Thermal Effects of SCMs in the Headwaters of the Jenkintown Creek

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Presentation Outline

• Project Background
• Site Description
• Monitoring and Equipment
• Stream Temperature Analysis
• Results & Discussion
Project Background

- Delaware River Watershed Initiative (DRWI)
- Reduce the effects of urbanization

Headwaters Rain Garden

2\textsuperscript{nd} Rain Garden
The Jenkintown Creek

• Headwaters of the Jenkintown Creek in the Tookany-Tacony Frankford (TTF) Watershed

• High degree of urbanization

• Jenkintown Creek sub-watershed
  • 1,177 acre drainage area
  • 81% Urban Cover
Headwaters Rain Garden

- Impervious area ratio – 11:1
- Storm size managed – 1”
- Ponding time – 72 hours
- Maximum volume of storage – 1,980 $ft^3$
- Drainage area – 17,082 $ft^2$ of parking lot cover
- Outlet structure – Underdrain and Orifice
April 6th 2017: 10:10AM – 6:30PM: 1.10” Event
2nd Rain Garden

- Impervious area ratio – 10:1
- Storm size managed – 1”
- Ponding time – 72 hours
- Maximum volume of storage – 1,400 $ft^3$
- Drainage area – 13,650 $ft^2$ of parking lot cover
- Outlet structure – Underdrain and Thel-mar Weir
Site Overview
Monitoring and Equipment

VIEW OUR WEATHER DATA LIVE ONLINE!
www.stevens-connect.com/public/WPF-Villanova
Stream Temperature Analysis

• Analyze individual storm event using weather data
• Collect flow depth and water temperature data
• Match rain to flow depth data
• Determine maximum temperature change in creek
Individual Storm Event

- 1.0” (0.254 cm) rain events or larger
- Ends where 6 hours with less than 0.02” (0.051 cm) rain accumulates
- Indicate “sub-storm” of high-intensity
- Flow Depth

05.29.2019

Rain (in)

Flow Depth

- 0.38”
Individual Storm Event

05.29.19

Rain (in) vs Flow Depth (mm)

Flow depth (mm)

Rain (in)

0.38”
Stream Temperature: Total Δ (°C)

05.29.2019

Maximum = 18.58 °C

Initial = 16.19 °C

Total Δ = 2.39 °C
**Exceedance Probability**

![Graph showing exceedance probability with data points for Pre-Construction. The graph includes an equation: \( P_x = \frac{n}{m+1} \).]

*Equation 3.1: Weibull (1939) Distribution*
Exceedance Probability

- Pre-Construction
- Headwaters Rain Garden
- 2nd Rain Garden Installed
Other Influences on Stream Temperature

- Seasonal variations
- Air temperature
- Natural fluctuations
- Solar radiation
- Time of day

Seasonal Variations of Total Δ

\[ y = 0.0764x - 0.4145 \]

\[ R^2 = 0.3878 \]
Conclusions & Future Work

• Influence of heated runoff on creek temperature
• Total $\Delta$ reduction of 1°C by introducing SCM to the site
• Effect of rain garden reconstruction on stream temperature
• Inflow temperature sensor at rain gardens
Questions?

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[Logo of William Penn Foundation]
Thank You

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