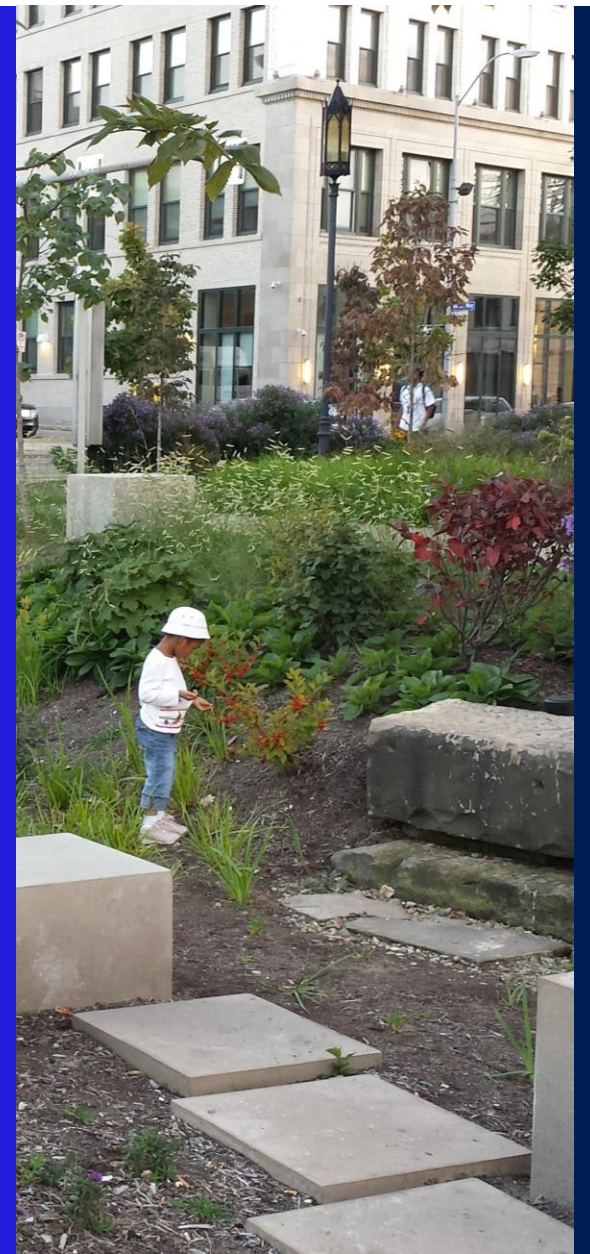


# Green Infrastructure for Healthy Communities Session 1

December 15, 2021



In the kNOW Webinar Series



# Presenters

- **Dustin Atchison, Jacobs**  
Stormwater & Watershed Management Global Technology Lead
- **Andrew Potts, Jacobs**  
Green Infrastructure Community of Practice Lead
- **Tracy Tackett, Seattle, WA Public Utilities**  
Green Infrastructure Program
- **Liu Huei-Lyn, PUB, Singapore's National Water Agency**  
Active, Beautiful, Clean (ABC) Waters Program

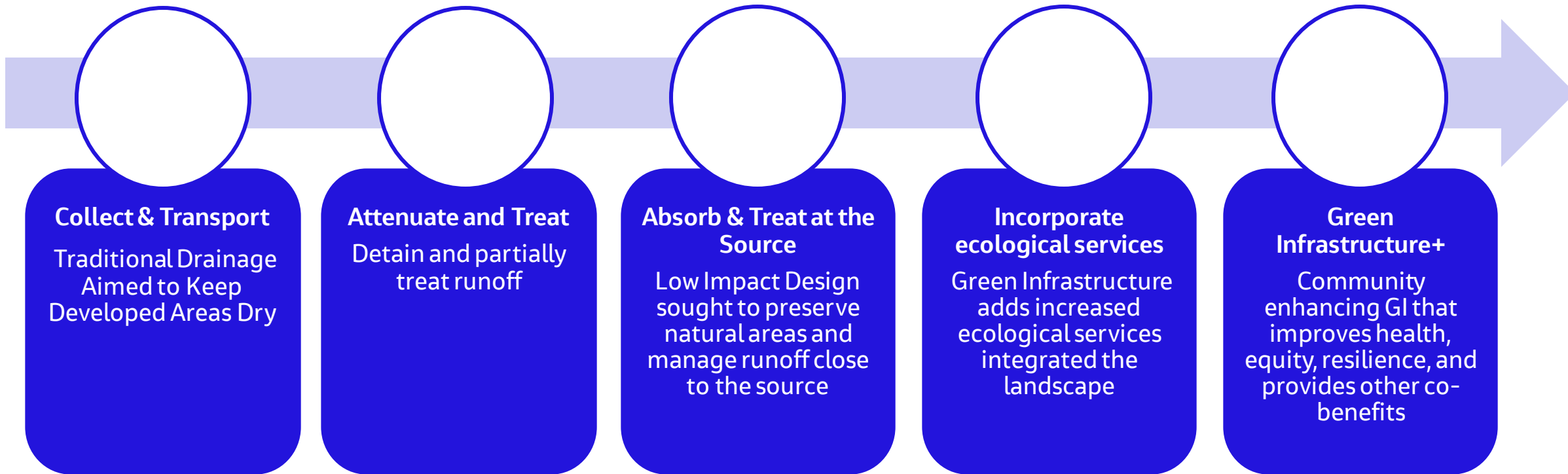


# Setting the Stage

Andrew Potts



# Evolution of Stormwater Management?



# GI and Social Equity

- From Nov. 16, 2021 release statement:
  - *The Taskforce piloted new strategies for community engagement and workforce development, focusing on planned green infrastructure projects in the Proctor Creek watershed funded by the City's \$14 million Environmental Impact Bond [EIB].*
- GSI EIB also focuses on flood reduction in these vulnerable neighborhoods, increasing resilience

*“If we think the stormwater and green infrastructure concerns are just about the blue and the green, we have sadly missed the mark. These issues **must be people-centered.**”*

— Atlanta Watershed Learning Network participant



## AN EQUITABLE WATER FUTURE Atlanta



# Public engagement highlights community goals for Green Infrastructure Challenge parks sites in Washington, D.C.

**dc** water is life™ **dc clean RIVERS PROJECT**

## ISSUES in the Parks

**STATION E** What are the current issues you have noticed in the park?

Place **all** color-coordinated dots **that apply** on each park where you have recently noticed any of the following issues:

- Crime
- Loitering/trash
- Flooding
- Pet waste
- People smoking
- Poor landscape maintenance
- Vehicle/pedestrian accidents
- None - I don't use the park

*To add other issues, take a post-it, write the issue, and place it on the map.*

DCWATER.COM

**dc** water is life™ **dc clean RIVERS PROJECT**

## DESIGN your Parks

**PART 2 D** What is your ideal mix of green and paved surfaces in the parks?

Place **1** color-coordinated dot to show your ideal mix of green and paved space in the redesigned parks

