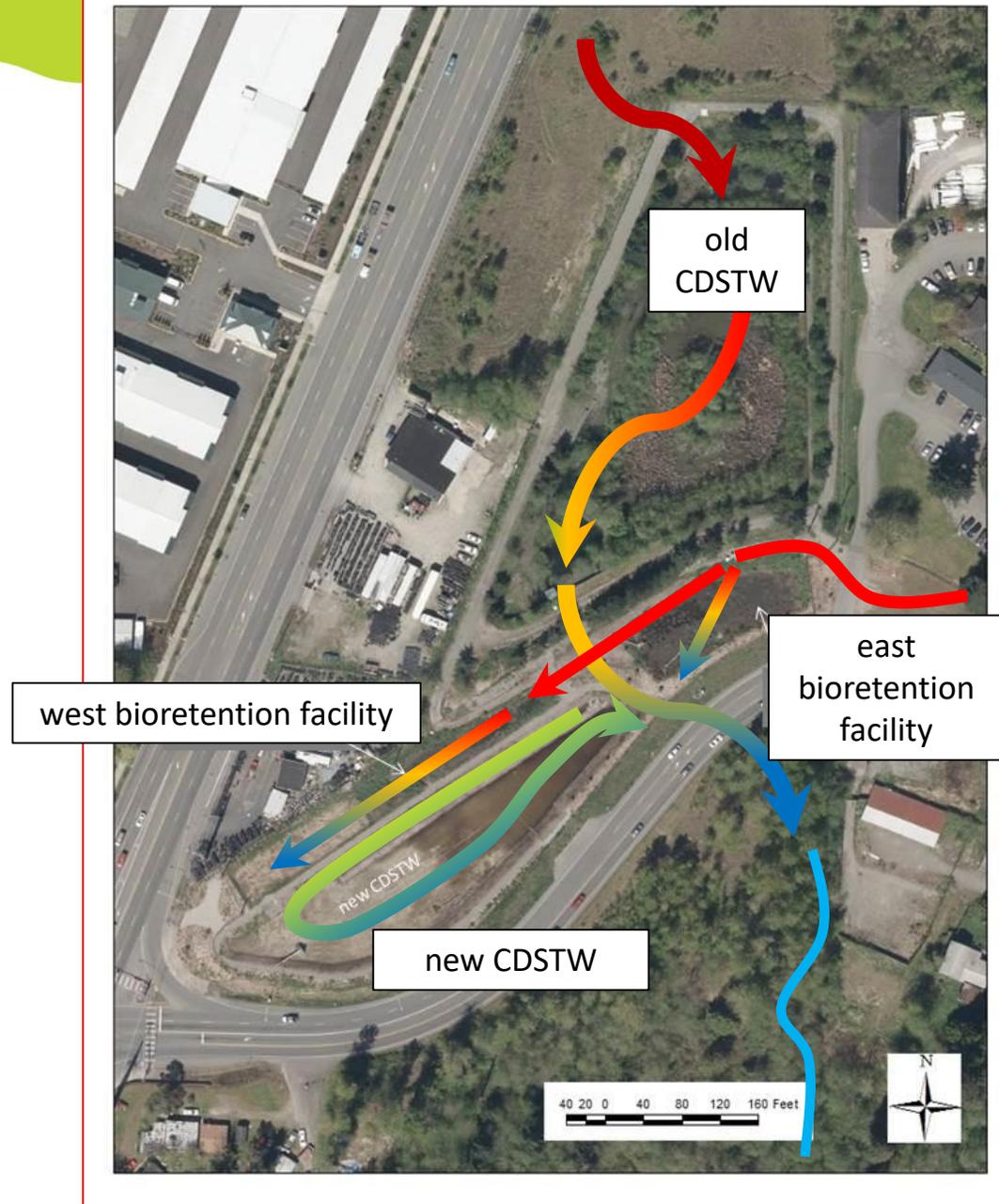
New “wetland”

- Increase capacity
- Unlined, but infiltration limited



New “wetland”

