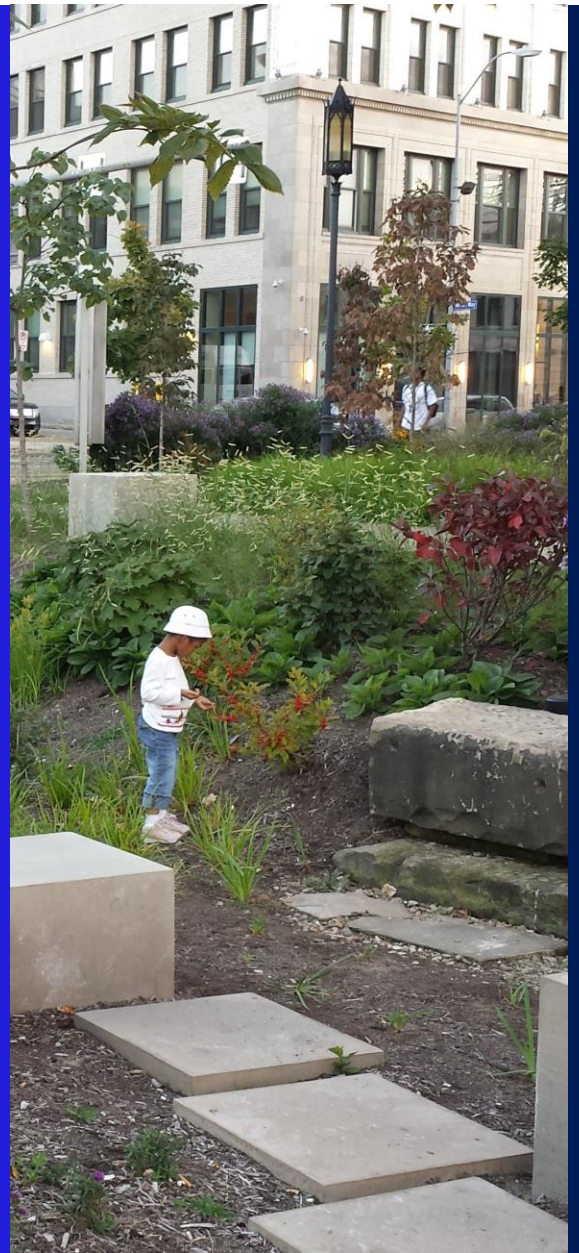
Jacobs Challenging today. Reinventing tomorrow.

Green Infrastructure for Healthy Communities

Session 2

December 16, 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
- **Adam Woodburn, Onondaga County, NY**
  Save the Rain Program
- **Zach Monge, Jacobs**
  Senior Project Manager
- **Paul Hargreaves, Jacobs**
  Head of Discipline – Surface Water Drainage (UK & Europe)

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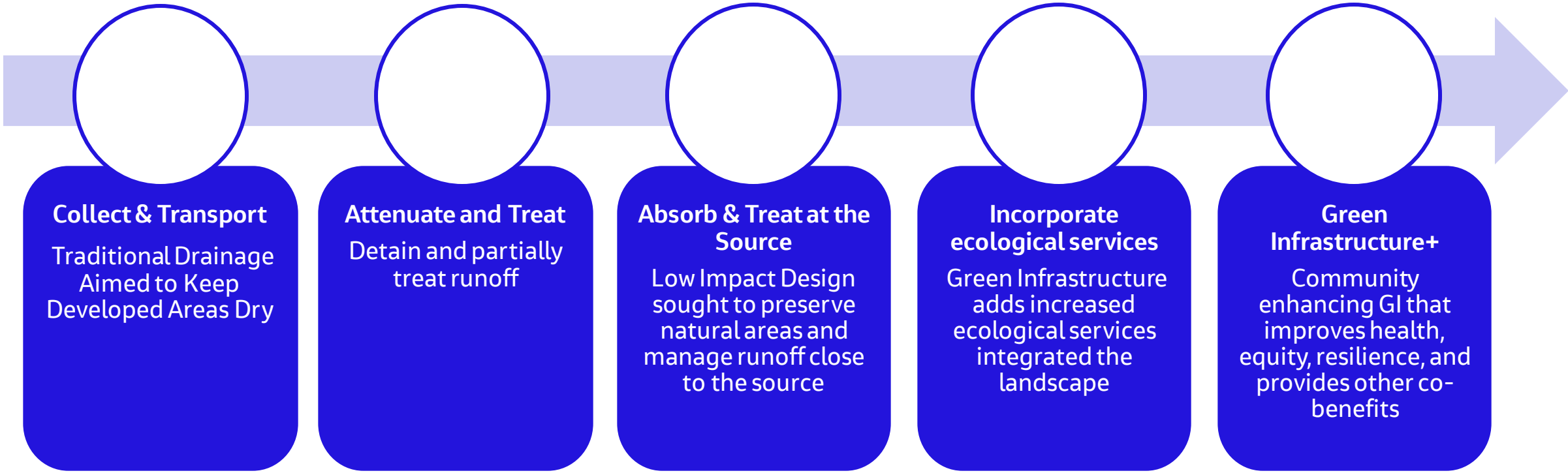
Setting the Stage

