

Restoring Streams to Enhance Resilience, Protect Infrastructure and Advance Equity

SAME GKC Post Industry Day

Laura Adams & Matt Scott | Black & Veatch

Introductions



Laura Adams, PE, ENV SP
Nature-based Solutions Lead

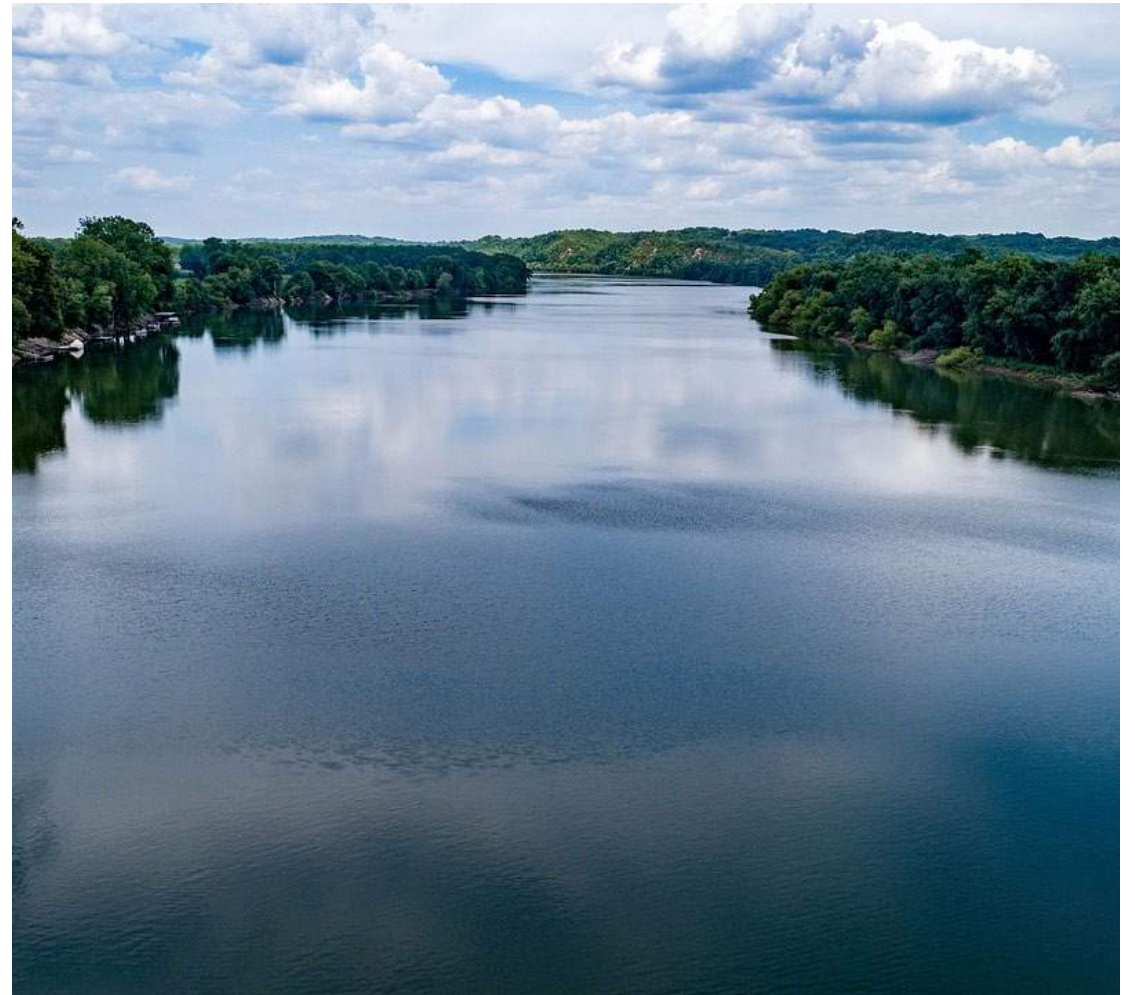


Matt Scott, PE
KC Regional Planning Lead

Workshop Agenda

Agenda

- Setting the Stage
- Emerging Best Practices
 - Resilience
 - Protecting Infrastructure
 - Advancing Equity
- Case Study
 - Florida's Extreme Climate
 - McCoy's Creek Restoration
- Reflections



Today's Objectives

Be inspired to think about what our region needs to advance restoration of natural resources, and what is possible for your community.

Understand a new approach to rapid hydro-bio-geomorphic assessment.

Learn from one another about the outstanding opportunities to advance equity as we restore ecosystems.