**GREEN vs PAVED spaces**

**GREEN SPACE**  
Landscaped/lawn space with grass and plantings



**PAVED SPACE**  
Space covered with pavers, concrete, or asphalt





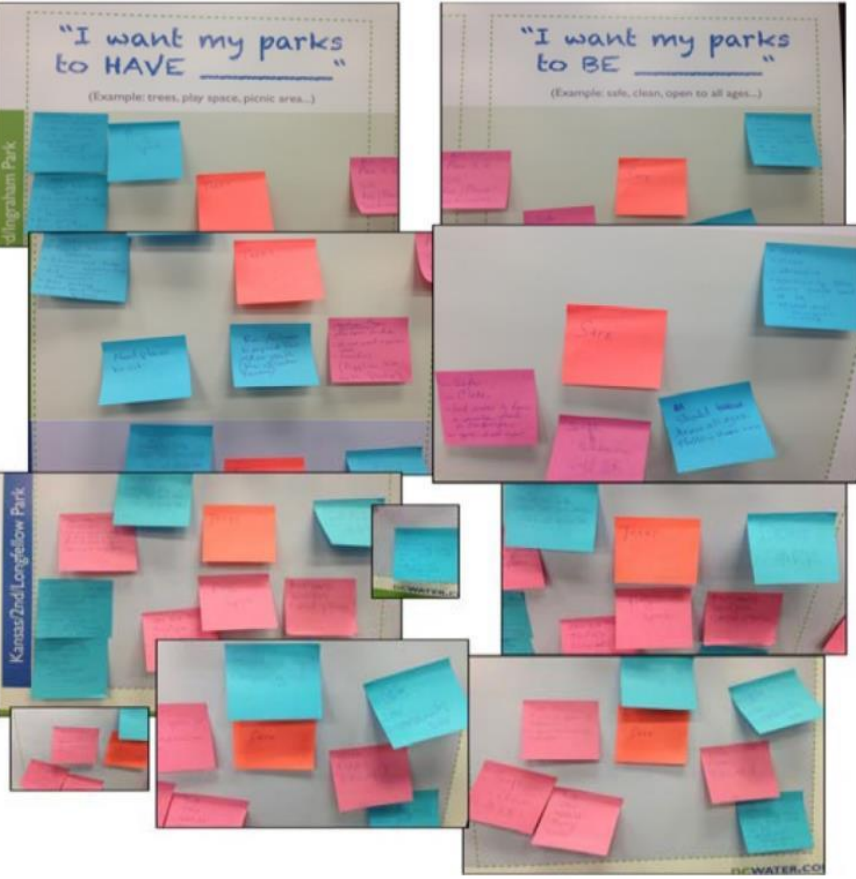
DCWATER.COM

"I want my parks to HAVE \_\_\_\_\_"

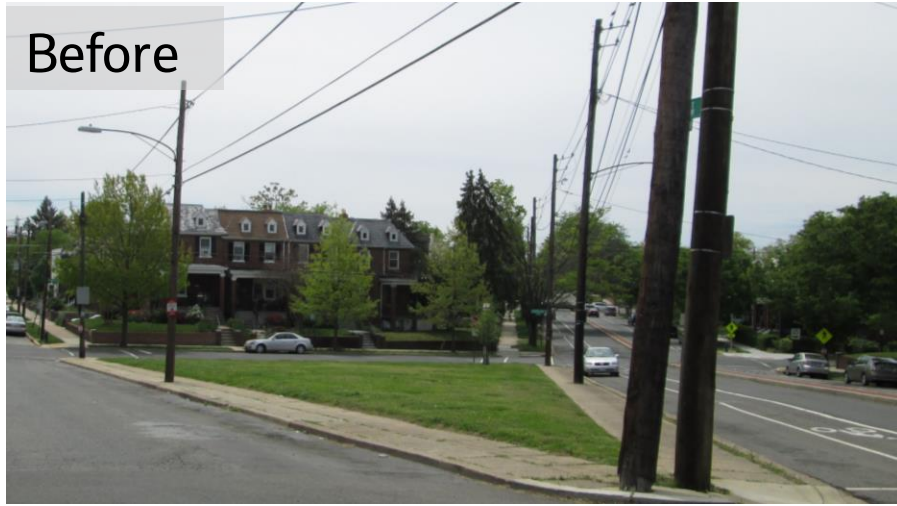
(Example: trees, play space, picnic area...)

"I want my parks to BE \_\_\_\_\_"

(Example: safe, clean, open to all ages...)






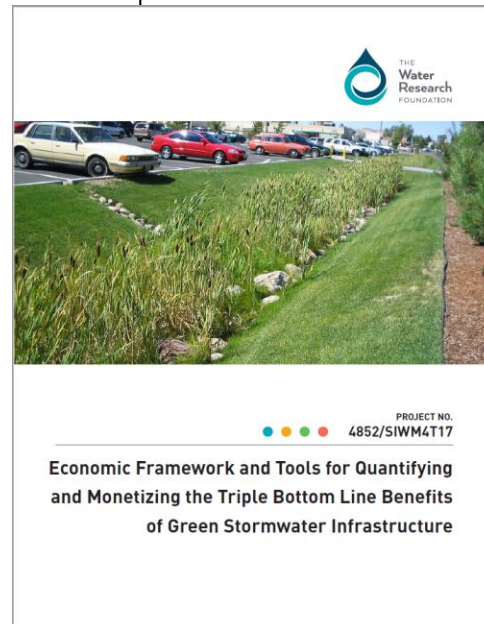
# Leading to community assets and functional green infrastructure



# Providing and Quantifying Co-Benefits Supports Business Case for GI

- New Water Research Foundation tool for quantifying triple bottom line benefits of GSI
- Monetization allows for
  - Comparison
  - Building community & internal support
  - Leveraging alternative funding
- Includes case studies from 4 cities
  - Lancaster
  - Seattle
  - Cleveland
  - St. Paul