- Increase capacity
- Unlined, but infiltration limited

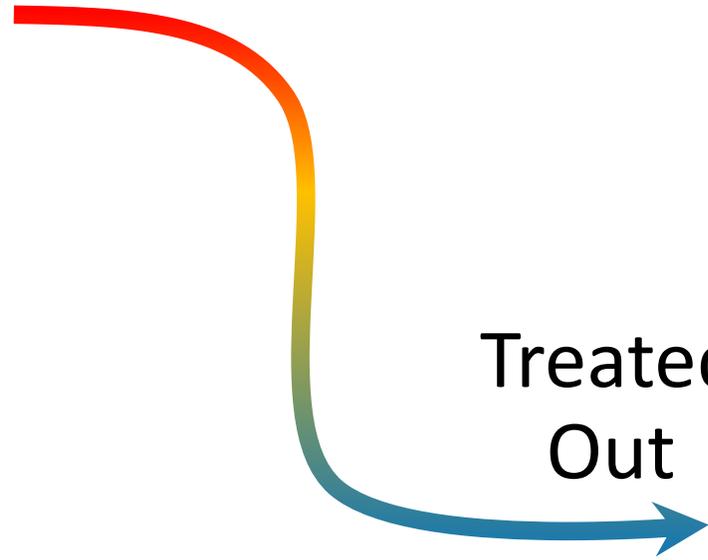


Bioretention facilities

- New capacity
- Underdrained
 - East: drains quickly
 - West: drains slowly



Untreated
In



Treated
Out

- East bioretention facility
- West bioretention facility
- Wetland complex



Receiving waters:
North Fork West Hylebos Creek



Sampling

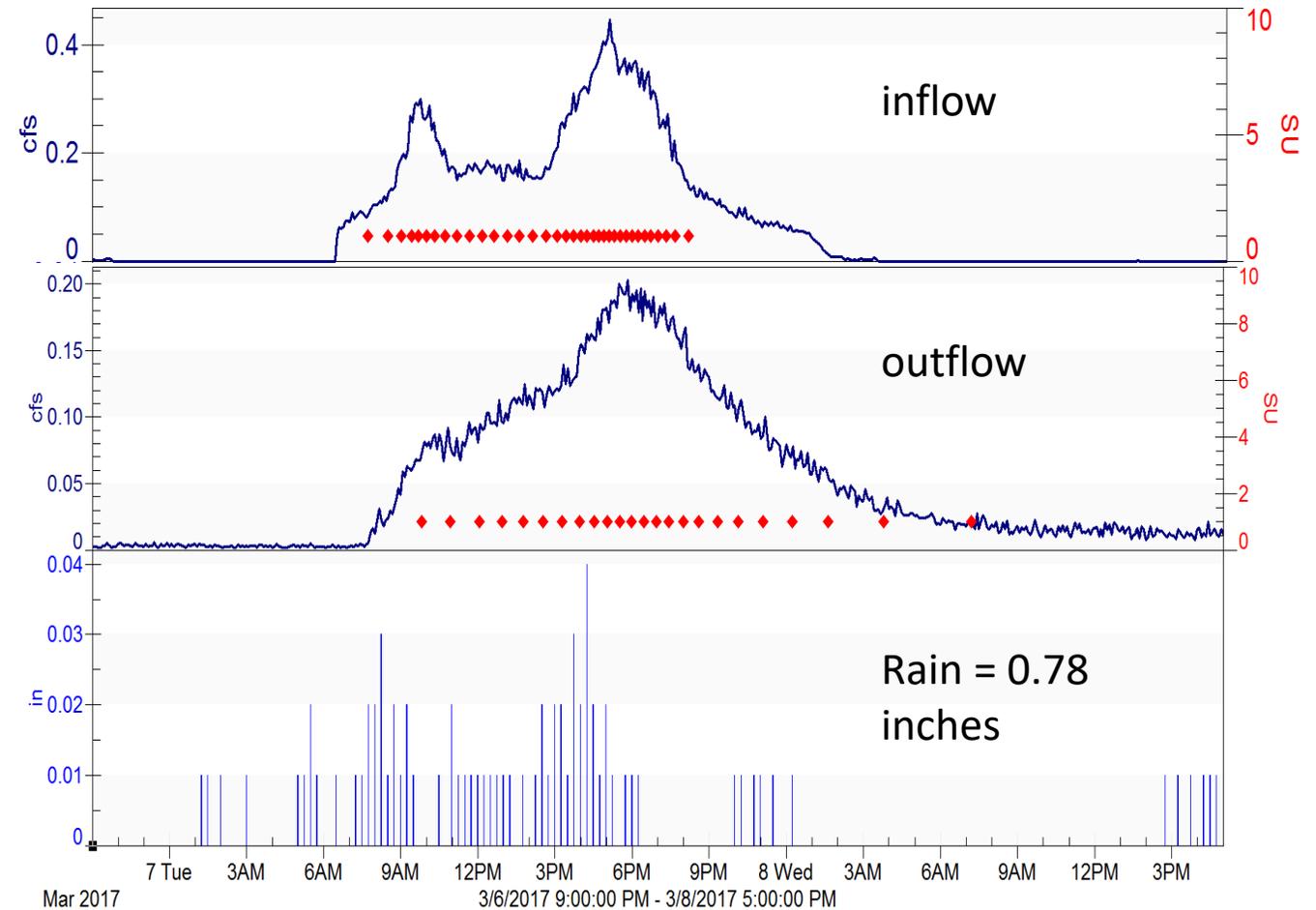
- Flow at 7 locations
- 18 storms sampled for TSS, metals, nutrients, PAHs
- 10 storms for PCBs, fecal coliforms
- 6 storms for toxicity