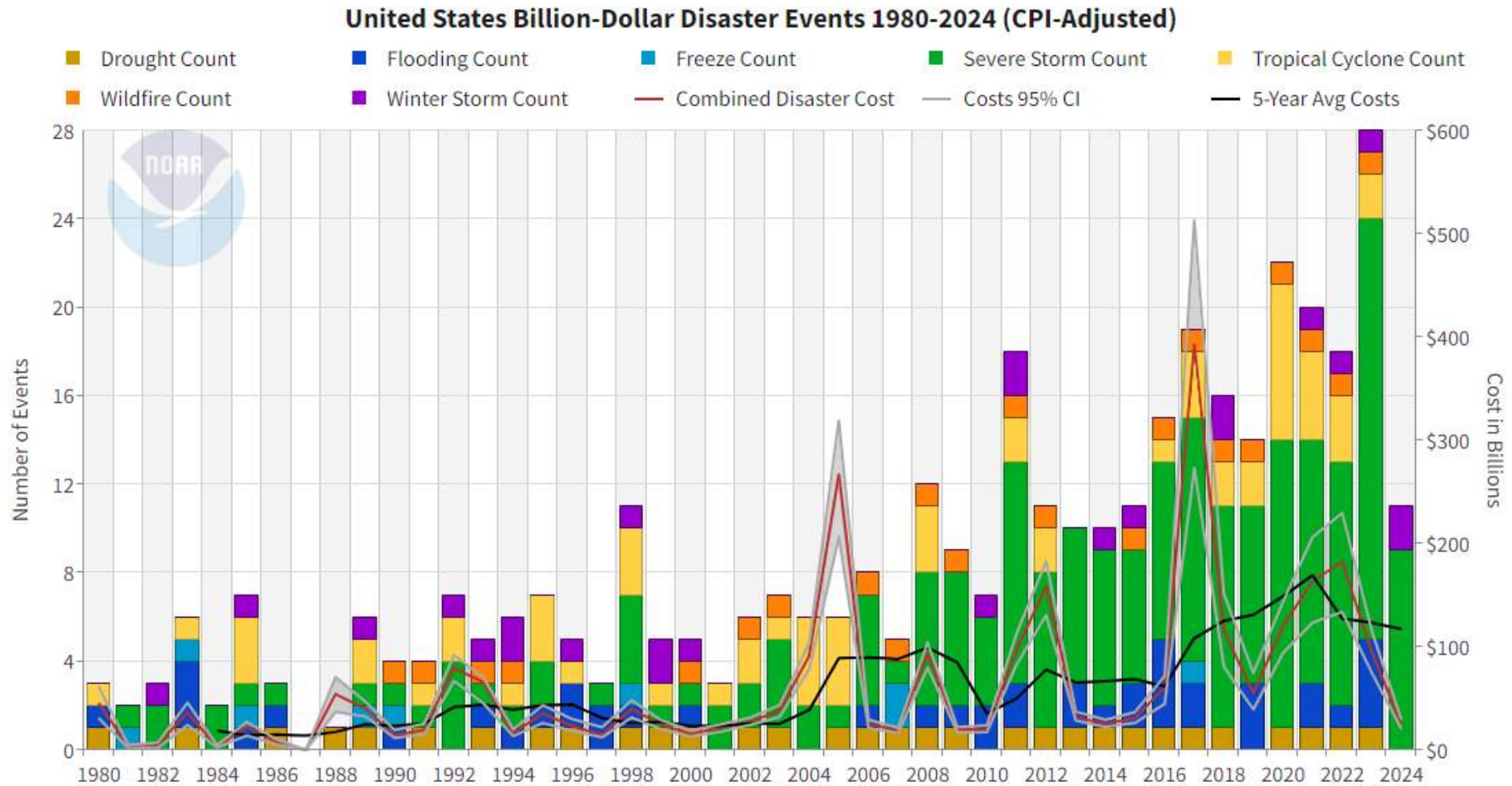
Setting the Stage

Driving Influences & Trends

Drivers of Changing Runoff Intensity



National View - Driving Influences & Trends



NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2024). <https://www.ncei.noaa.gov/access/billions/>