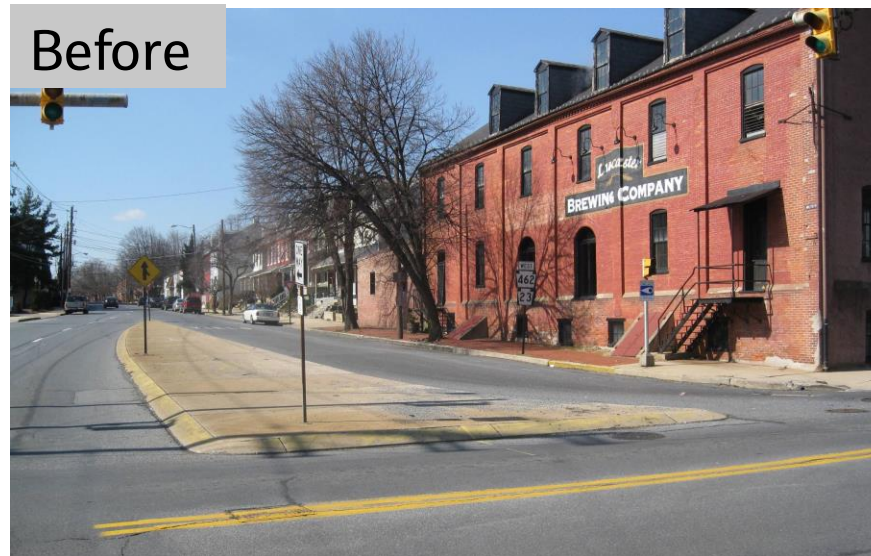
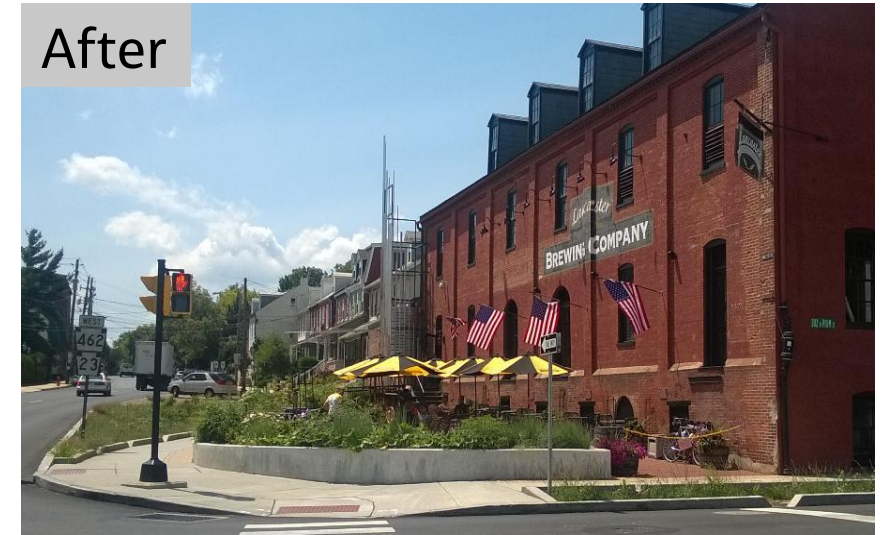
 <b>Financial</b>	 <b>Social</b>	 <b>Environmental</b>
<ul style="list-style-type: none"> <li>• Avoided infrastructure and/or treatment costs</li> <li>• Avoided maintenance and replacement of non-stormwater assets</li> <li>• Energy savings</li> </ul>	<ul style="list-style-type: none"> <li>• Improved air quality and related health benefits</li> <li>• Water supply benefits</li> <li>• Improved aesthetics and community sustainability/livability</li> <li>• Reduced urban heat stress and related public health benefits</li> <li>• Increased recreational opportunities</li> <li>• Green job creation</li> <li>• Flood risk reduction<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Water quality and associated aquatic habitat improvements</li> <li>• Carbon emissions reduction and sequestration</li> <li>• Terrestrial and wetland ecosystem benefits.</li> </ul>





# Integrating GSI with safety improvements at Plum and Walnut benefits users, local businesses, and brings new funding sources

- Built with Transportation and GI Grant funds
- Improves pedestrian safety, supports local businesses
- 2014 *Best Urban BMP in the Bay Award* (“BUBBA”)
- *Governor’s Award for Environmental Excellence*
- Measured reduction in traffic speeds entering downtown



## Poll Question #1

**How much progress have you made with green stormwater infrastructure?**

- a) None
- b) No constructed projects yet, but setting the stage
- c) Have completed a pilot project or a few GSI projects
- d) Several GSI projects completed
- e) We are implementing widespread GSI

# Leveraging Drainage & Wastewater Investments for Community Health

9/28/2021

Seattle Public Utilities



City of Seattle



# SPU

## BY THE NUMBERS

---

**4 LINES OF BUSINESS**

DRINKING WATER

STORMWATER

WASTEWATER

SOLID WASTE

---

OVER **1.5 MILLION**  
CUSTOMERS

---

**\$1.35 BILLION/YEAR**  
REVENUE

---

**\$294 MILLION/YEAR**  
CAPITAL BUDGET

---

**1400+**  
EMPLOYEES

# SPU's 50 Year Aspirational Vision

Our bold vision reflects SPU's goals for the next 50 years of service, infrastructure investment, and management of water and waste. We will lead with equity and work in partnership with communities and employees to create a just and sustainable future. We understand that the actions we take today have the power to transform our employees, community, environment, and economy for generations to come.

## OUR VISION

### ONE WATER

Water is essential for life. Our health, wealth, and livelihoods depend on it, and we must protect it for future generations.

One Water means we value and carefully manage water in all its forms: through conservation, capture, restoration, and reuse. Whether it is fresh water or wastewater, all water is protected and managed in an integrated and sustainable way, and all people and species have access to healthy waters.

### COMMUNITY CENTERED

We put people at the heart of our work and work with them to understand and address their priorities. We seek to better understand and address employee, customer, and community needs, and build the long-lasting, equitable, and inclusive relationships necessary to address these needs.

SPU strives to live by this inclusive principle and embed it in all we do.

### ZERO WASTE

All resources have value, and we strive to waste nothing. We must look at the whole life cycle of materials so we can eliminate waste, prevent pollution, encourage product durability and reusability, conserve natural resources, and ultimately build a circular and inclusive economy.

Zero Waste protects health and the environment through the conservation of all resources from production through consumption without burning or pollution to land, water, or air.

## OUR MISSION

Seattle Public Utilities fosters healthy people, environment, and economy by partnering with our community to equitably manage water and waste resources for today and for future generations.

- Community-Centered
- One Water
- Zero Waste



**External pressures will change Seattle over the next 50 years**

- ☉ **Climate Change**
- ☉ **Population Growth**
- ☉ **Earthquakes**
- ☉ **Affordability**
- ☉ **Racial injustice**
- ☉ **Pandemics/Covid**

# Health Defined by Geography?



Duwamish Valley Program

## Life Expectancy



## Asthma Prevalence



## Living Near Contaminate Site, Superfund Site, or Freight Corridor



# What is our role?

## Drainage & Wastewater Infrastructure Sector

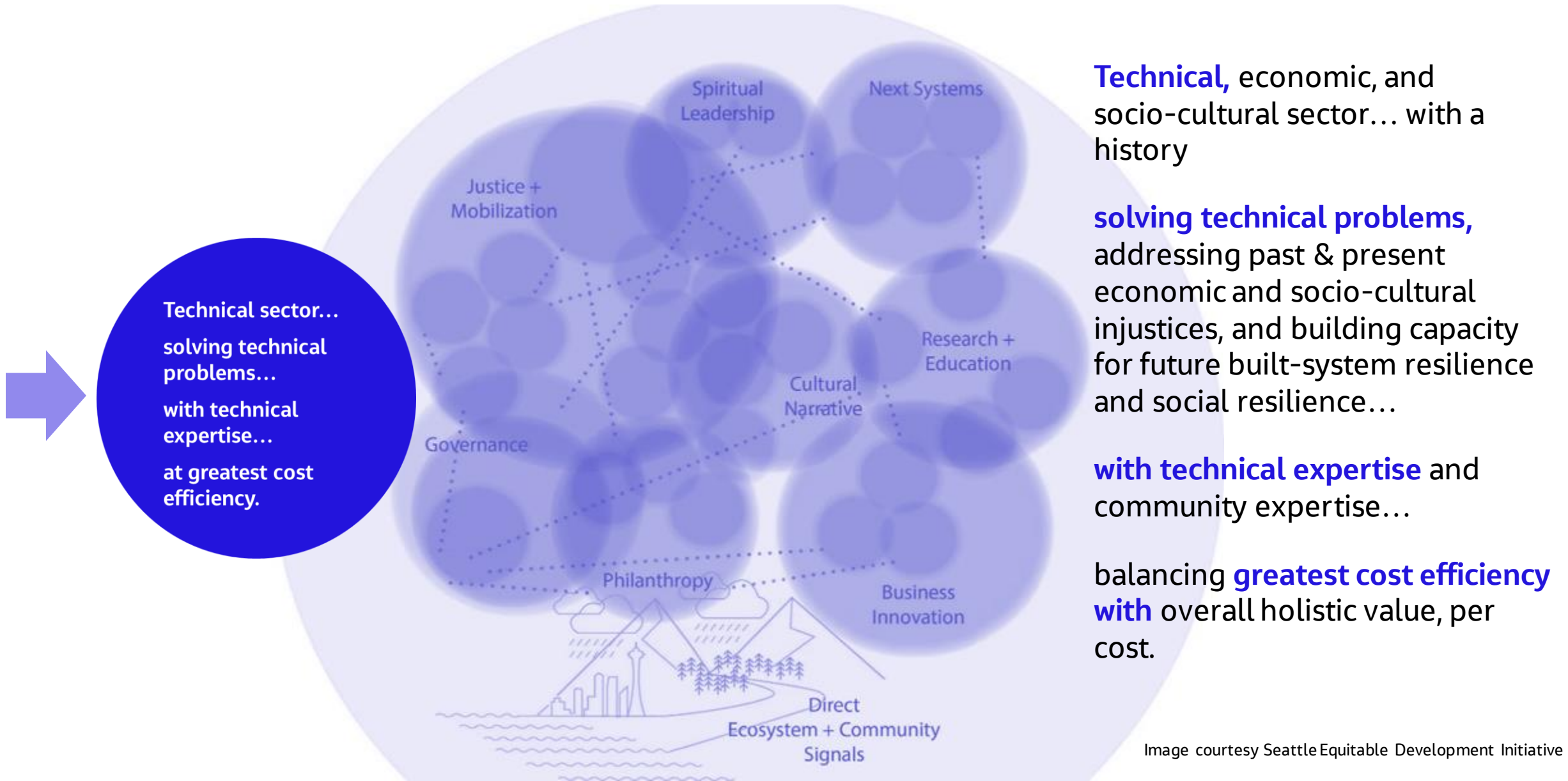
Technical sector...  
solving technical  
problems...  
with technical  
expertise...  
at greatest cost  
efficiency.