Andrew Potts

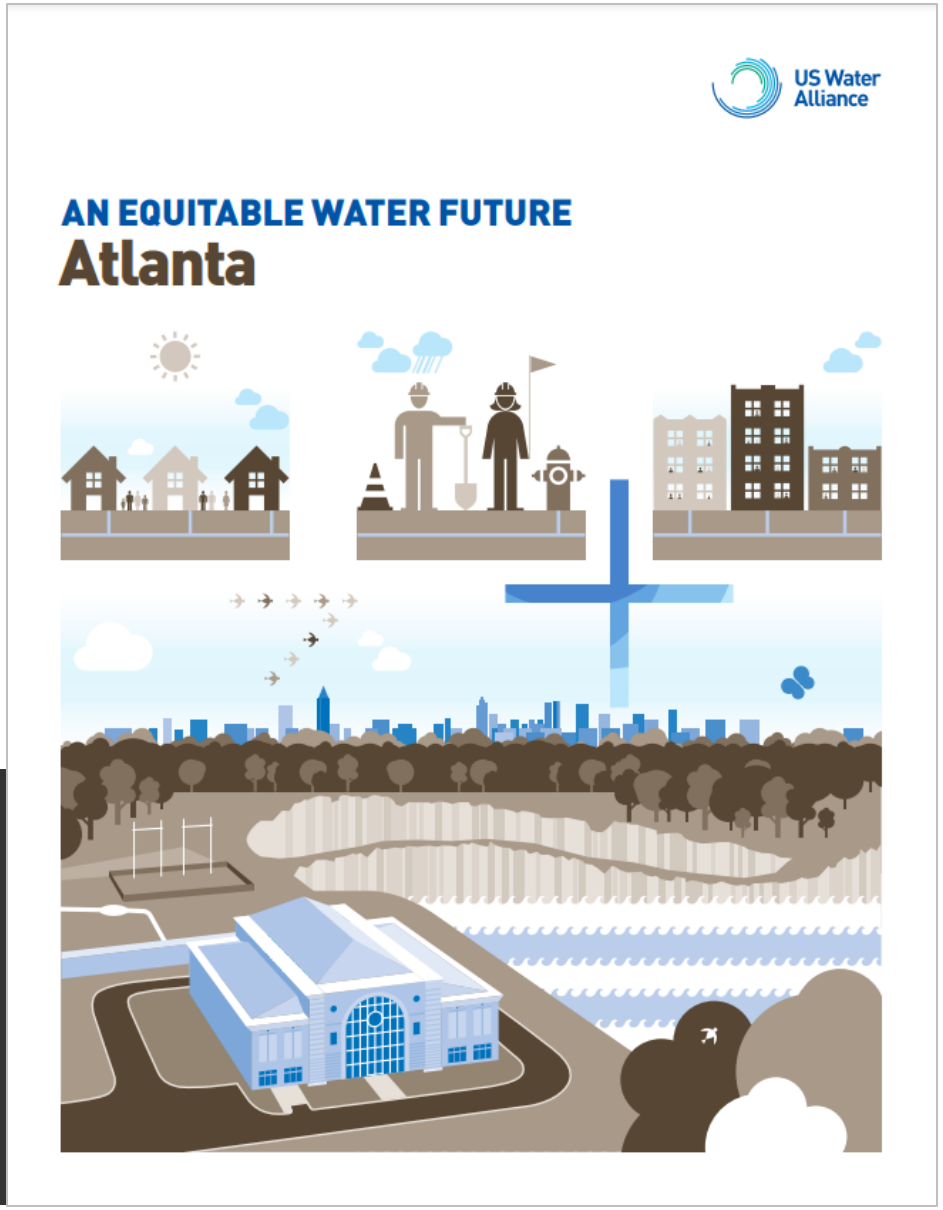
Evolution of Stormwater Management?



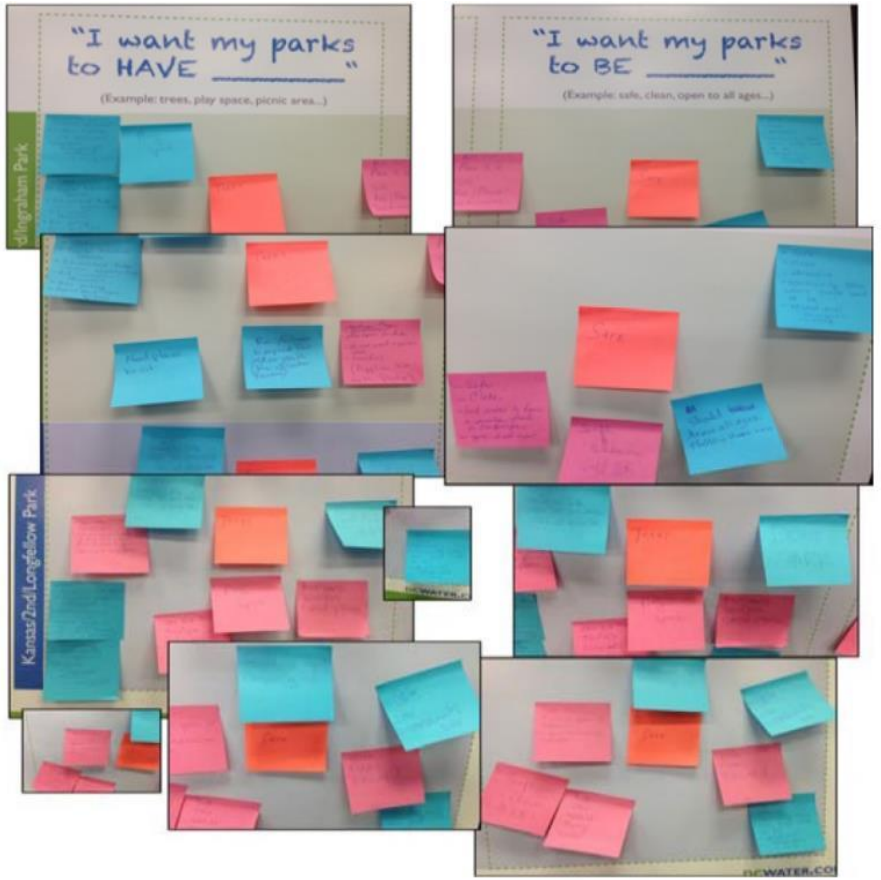
GI and Social Equity

- 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].*
- GI EIB also focuses on flood reduction in these vulnerable neighborhoods, increasing resilience