KC Region Stormwater Drivers

**Stream
Erosion &
Migration**



**Increased
Intense Storms
& Flooding**



**Degraded
Water
Quality**



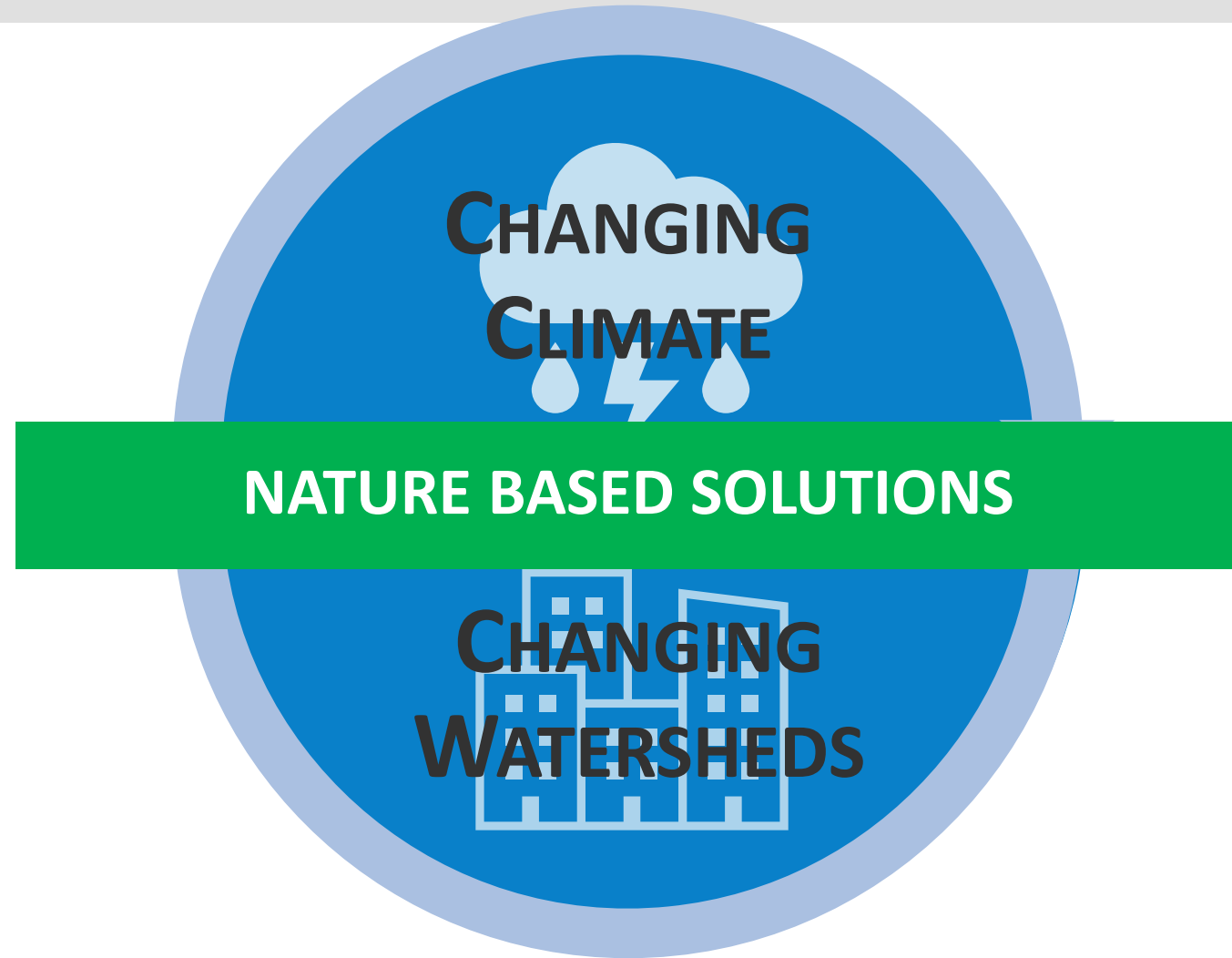
Mitigation



\$4-6 for every \$1

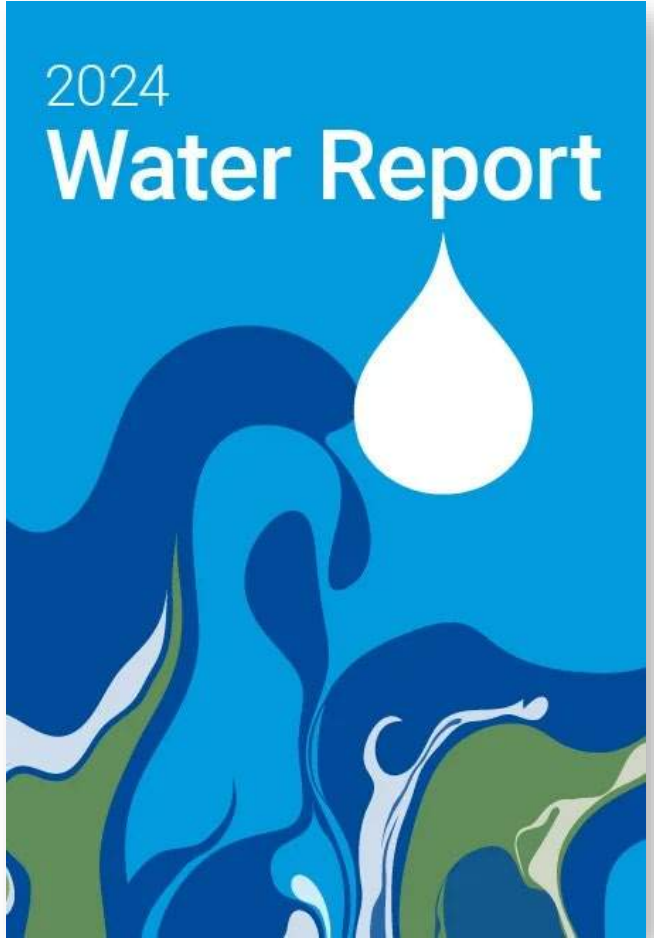
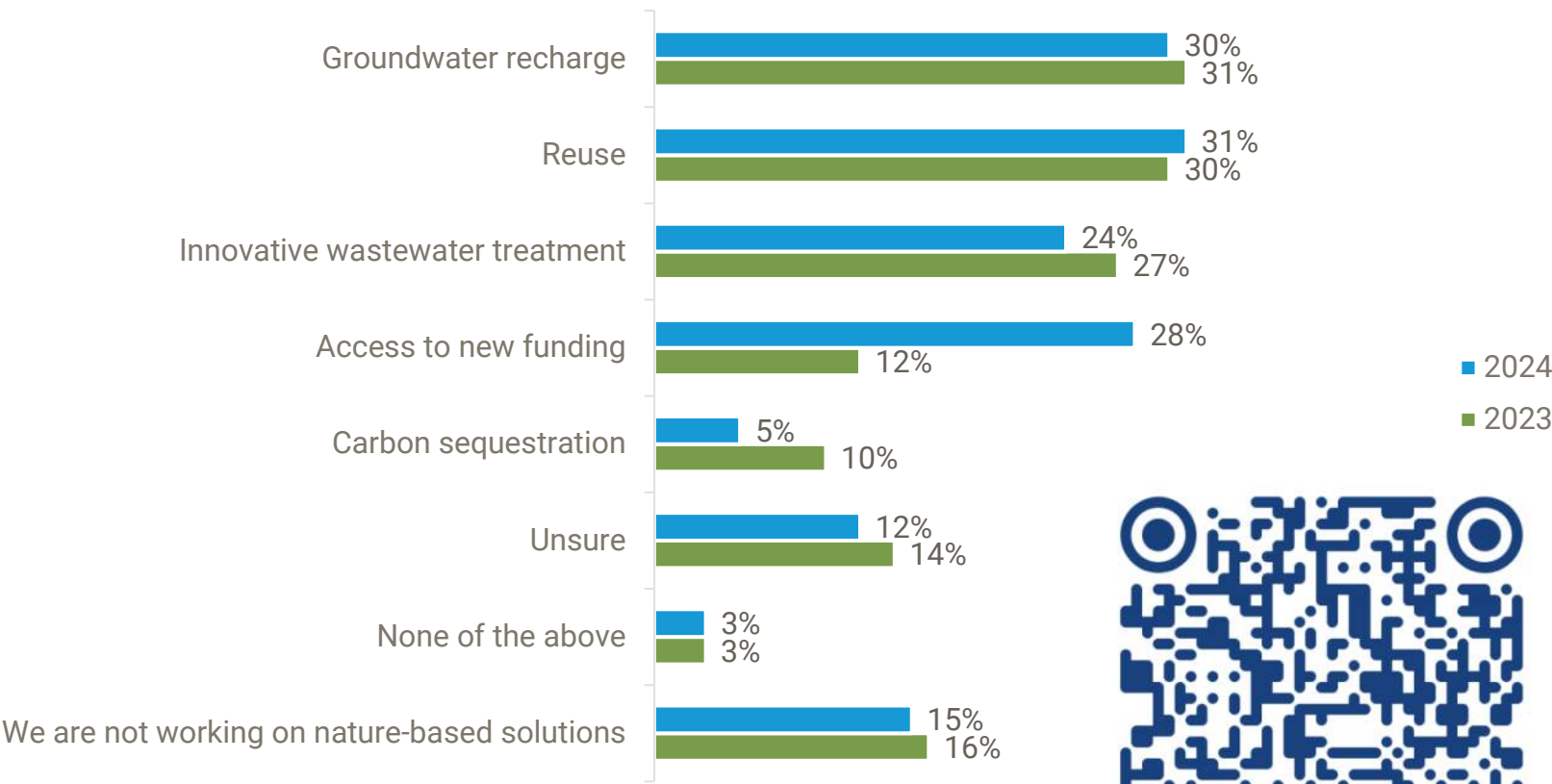
Reduction on future disaster costs by
mitigation (National Institute of
Building Sciences, 2017)

Mitigation Disrupts Cycle



Nature-based Solutions & Resilience

What priorities are driving integration of nature-based solutions?





Emerging Best Practices

Resilience

Protecting Infrastructure

Advancing Equity



Infrastructure

The ability of assets, networks, operators and systems to anticipate, absorb, adapt to, and / or rapidly recover from a disruptive event.

Providing hardening and protection against damage or disruption.

Assets designed and maintained to operate under a range of conditions and mitigate damage or loss from an event.



Availability and level of back-up installations or spare capacity.

Fast and effective response to and recovery from disruptive events.

Enhancing Resilience

Room for the River

Netherlands increasing capacity of rivers at 30 locations, moving levees inland, lowering flood plains