# What is our role?

## Drainage & Wastewater Infrastructure Sector



## Example: SBP's Grow GSI Initiative - Goals

- **Decrease impact of polluted runoff to water quality** in our creeks, lakes, the Duwamish River, and Puget Sound
- **Reduce CSO, flooding, and SSO/back-up risk** and incidence by preserving or improving system capacity
- **Deliver a range of risk reduction + community co-benefits** with DWW system investments, optimizing overall value per cost



Porous Public Spaces 2016 UW Green Futures Lab

# GSI Provides Good Opportunity for Growing Ability

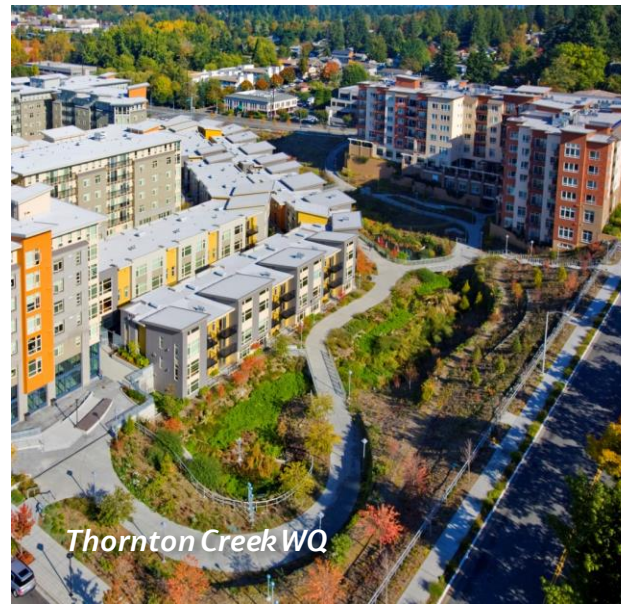
Retrofits of Existing Space



Flow Control/WQ Treatment in the ROW



Purpose-built Stormwater Parks



# Growing GSI in Seattle

GSI characterized by

LID Best Practices

Utility-led & funded pilots to in ROW and on parcels to establish efficacy/proof-of-concept

From 'pilots' to \$70M program + SW Code update

SPU investment integrated w/open space, transportation, health, equity, development, resilience

Examples

2000



SEA Street



HighPoint



RainWise

2013



Citywide Program Initiation

2018



Innovative Co-investment Partnerships

1850

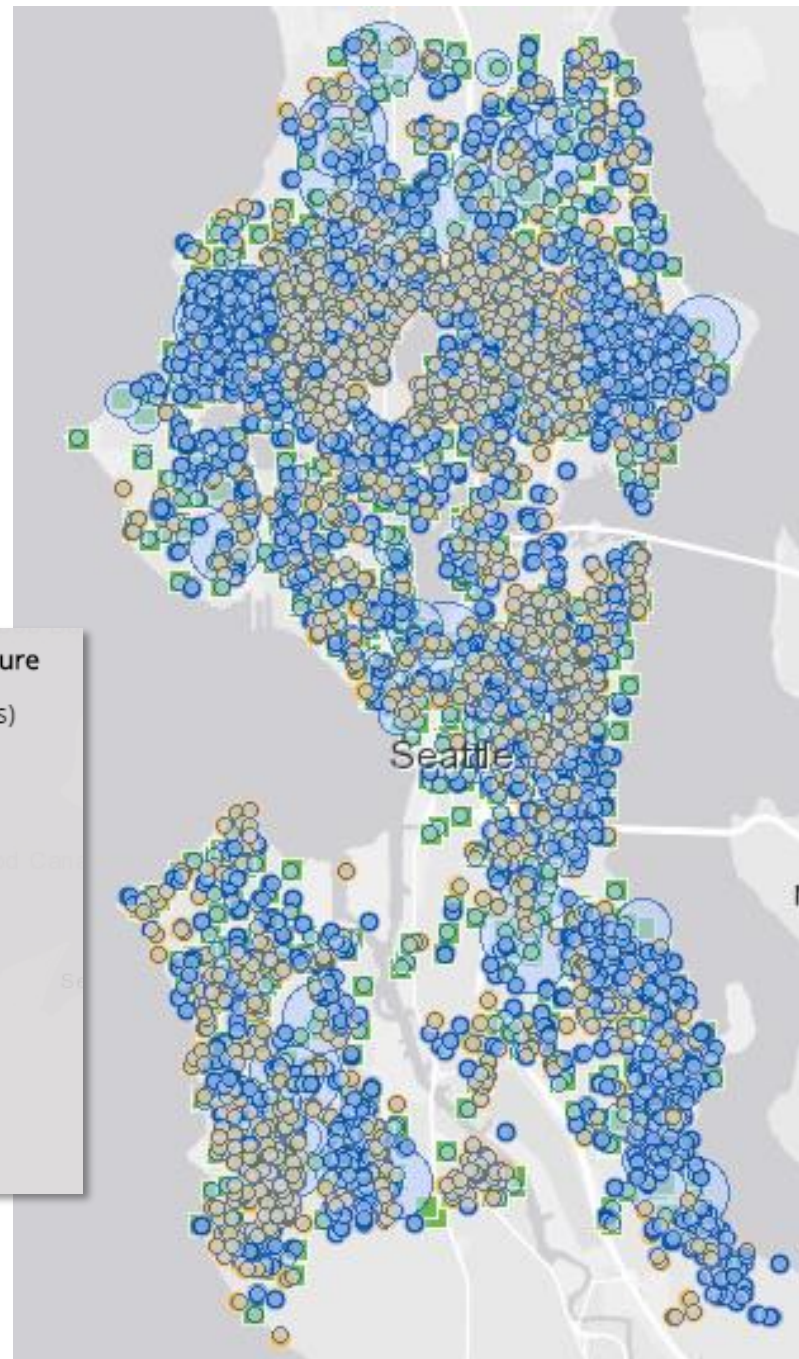
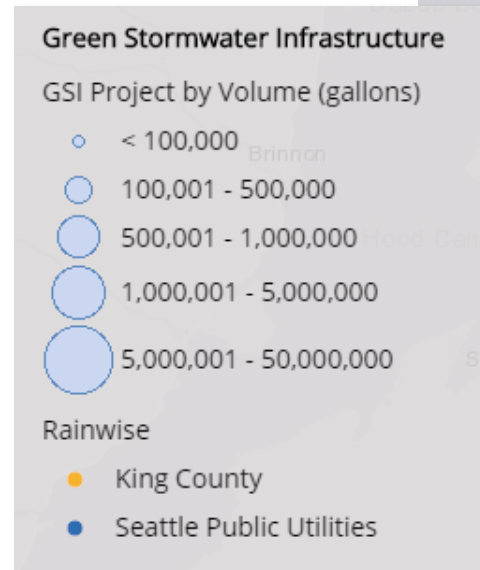
1900