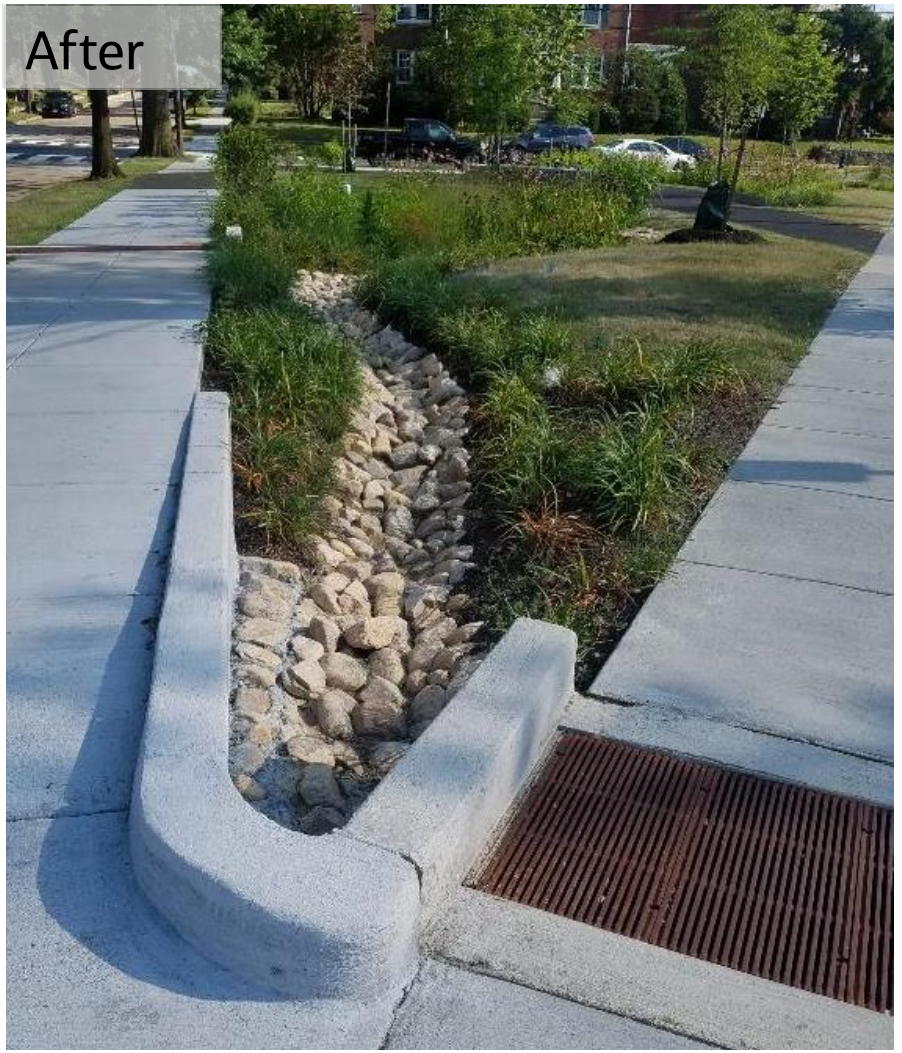
> *"If we think the stormwater and green infrastructure concerns are just about the blue and the green, we have sadly missed the mark. These issues must be people-centered."*
>
> **— Atlanta Watershed Learning Network participant**



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



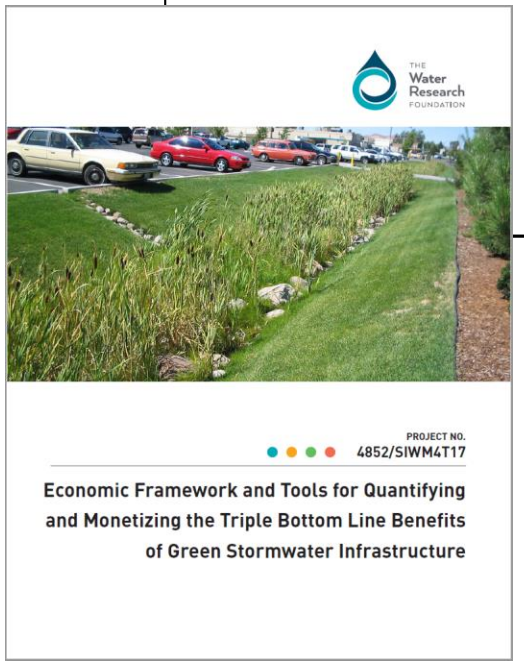
Leading to Community Assets and Functional Green Infrastructure



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

Financial	Social	Environmental
• Avoided infrastructure and/or treatment costs • Avoided maintenance and replacement of non-stormwater assets • Energy savings	• Improved air quality and related health benefits • Water supply benefits • Improved aesthetics and community sustainability/livability • Reduced urban heat stress and related public health benefits • Increased recreational opportunities • Green job creation • Flood risk reduction[a]	• Water quality and associated aquatic habitat improvements • Carbon emissions reduction and sequestration • Terrestrial and wetland ecosystem benefits.