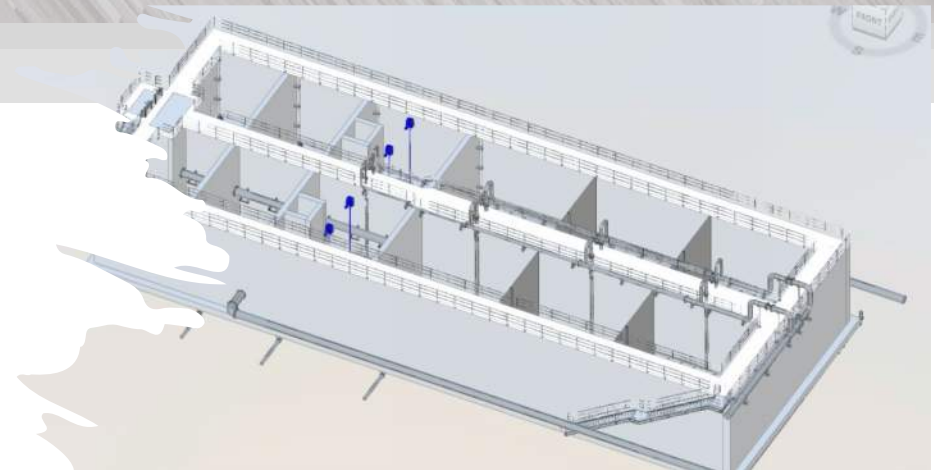


Protecting Infrastructure

Aging Infrastructure is the Challenge of our Generation

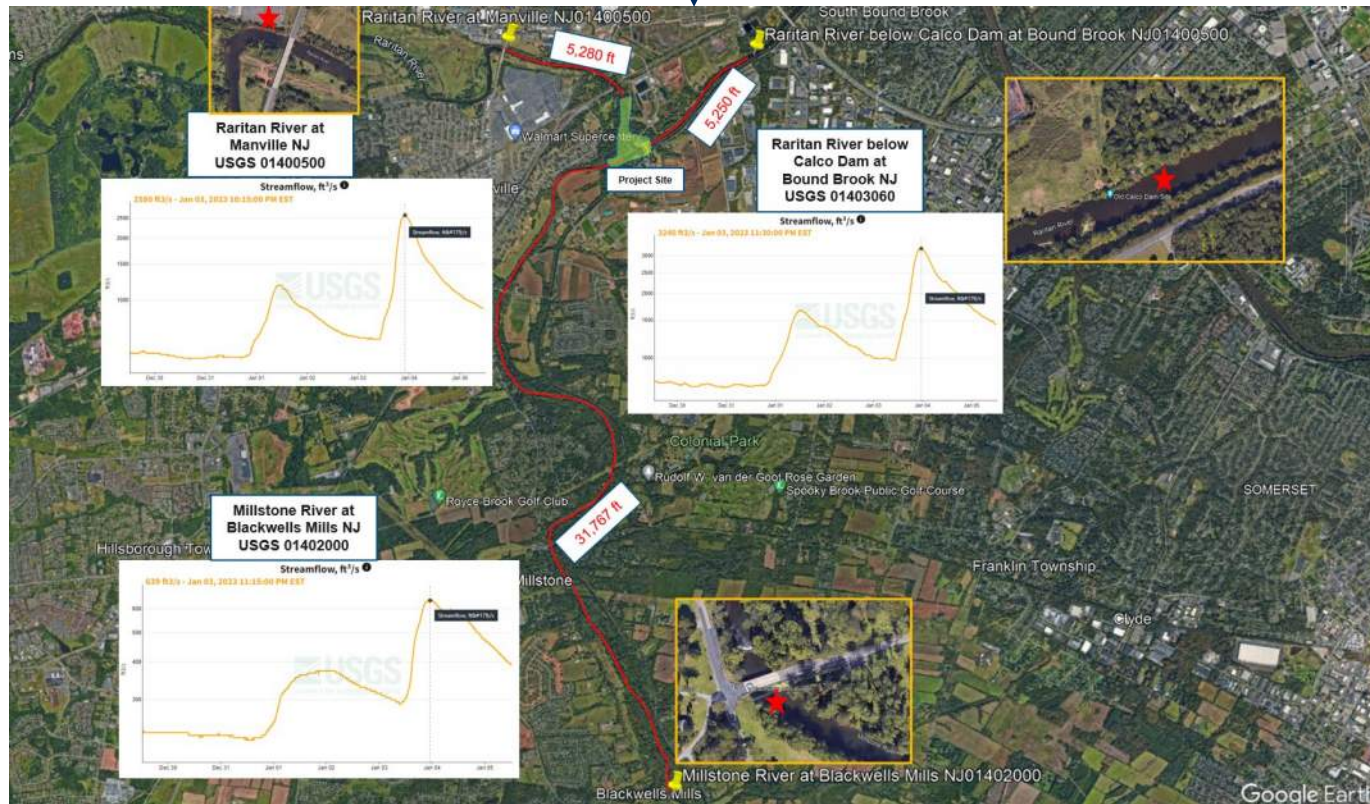
Maximize Useful Life & Capacity

Emerging **Hydraulic Modeling Tools** should be **Aligned with Purpose**

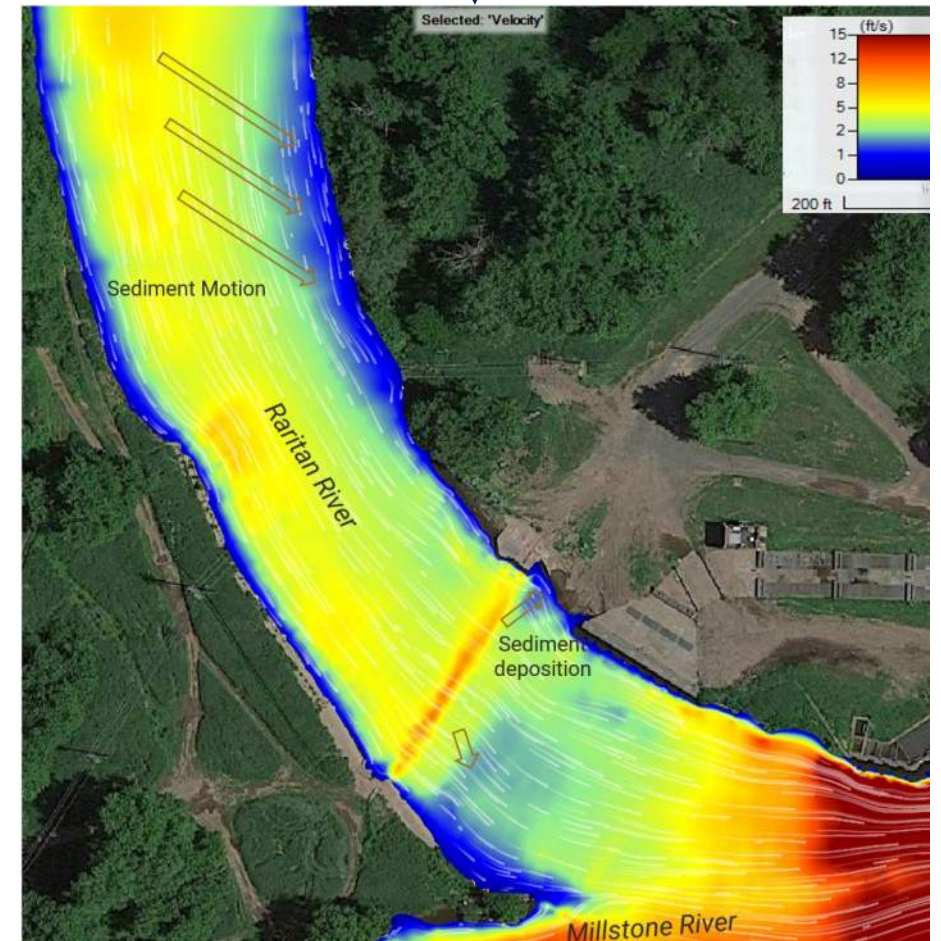


Protecting Infrastructure

Calibrated to River Discharge and Stage Data



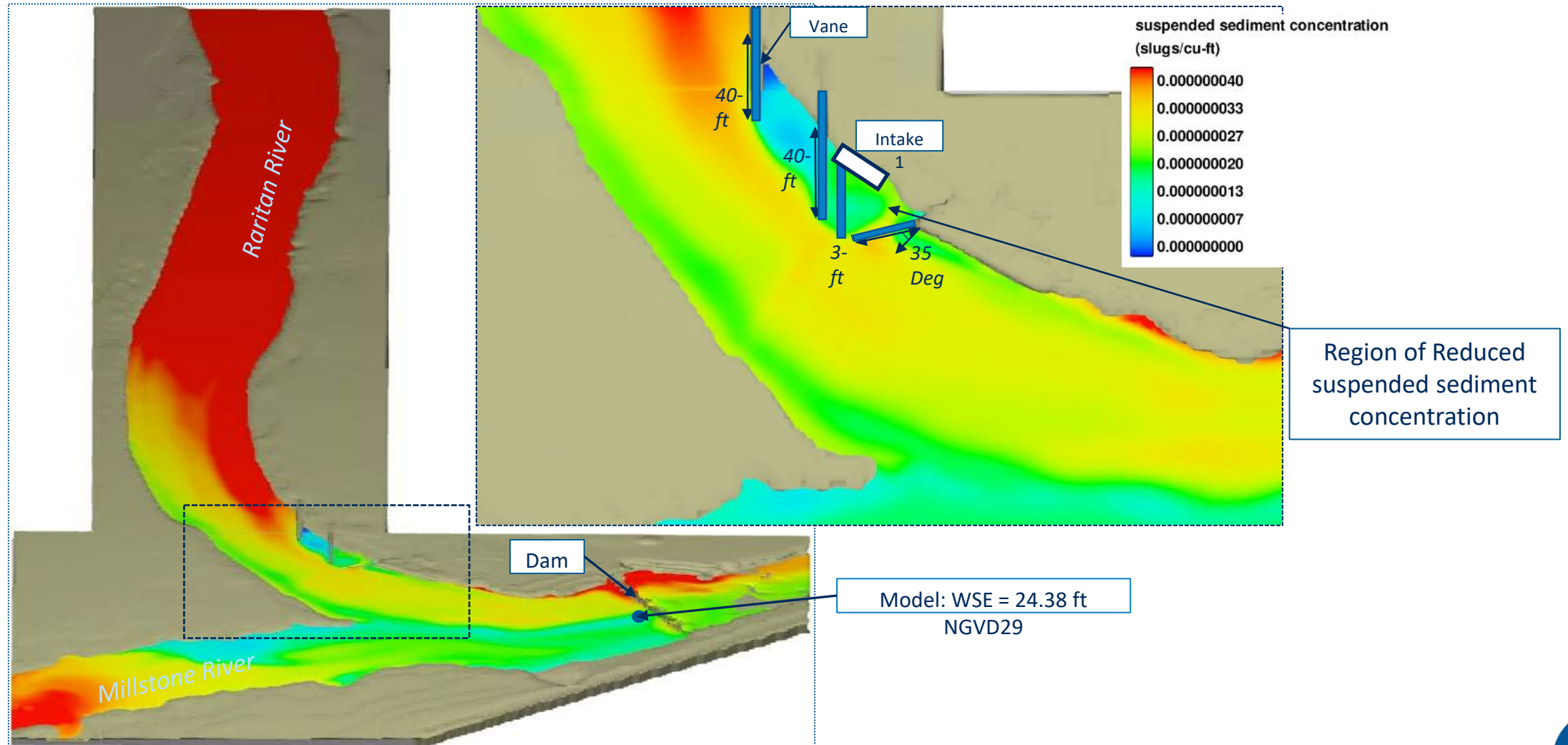
Larger Domain



Simulated Flow Velocity Contours

Protecting Infrastructure

3D CFD Modeling



Communities Have New Expectations for Infrastructure

- What do today's infrastructure projects need to deliver?
- How are we rethinking projects for the public good?
- What lessons can we learn from our past work to create vision and partnership for our future?



Fontenelle Lagoon Rendering by Vireo

Advancing Equity

Fairness

Justice

Identity

Power

Inclusion

Access

Agency

Subjectivity

Vulnerability

Discrimination

Disinvestment

Equity initiatives and policies require we confront complex, weighty topics.

Centering equity in resilience planning is a way to prioritize and address the uneven distribution of environmental burdens and historical injustices.

At the core:

Fair treatment for all people.