1950

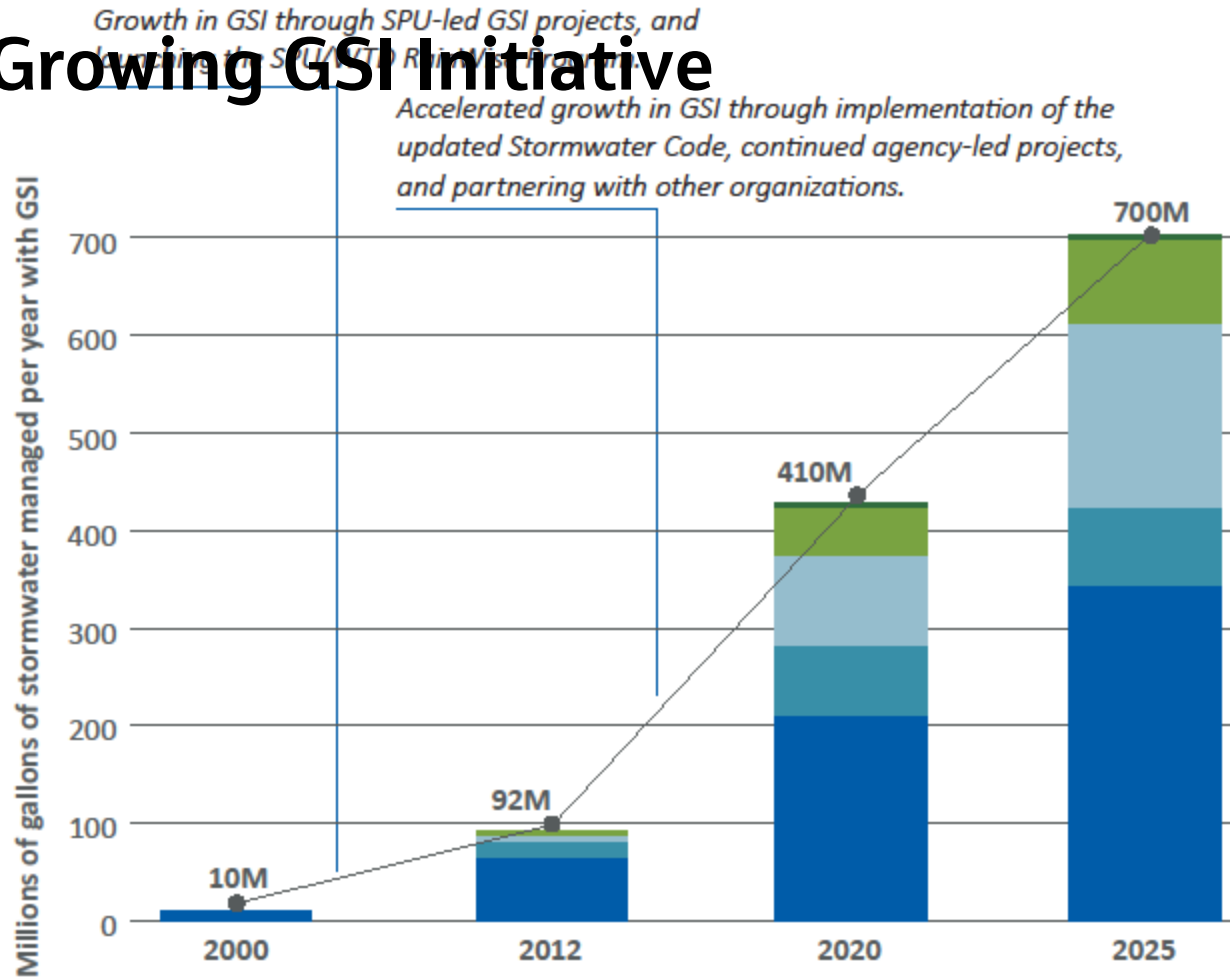
TODAY



# Existing GSI Projects in Seattle



# Growing GSI Initiative



## GSI Project Types

- WTD-built projects
- Public-private partnerships (with SPU/WTD funding)
- Projects required by code
- Public-private partnerships (without SPU/WTD funding)
- SPU-built projects

Public-private partnerships (incentivized)



Code-Required



Public-Private (w/o funding)



SPU-Built Projects



# GSI Retrofit Partnership Programs with CIP-funding

## Utility-led Projects

Large-scale  
Co-development Capital  
Projects



## Partner-led Projects, SPU Incentivized

Rebates  
Projects on Private Parcels



Direct Partnerships (MOA)  
at Point of Redevelopment



Service Delivery  
Performance-based Contract



Service-Based Contract



# Venema

## Constructed in 2015

### Project Highlights:

- Large regional facility within neighborhood
- Deep infiltration with underground injection control (UIC) well





# Ballard NDS / constructed in 2015



# Capitol Hill Water Quality Project “Swale on Yale”

**Constructed in  
2014 and 2019**

Project Highlights:

- Partnership with developer
- Regional facility in urban ROW
- Built to be monitored