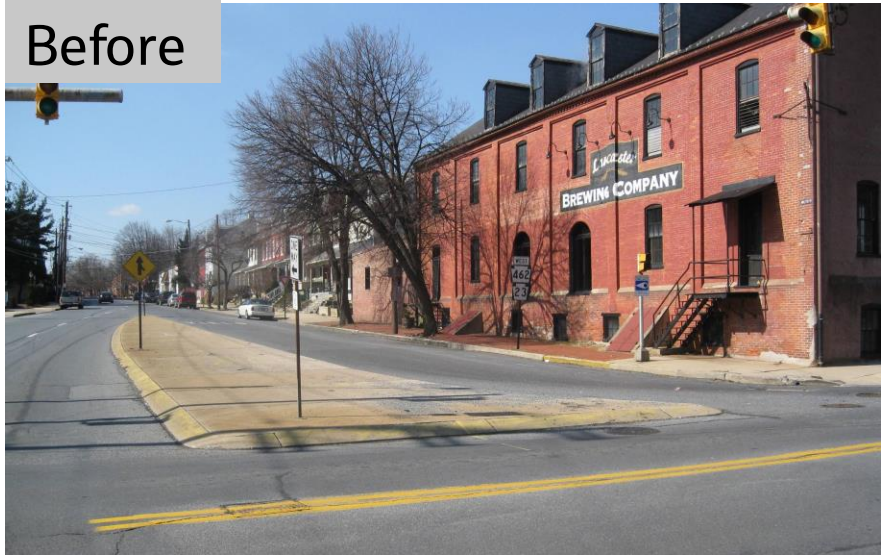


Integrating GSI with safety improvements at Plum and Walnut benefits users, local businesses, and brings new funding sources

- 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

After

Before



After

Onondaga County, NY
Save the Rain Program

Adam Woodburn, RLA – Onondaga County Stormwater
Program Coordinator

Zachary Monge, PE
Jacobs Program Manager

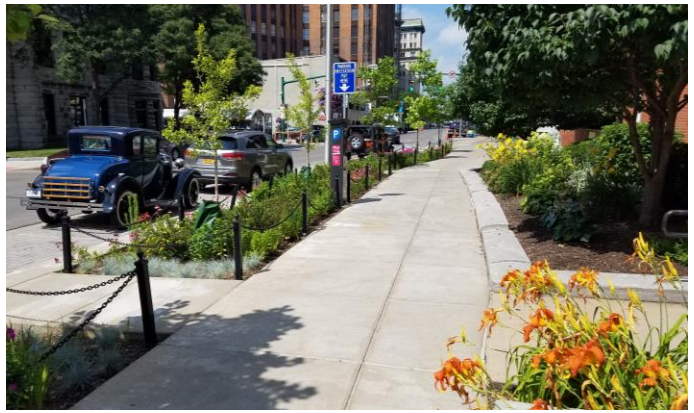
Onondaga County Save the Rain

- First Consent Order in the US to require Green Stormwater Infrastructure (GSI) as part of a combined sewer overflow (CSO) abatement program
- Goal: Improve water quality in Onondaga Lake and CSO tributaries
- GSI compliments the traditional gray infrastructure program
  - GSI more cost effective on a gallon captured/treated basis
  - Gray infrastructure captures much larger volumes

Onondaga County, New York

GSI Implementation

- 1st Project – 2008
- 50th Project – 2011
- 100th Project – 2013
- 200th Project – 2017
- Currently – 245 completed GSI projects
- 206 million gallons of CSO capture/elimination
- $90M USD construction cost