Advancing Equity

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Justice

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Disinvestment

Equity in Infrastructure

Justice40 Initiative to advance climate justice, deliver equitable investments

The Environmental Justice Scorecard
Climate & Economic Justice Screening Tool

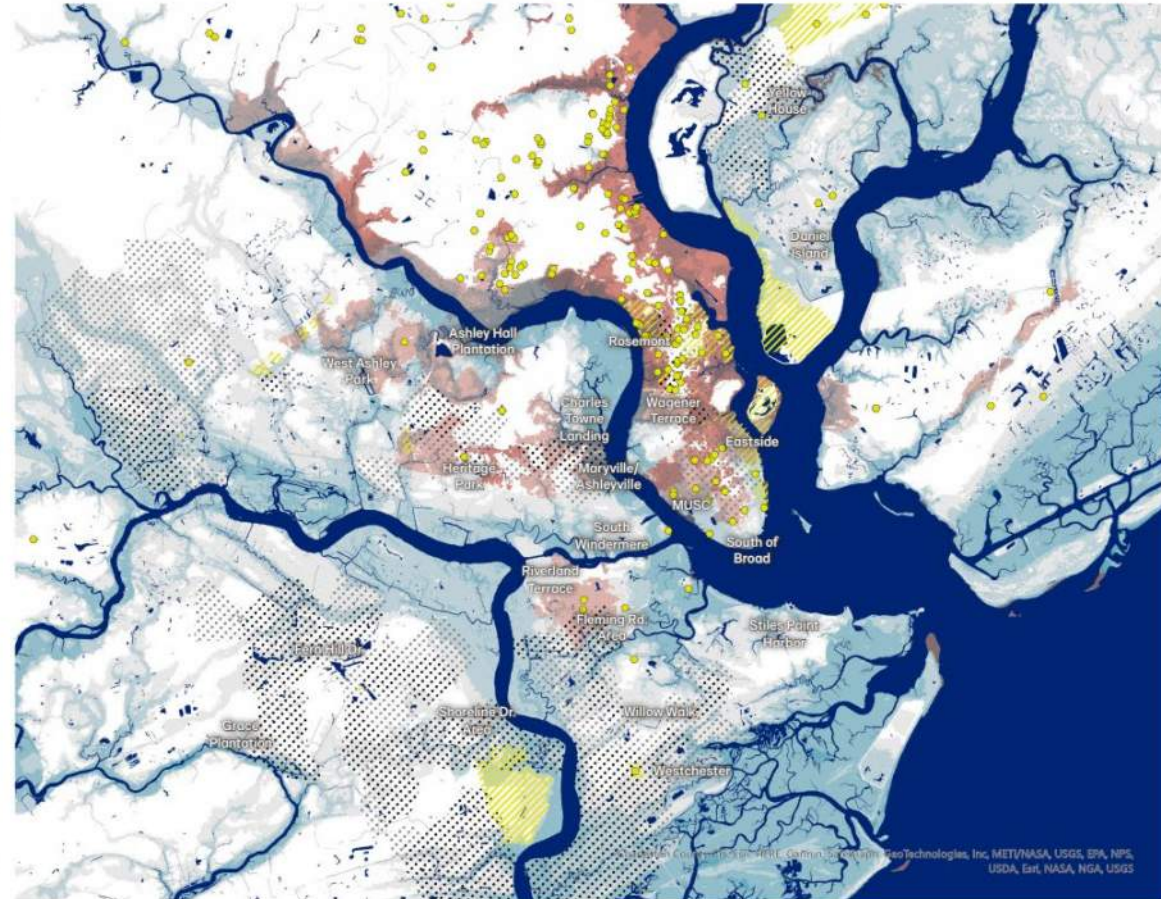
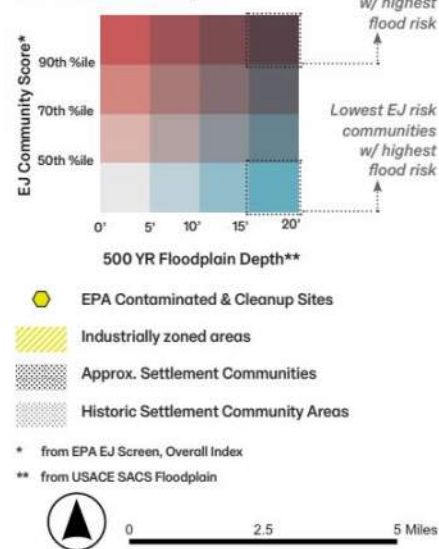
Advancing Equity

Fairness
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Identity
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Disinvestment

Charleston EJ Areas within 500 YR Floodplain From EPA EJ Screen Overall Index & SACS Floodplain Data

This map highlights both flood and environmental justice risks facing some communities in Charleston. Any area colored in grey, blue, or red is within the 500 year floodplain, meaning they will likely experience some level of flooding if a 500 yr surge event occurs. The deeper blue and purple areas will experience higher floodwaters, whereas lighter blues and pinks will experience shallower floodwaters. The areas colored in this map also have varying amounts of environmental justice risks, which are identified and quantified by the US EPA. Any area showing pink, red, or purple has greater total environmental justice risks than 50% of the nation. Areas of deep reds and purples have greater environmental justice risks than 70% of the nation.

Legend EJ and 500 YR Floodplain





Case Study

Lessons from Florida's Extreme Climate



Resilient Florida Stream Systems

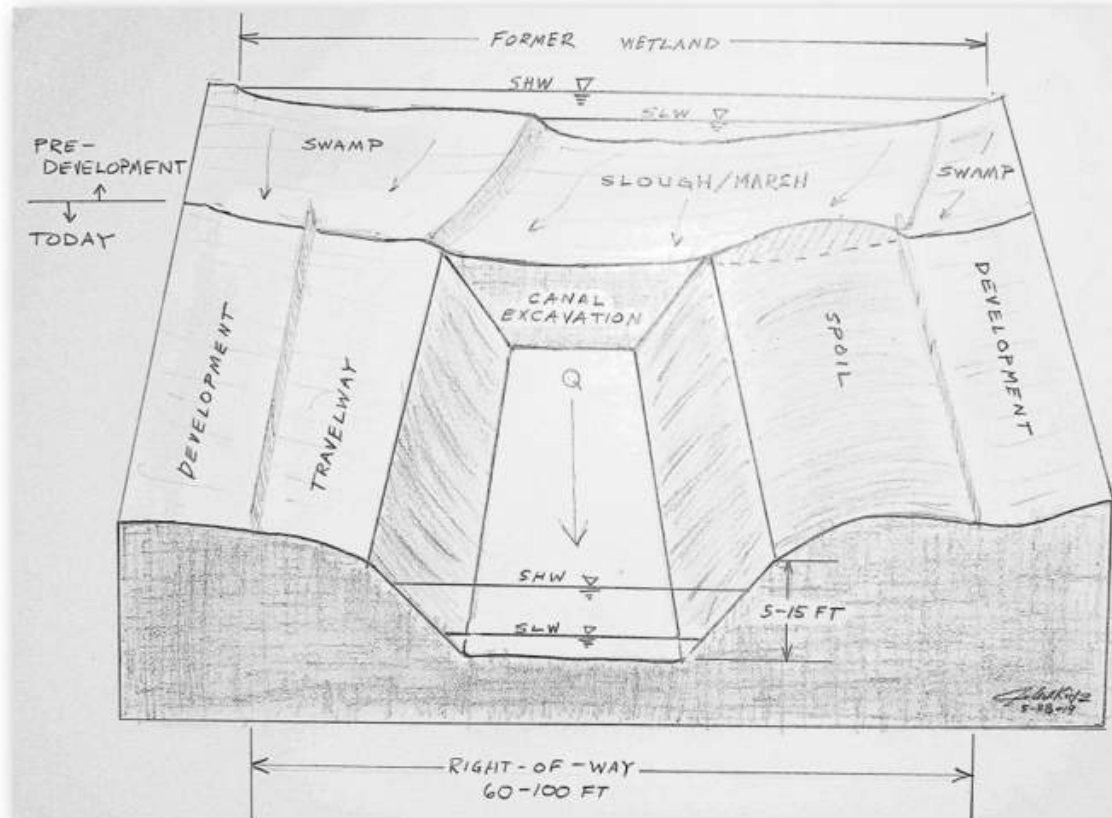
Florida systems adapted to intense rainfall and runoff conditions over millennia.
What aspects of these systems contribute to their resilience?



Priority 1 Restoration – at Myakka River State Park. July 2023.