# Utility-led CIP w/ Partnership: SPU + SDOT + 1% Arts Longfellow Natural Drainage System Project





# NEW GSI Program in Development

Seattle Opportunity Job Corp:  
Local Jobs for GSI Landscape

# Geographic Basis for Partnering

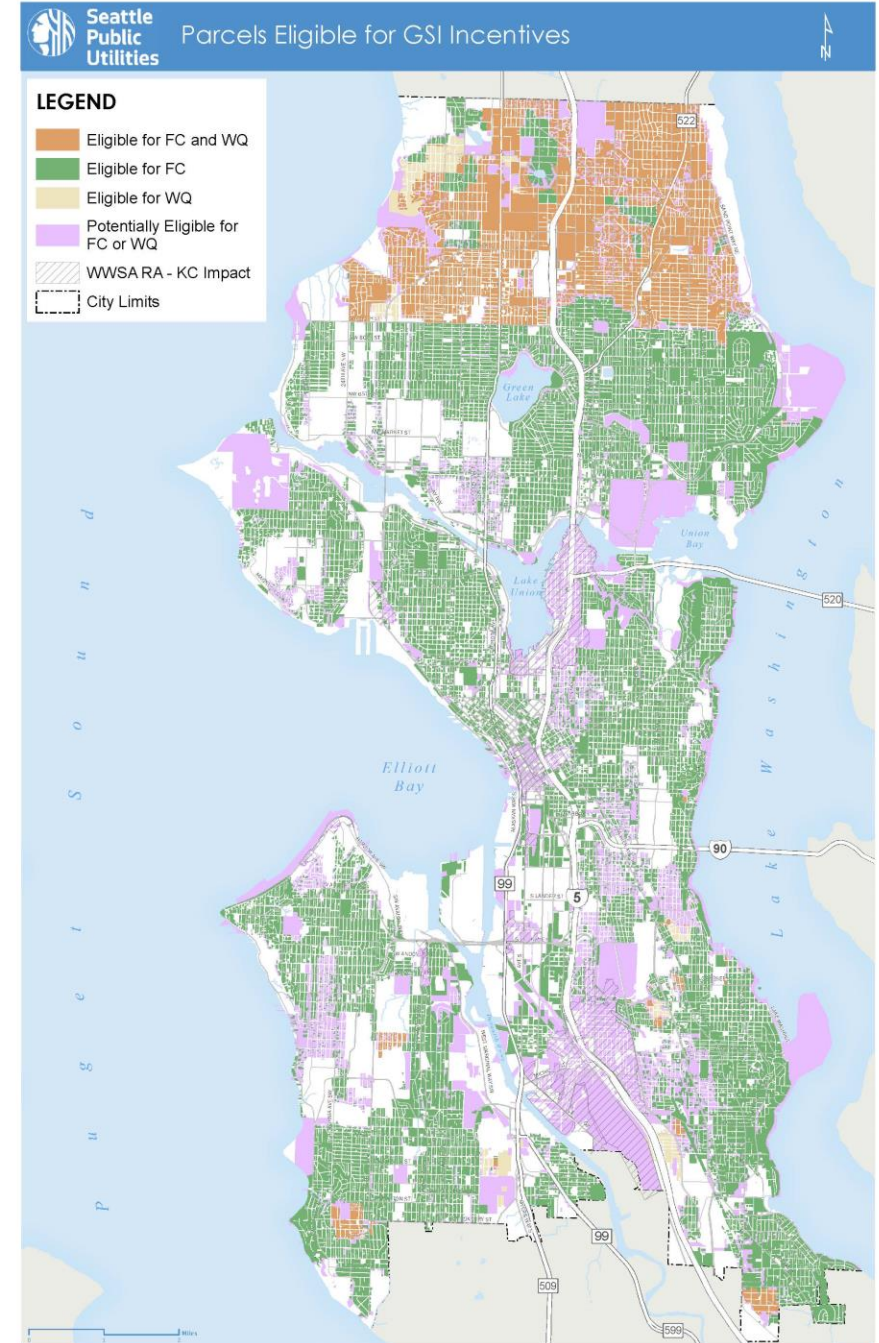
## Where We Can Partner

### Water Quality

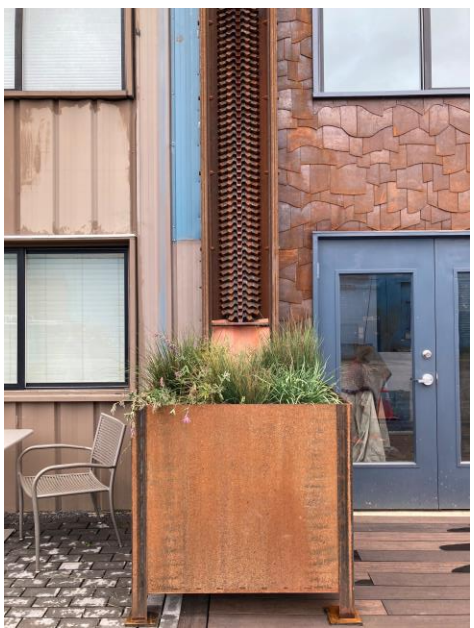
- WQ Priority Areas
- Creek Basins

### Flow Control

- WWSA Risk Areas
- DSA Risk Areas
- SPU CSO Basins
- Creek Basins



# Private Property Projects



Equinox Studios - Georgetown



Goodwill - Dearborn



Greenhouse Apartments - Columbia City



Isola Homes - Ballard

# Private Property Incentives



# RainCity Community-Based P3

## ONE PERFORMANCE-BASED CONTRACT



### Plan + Design

Green infrastructure projects



### Install

Green infrastructure projects



### Commission\*

Green infrastructure projects

\* through plant establishment period, 3 years

**Water Quality Performance Metric** deliver a portfolio of green stormwater infrastructure retrofit projects within the eligibility area that will manage at least twenty-five (25) acres of effective impervious area up to the flow control design standards described in Appendix 4.

**Community Benefit Performance Metrics:** deliver proposed community-based benefit outcomes, including but not limited to: local hiring targets, community-engaged (and resourced) project delivery, riparian area restoration (at min. 1 acre), leveraged investment, and organizational/business mentorship.



# Partner-led Projects: Visualizing Opportunities



Existing conditions



GSI retrofit project that manages runoff to required flow control design standard

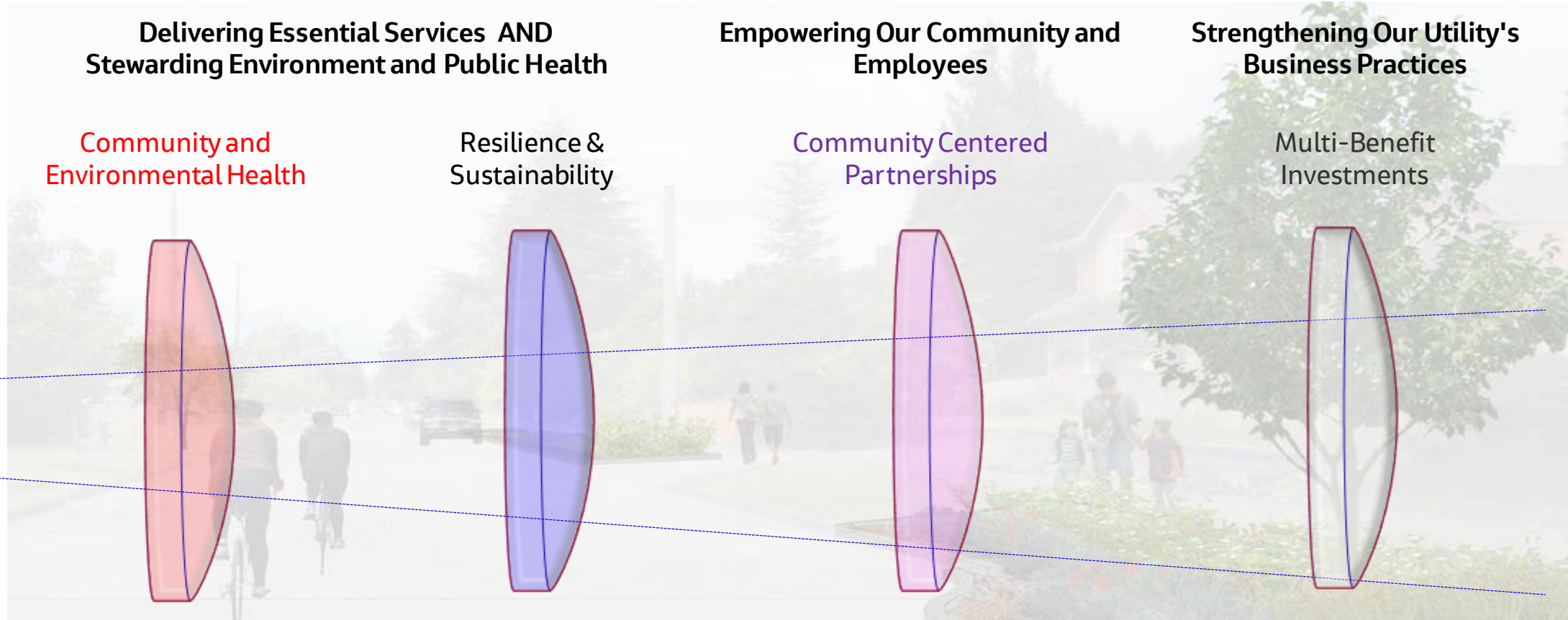
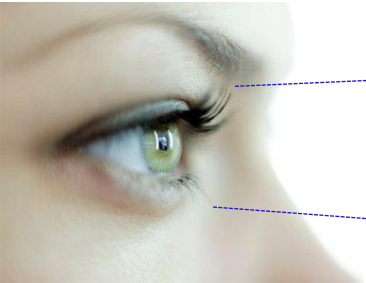