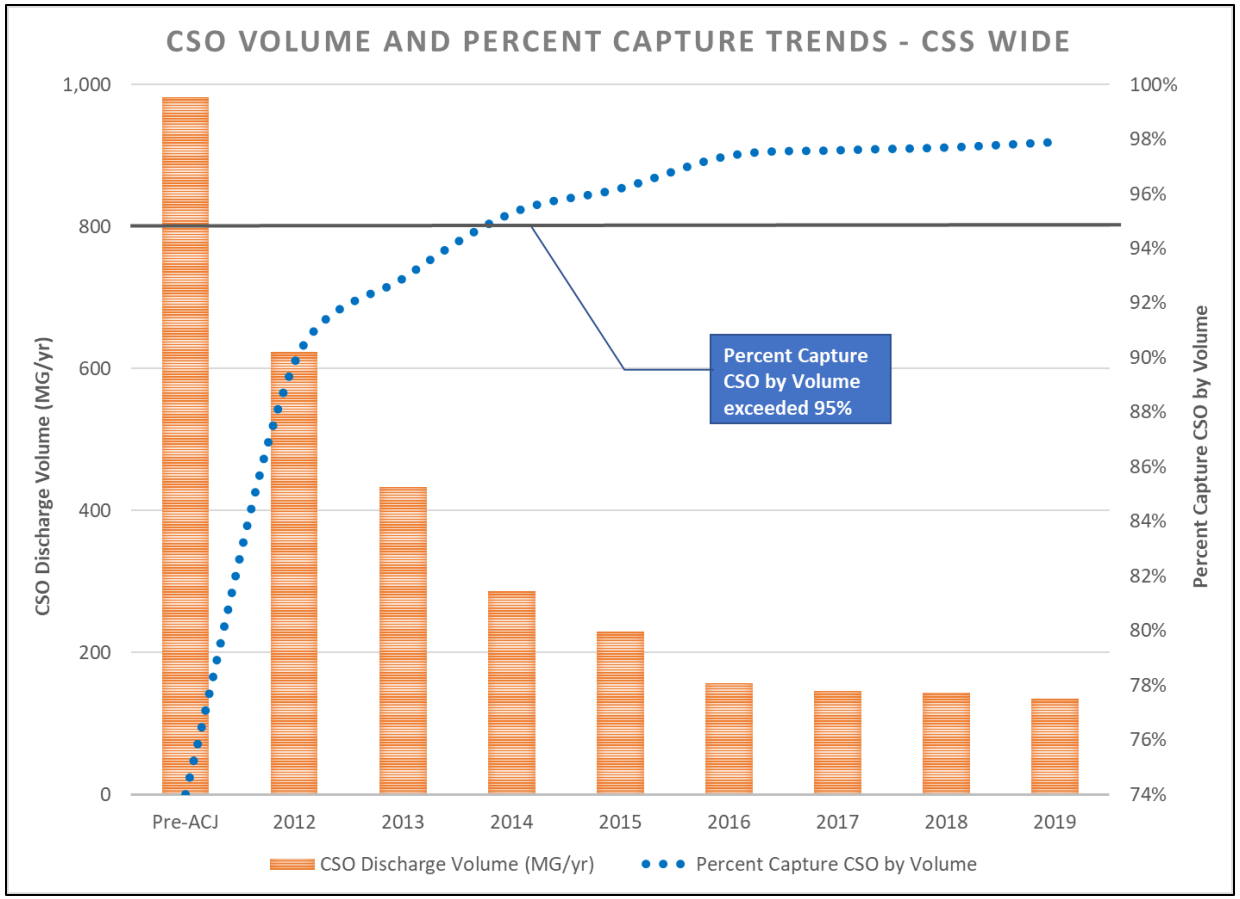


GSI is More Cost Effective than Gray

Project Type	Average County Construction Cost/Gallon of Runoff Captured or Eliminated
Offset/Voluntary Projects with no County Contribution	$0.00
City Road Reconstruction GI	$0.21
GIF – Ground Based	$0.23
Gray Infrastructure – CSO Regulator Optimization	$0.38
Green Parks	$0.42
Green Vacant Lots	$0.47
Green Streets (Excluding Road Reconstruction Projects)	$0.58
GIF – Green Roofs	$0.90
Gray Infrastructure – Sewer Separation	$5.13
Gray Infrastructure – Storage	$12.28

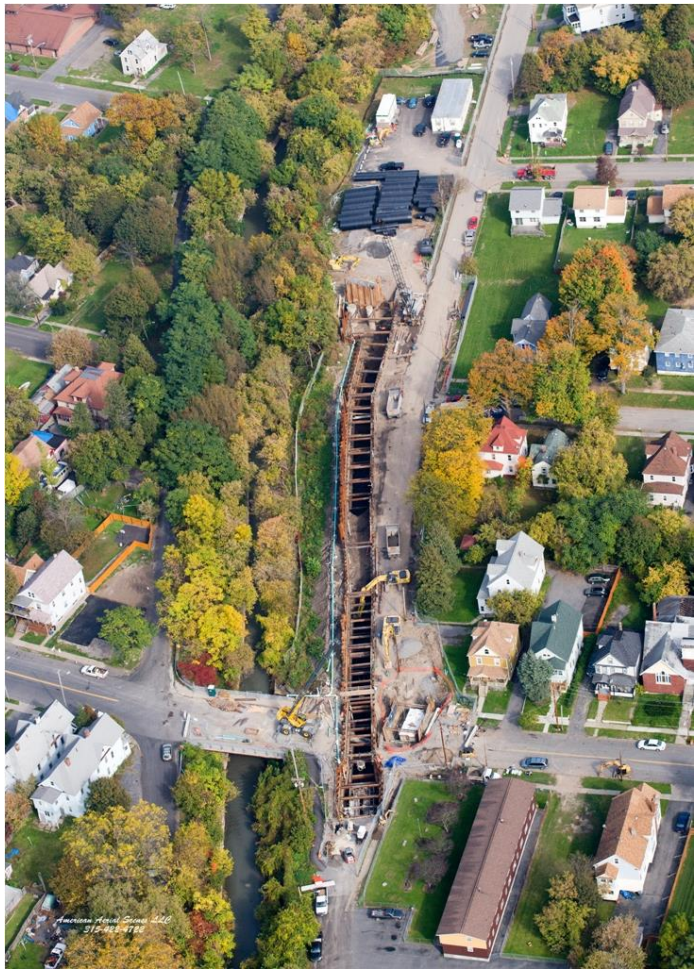
We've Achieved More for Less than Budgeted Cost…How?...GSI!

- Incorporating GSI into CSO program lowered overall cost allowing us to achieve more
- $425M authorized for CSO program in 2008 to meet 95% CSO reduction requirement
- Through 2020, $400M spent
- 98.1% CSO Capture/Elimination achieved through end of 2020
- Under Budget!