- Pre- and post-retrofit turbidity and temperature data



Flow Monitoring Results

- Flow-weighted composite sampling successful
- Reduction in peak flows and delay in peak timing at all facilities



Flow Monitoring Results continued

- But, less certainty in flow volume estimates
- Unclear extent of groundwater intrusion and/or infiltration
- Results focus on concentration changes rather than mass loadings

Treatment?

Concentrations in effluent vs. influent:

Significantly reduced



Somewhat reduced



Somewhat increased



Significantly increased



Caveats

- Pollutant concentrations in bioretention influent were lower than in wetland complex influent
- Bioretention soil mix was standard 60% sand/40% compost mix but it was 30 inches deep
- 90% of total flow is through the wetland complex



Pollutant	Bioretention Facility		Wetland Complex
	East	West	
Fecal Coliform			
TSS			
Turbidity			
Conductivity			

Take Home:

- System reduced total suspended solids (TSS) loads

Pollutant	Bioretention Facility		Wetland Complex
	East	West	
Zinc, total	Blue	Blue	Blue
Zinc, dissolved	Blue	Blue	Red
Copper, total	Light Red	Red	Blue
Copper, dissolved	Red	Red	Light Red
Lead, total	Blue	Light Red	Blue
Lead, dissolved	Red	NC	Light Red
Cadmium, total	NC	NC	Blue
Cadmium, dissolved	NC	NC	NC

Take Home:

- Mixed results, but complicated by low influent concentrations in bioretention facilities
- System reduced loads of total metals
- System source of dissolved metals

Pollutant	Bioretention Facility		Wetland Complex
	East	West	
Total PAHs			
Total PCBs			

Take Home:

- System reduced loads of PAHs and PCBs

Pollutant	Bioretention Facility		Wetland Complex
	East	West	
Total Phosphorus			
Orthophosphate P			
Total Nitrogen			
Nitrate + Nitrite N			
Ammonia N			

Take Home:

- Bioretention facilities: large source of N & P (~80% of total phosphorus load)
- Overall system is a source of all nutrients except ammonia

Study Conclusions

- Overall, effectiveness determined by wetland complex (90% of flow)
- Bioretention facilities are large sources of phosphorus and nitrogen (these should not be built as is in basins with nutrient concerns)
- Pre- and post-retrofit data indicate treatment improved

Lessons Learned

- Flow monitoring is very challenging.
- Anticipate delays.
- Groundwater may complicate matters.
- Some questions may be answered with cheap(er) continuous data.
- Urban basins are subject to change.



Questions?

kate.macneale@kingcounty.gov