GSI retrofit project that also leverages infrastructure investment with match to deliver on community's 'whole project' vision

# DWW Values Lenses (Affordability + Expanded Outcomes)

SBP:

Shape Our Water:



Framework for Assessing Values

- Sewer & Drainage System Problems
- Expanded Public Health Outcomes
- Water Quality + Aquatic Health

- Climate Risk
- Environmental Sustainability
- Seismic Risk

- Historically Underserved community
- Relationship to regional planning
- Community voice

- Local Economic Development
- Aligned with city livability investments
- Learning / Innovation
- Anti-Displacement

# PUB, Singapore's National Water Agency

ABC Waters Projects – A selection along Kallang River

# 2006 ABC Waters Programme

The background image shows a vibrant urban park scene. In the foreground, a small, clear river flows through a lush green landscape with various plants and trees. In the middle ground, there are more trees and a paved path. In the background, several modern high-rise apartment buildings with balconies and windows are visible against a clear sky. The overall atmosphere is bright and clean.

## ACTIVE

- New recreational and community spaces

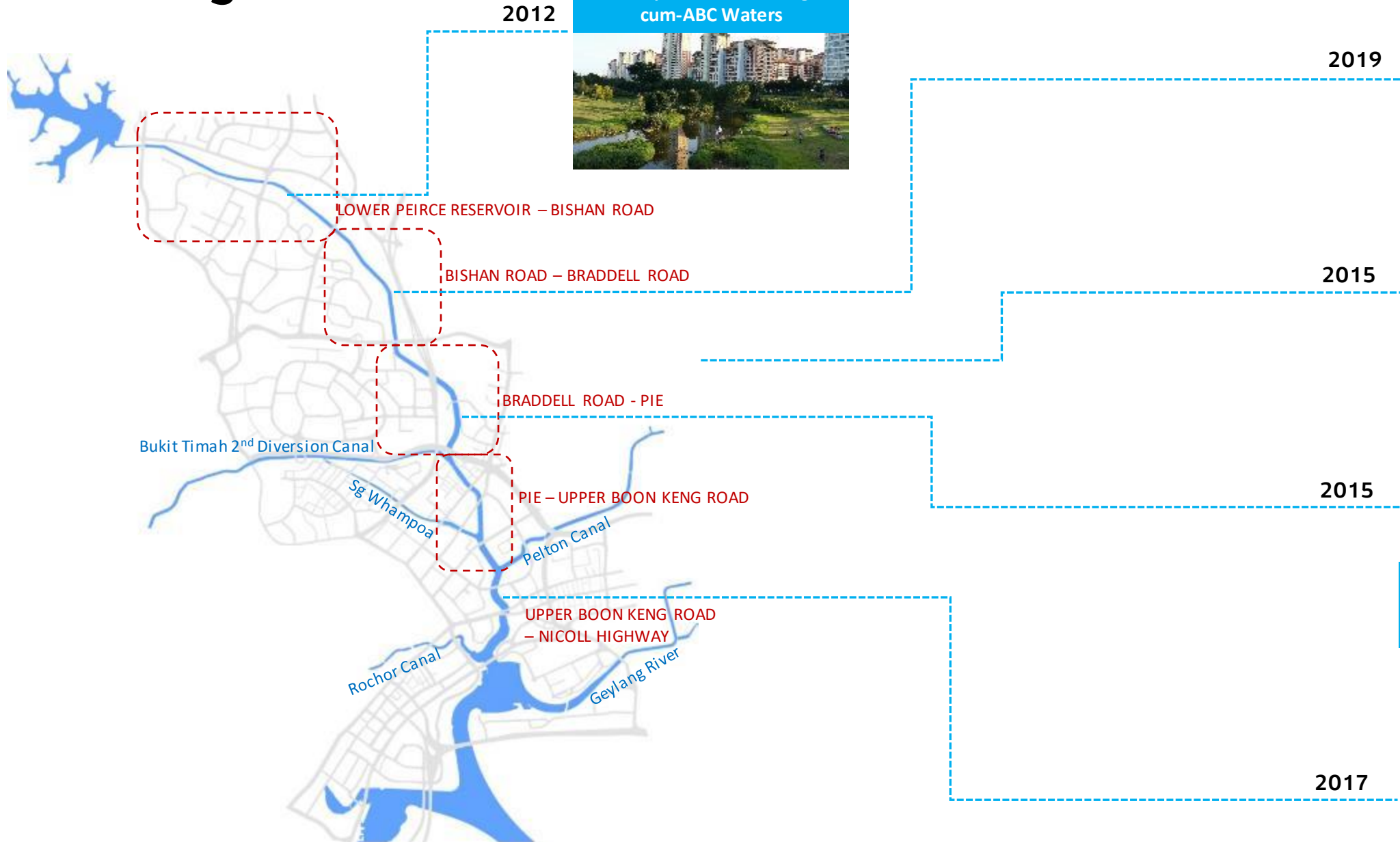
## BEAUTIFUL

- Integrating waterbodies and waterways with their urban landscape

## CLEAN

- Improving water quality
- Bringing people closer to the water

# Kallang River



**Bishan-AMK Park:**  
integrated with park re-  
development and drainage-  
cum-ABC Waters



**Bishan-Braddell:**  
drainage-cum-ABC Waters

**2019**

**Toa Payoh Lor 8:**  
integrated with NRP

**2015**

**Potong Pasir:**  
integrated with NRP

**2015**

**Upper Boon Keng Rd –  
Sims Ave:**  
integrated with HDB Trivista

**2017**

# Fully Naturalised/Floodplain Concept

## Kallang River Bishan-Ang Mo Kio Park

- Project success and popularity has led to more requests for such similar projects
- Space constraints and other considerations
- Always on the look-out for other potential sites
- Hybrid options where possible can be implemented





**ABC WATERS @ KALLANG RIVER  
BISHAN ROAD – BRADDELL ROAD**

# Improvement to Kallang River (Bishan Rd to Braddell Rd)

Hybrid (Partially Naturalised)-  
90m stretch @ Node

179m length of canal to retain existing size (24m wide)