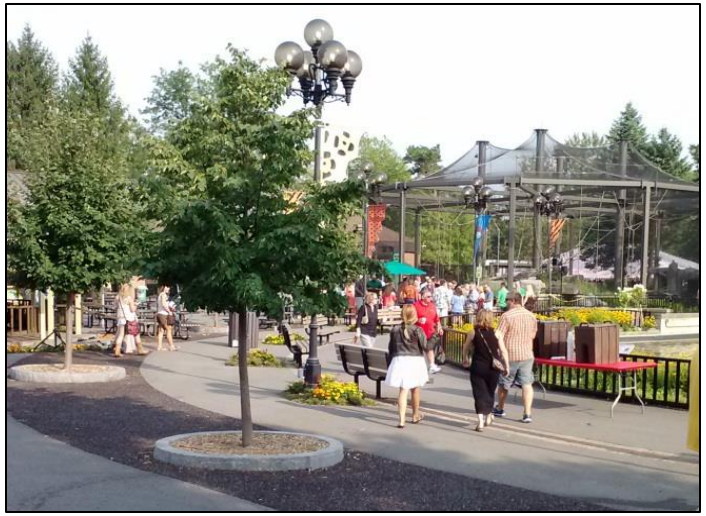
GSI as an Equitable, Community Based Approach

- Traditional stormwater management…



GSI as an Equitable, Community Based Approach

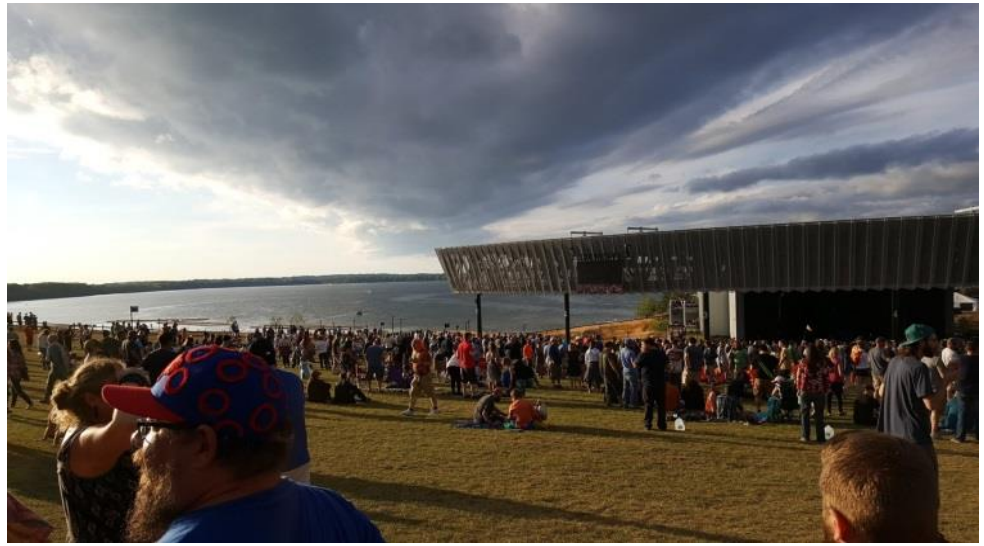
- Stormwater management with GSI…



Impact of Investing in our Community

- Onondaga Lake is clean and a community asset!
  - St. Joseph's Lakeview Amphitheatre, Loop the Lake Trail, Fishing Tournaments, Potential Future Beach, Boost in Recreational Activity
- Economic development
  - Increased property values, vacant lot redevelopment
- Job Creation
- Environmental Benefits – Not just water quality improvements
  - Air quality, Reduced Energy Usage, Reduced Climate Change Impacts

Impact of Investing in Our Community



In the KNOW:
Green infrastructure for healthy communities

Sidmouth Amphitheatre, Devon, UK

Dual-use Sustainable Drainage Systems (SuDS)

Paul Hargreaves,
Senior Associate Director, Jacobs

16th December, 2021

In the KNOW: Green infrastructure for healthy communities

Today's presentation will give a high-level overview of the award-winning Sidmouth Amphitheatre dual-use SuDS project, in Devon, UK:

- Why was the project needed?
- Historic context
- What were the drivers for a multi-functional solution?
- The concept
- Communicating the vision
- How does it work?
- Common questions from the client side

Why was the project needed?

Typical narrow street in Sidmouth

Overland flow routing in Sidmouth town centre

Historic context

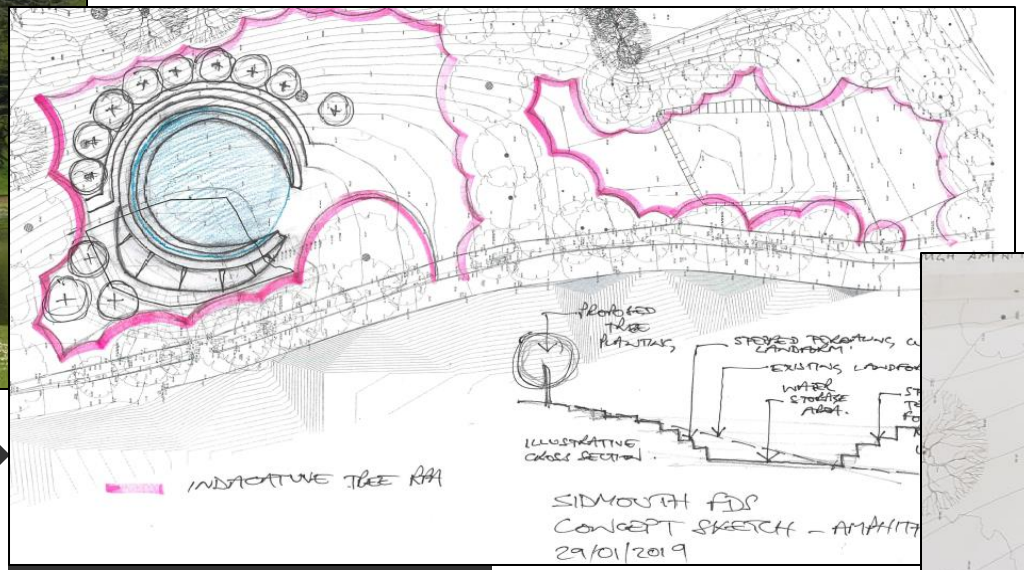
- In the 1830s the Knowle Arena was home to a Zoological gardens
- Sidmouth International folk festival from 1955 through to 2004
- Fast forward to 2021, and the Knowle Arena is a much-loved park

1955 International folk festival

What were the drivers for a multi-functional solution?