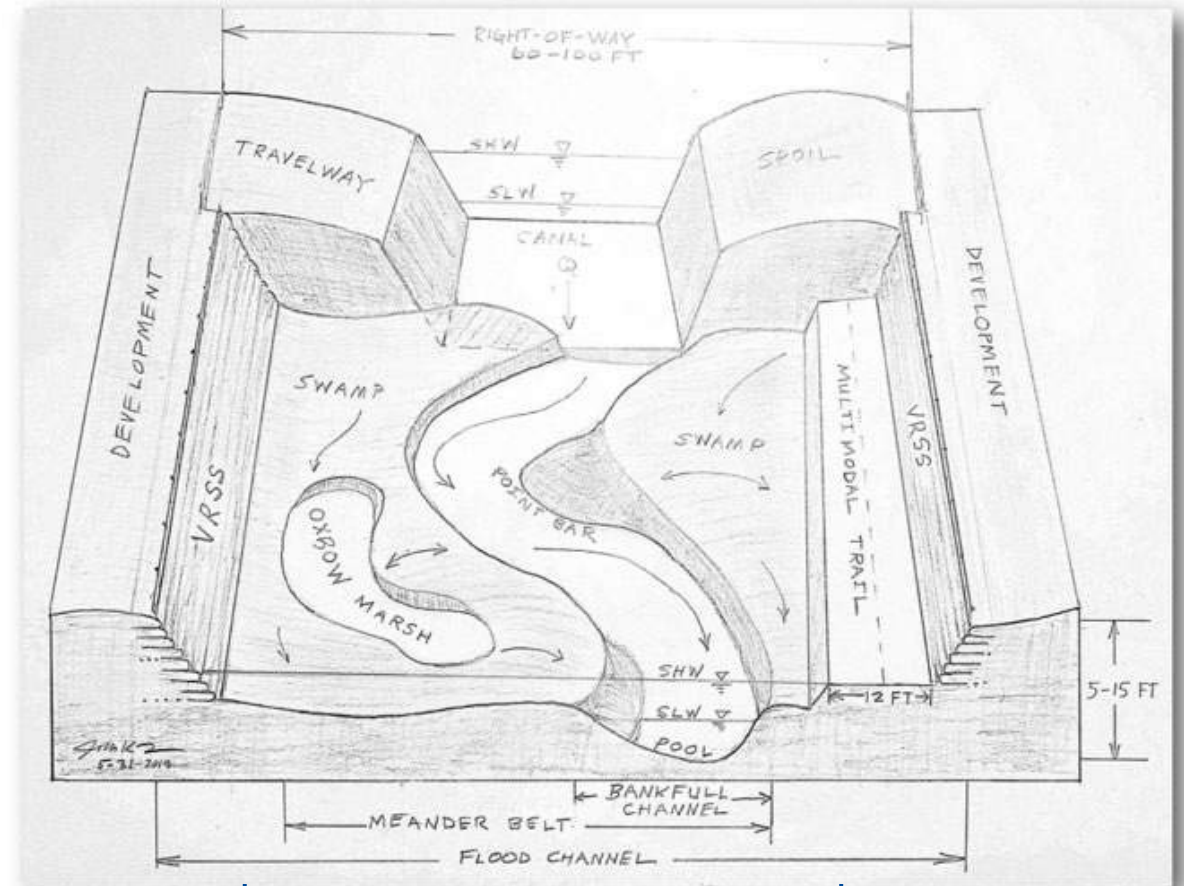
Priority 2 Stream Restoration

Developed Entrenchment



Resists ambient forces

Natural Channel Design



Self-adjusts to ambient forces

Florida Conditions & Stream Systems

Regional Variation

5 hydrophysiographic zones with differing rainfall patterns

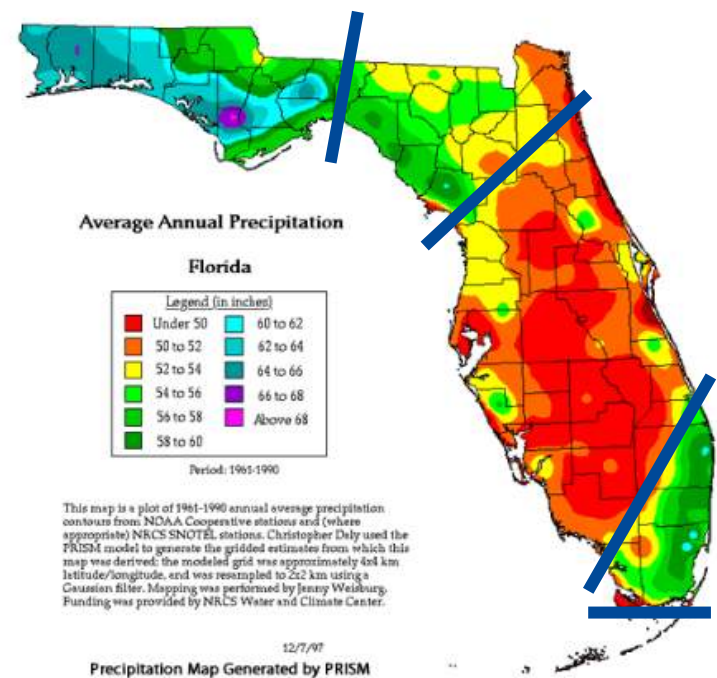


Figure 2.1. Florida's Annual Rainfall.