1613m length of canal to upgrade to ~ 40m wide (existing width is 24m-27m)  
DR 45m – 48m

Canal section undercrossing Braddell Road to be deepened by 1m with its width retained

Bishan-AMK Park

Bishan Rd

MRT Depot

Linear Park

Braddell Rd



# Concept Design

Greening of canal wall & meandering dry weather flow



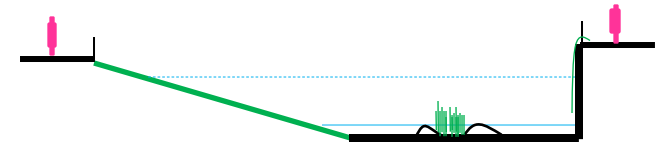
# Hybrid (Partially Naturalised)-90m stretch @ Node

Greening of canal wall & meandering dry weather flow



- Widened from 24m to 27m, to about 24m to 40m
- Deepened for 1m for a stretch of 800m of the canal from Braddell Road. Creating a permanent water body

# Hybrid (Partially Naturalised)-90m stretch @ Node



- Extending the concept of the naturalised river from upstream at Bishan AMK Park.
- Full naturalisation not feasible due to space constraints
- Enhancing the user experience along the waterway



# Community Node

## Kuo Chuan Secondary School and Future Housing

- Community Deck for events and views of the naturalised slope
- Located at the cascades & start of permanent water body

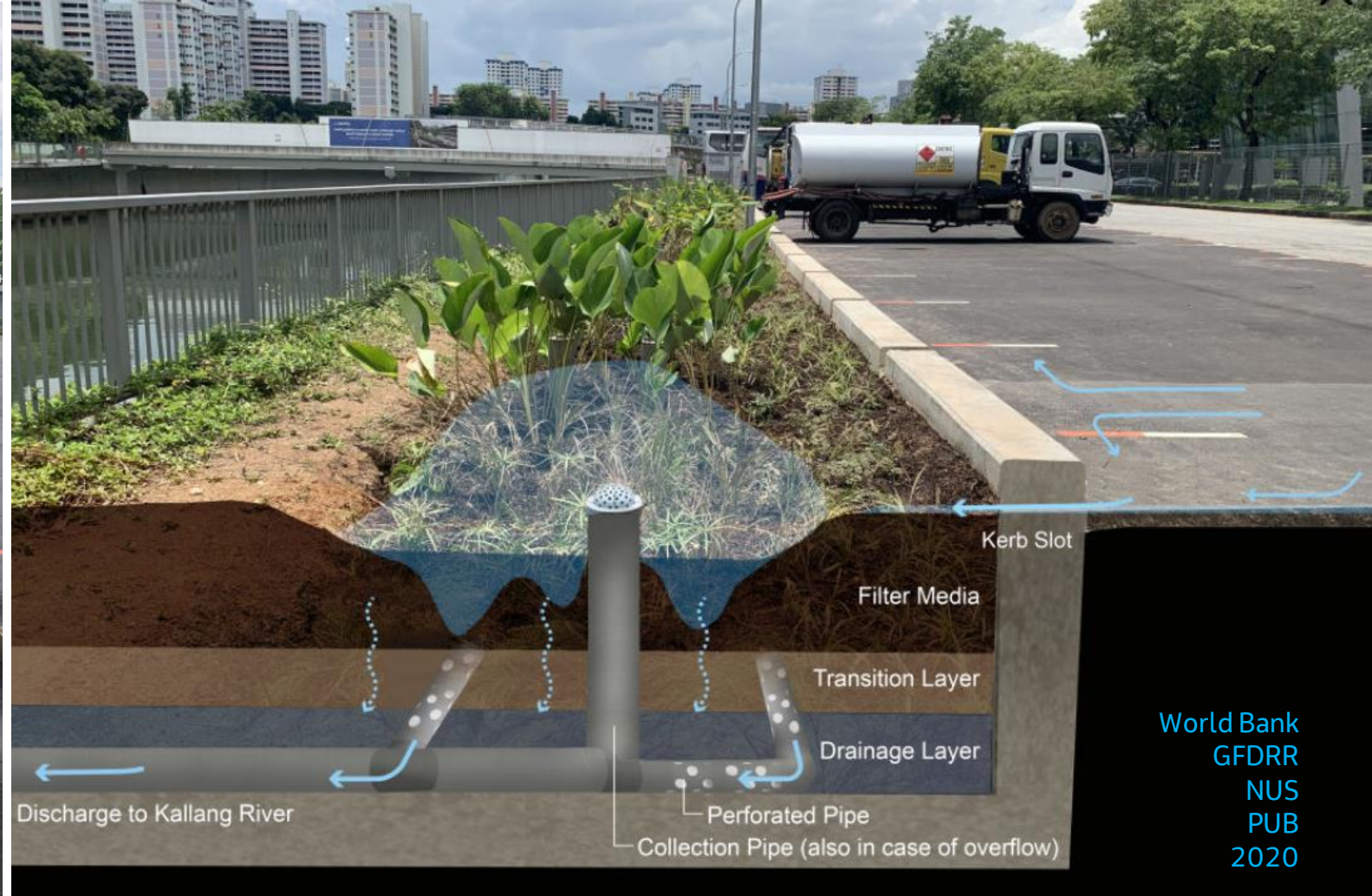


# Community Node



- 870 square meters
- Capacity for ~ 600pax

# Rain Garden – BCA Academy



World Bank  
GFDRR  
NUS  
PUB  
2020

# Cycling bridge at Braddell Road





**ABC WATERS @  
TOA PAYOH LOR 8**



# Site Conditions

Localised Inundation



World Bank and GFDRR, NUS & PUB 2020

# Site Conditions





A scenic view of a river in Potong Pasir, Singapore. The river flows through a lush green landscape with well-maintained grass banks. On the left, there are modern residential buildings with blue and white facades, partially obscured by a line of trees. On the right, a paved path runs alongside the river, lined with mature trees and a metal railing. The sky is clear and blue. The text "ABC WATERS @ POTONG PASIR" is overlaid in white at the bottom of the image.

**ABC WATERS @ POTONG PASIR**

# Site & Context

## Stakeholders



# Site & Context

## Community Engagement

- Bringing people Closer to the water
- Community Open Space
- Education ABC Waters Design Features



# Community plaza



# Bioretention swales, basins





# Community use

## Engagement & ownership





A wide river flows through a green landscape. In the background, a long bridge spans across the river. To the right, a tall, modern building is visible. The sky is overcast with grey clouds. The water in the river is calm, reflecting the sky and the surrounding greenery.

**ABC WATERS @ KALLANG RIVER  
UPPER BOON KENG ROAD – SIMS AVE**

# Site & Context

## Future development



# Site amenities



# Promenade development



# Community engagement



A vibrant garden scene featuring a variety of flowers. In the foreground, there are large, bright red and yellow flowers with green leaves. To the left, a dense patch of small pink and yellow flowers is visible. In the background, a train with a blue and red stripe is on an elevated track. The scene is set outdoors with trees and a clear sky.

Thank You



## Poll Question #2

**What do you see as the biggest barrier to implementing impactful green infrastructure in your community?**

- a) Cost/Funding
- b) Lack of familiarity (designers, contractors, permit agencies, etc.)
- c) Insufficient data/case studies on performance
- d) Maintenance concerns
- e) Silos between departments/agencies

# Questions & Answers



**Thank You**

**Jacobs**



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