Inspiration

Claremont Gardens, Esher, UK



Original landscape architect concept

Early SuDS sketch

The concept

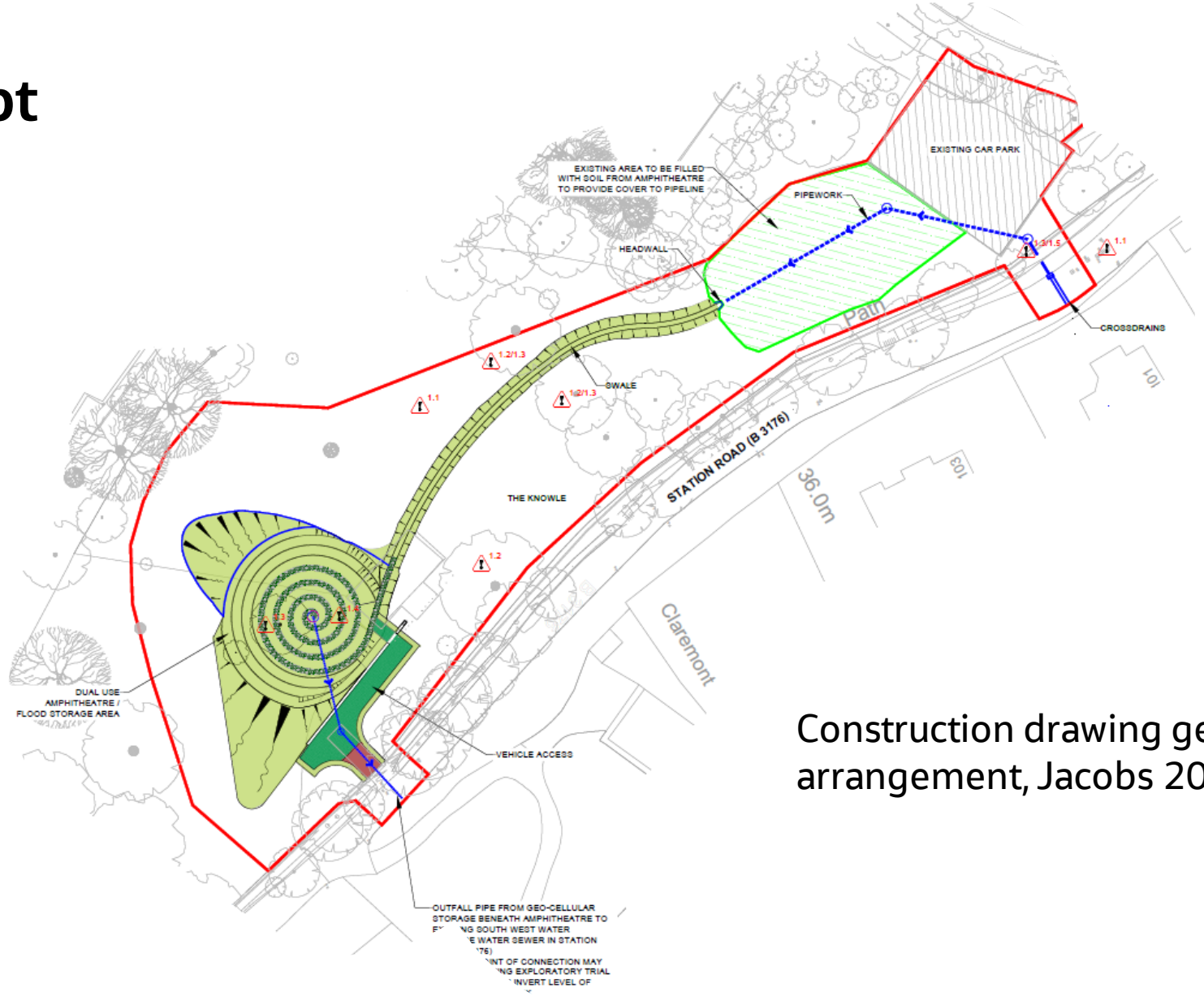
“ No one imagined that a scheme that obviously requires a significant volume of water to be intercepted and stored before it gets to the town could in effect be hidden in plain sight, giving the community a real asset that will be a draw for people.”

— Sidmouth County Councillor Stuart Hughes, 2021

Storage crates, November 2021

Looking north across Amphitheatre, October 2021

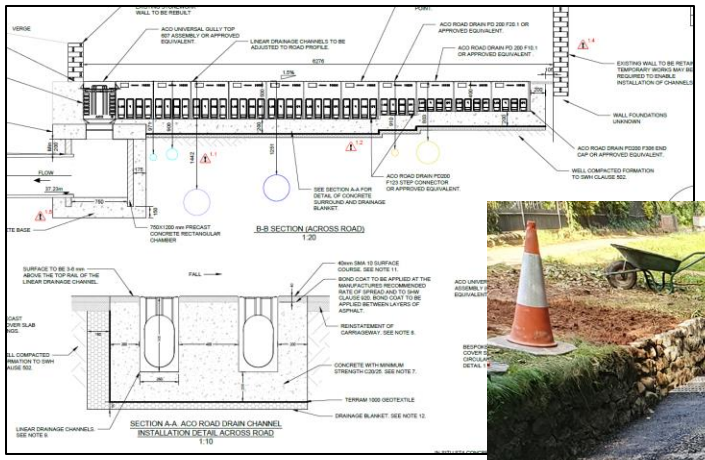
The concept



Construction drawing general arrangement, Jacobs 2020

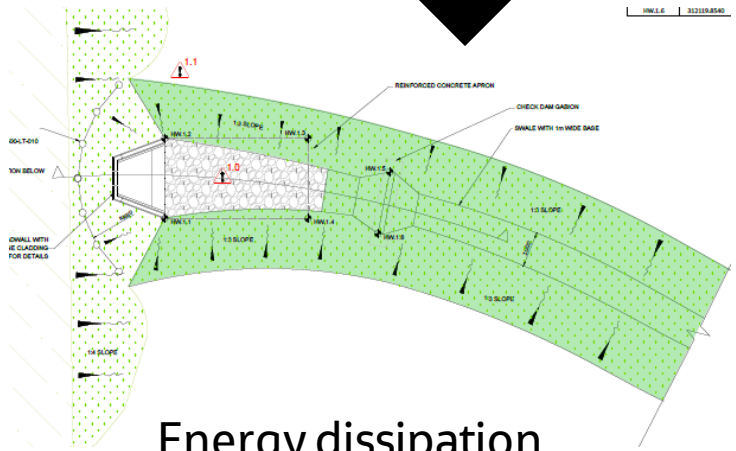
How does it work?

- From source to discharge
  - Cross drains on Station Road
  - Pollution control valve
  - 60m / 197 ft long conveyance pipeline
  - Energy dissipation headwall
  - Check dams
  - 90m / 295 ft long swale



Cross drain general arrangement & photo during construction

Swale, with wildflower sides & reinforced turf base



Energy dissipation headwall & check dam

How does it work?

- From source to discharge
  - Dual-use amphitheatre (flood storage and performance arena)
  - 145m / 476ft long spiral filter drain
  - 20m / 66ft diameter 300mm / 1ft thick drainage blanket (above and below storage tank)
  - 3,000 geocellular crates (400m3, or 150,000 gallons)
  - Central flow control chamber
  - Infiltration to ground as well as controlled discharge to sewer
  - Spillway for exceedance events

Looking north-east, 2021

Looking south-west across Amphitheatre, 2021

Communicating the vision

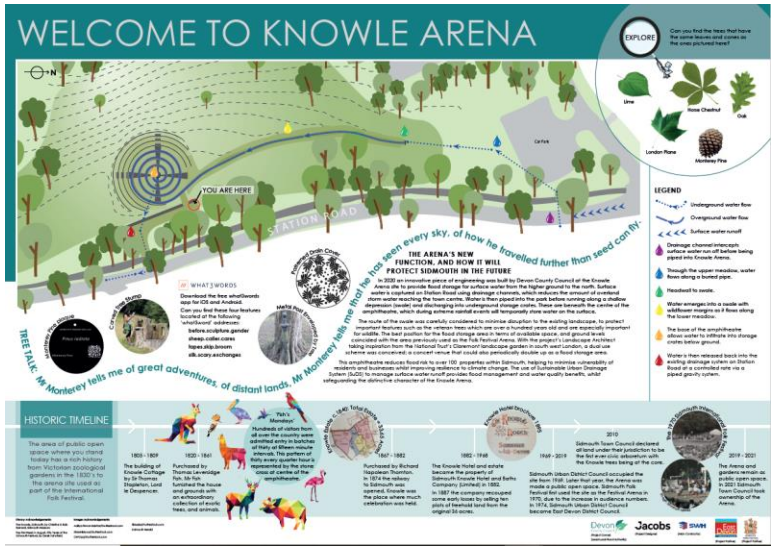
Artist's impression, Jacobs 2020

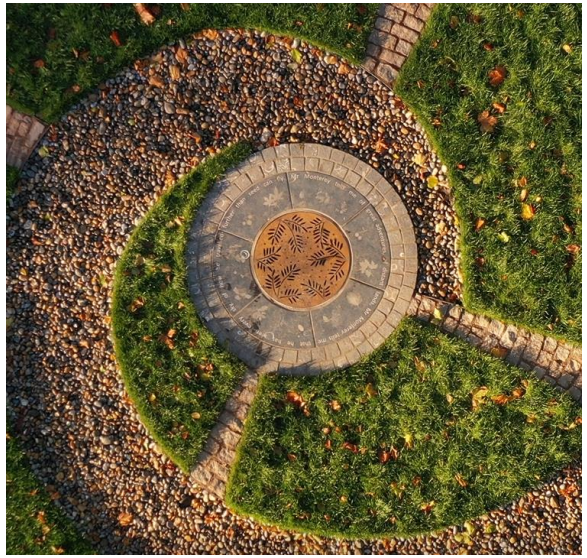
Communicating the vision

3D Studio Max visualisation, Jacobs 2020

Common questions from the client side?

- Is it really necessary to have such a high-quality finish?
  - Artful approach is valued by the community
  - High quality finishes can tell a story
  - Public interpretation boards explain the purpose
  - Positive economic impact
  - Reduces the likelihood of vandalism & theft





Common questions from the client side?

- What about the safety implications?
  - Flooding (frequency and depth)
  - Falls & trips (headwall and cut-off wall)
  - Theft of metalwork (central flow control chamber)
  - Exceedance (spillway)
  - Earthworks failure (cut-off drainage, and cut-off wall)

Drone aerial image of Amphitheatre, Jacobs, 2021

Common questions from the client side?

Flow control chamber self rising cover, Jacobs, 2021

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Questions & Answers

Thank You

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