Watershed Type Variation

3 watershed types with differing drainage and runoff patterns

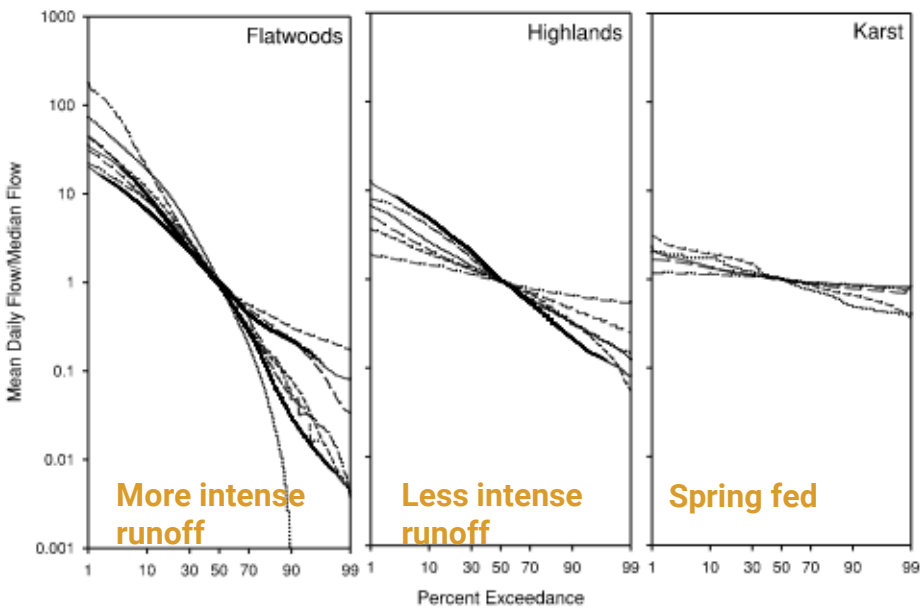
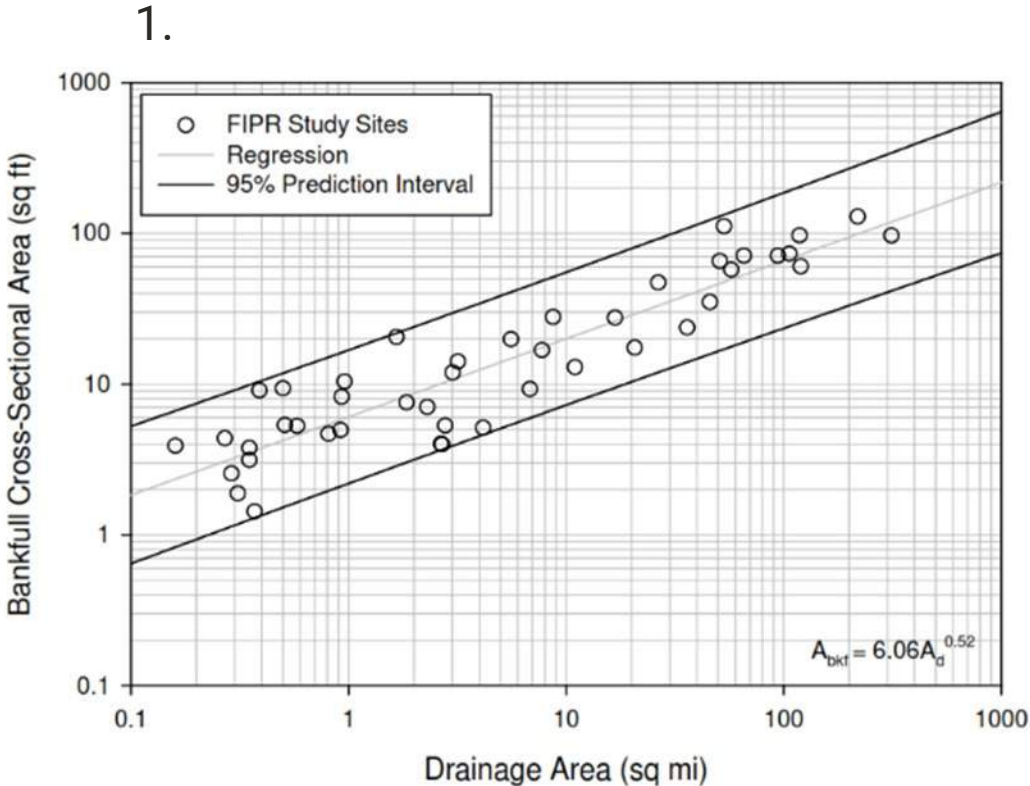


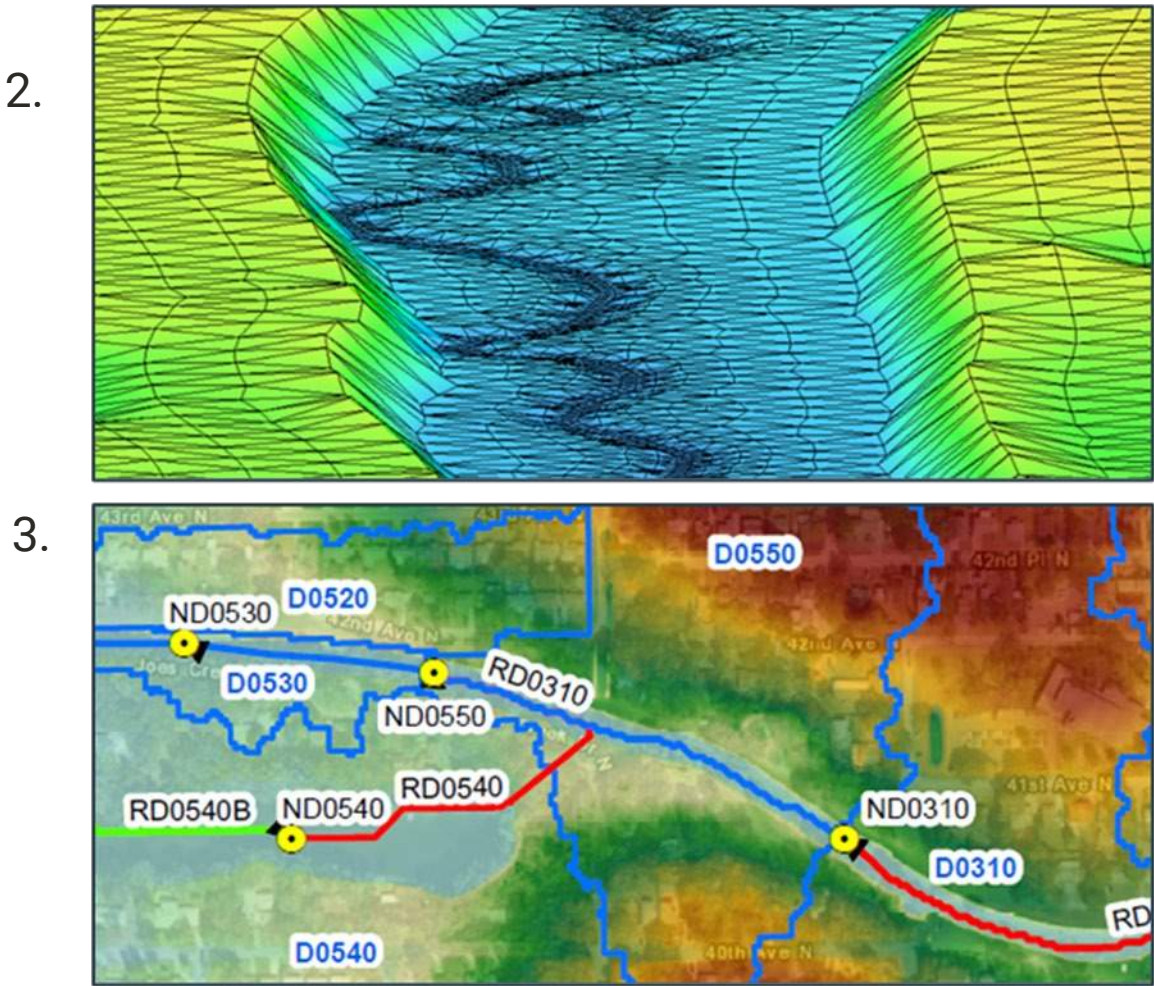
Figure 2.8. Flow Duration for Perennial Streams Draining Three Watershed Types.

Width Sufficiency Determination

Bankfull Channel - Empirical



Flood Channel – Empirical + Hydraulic

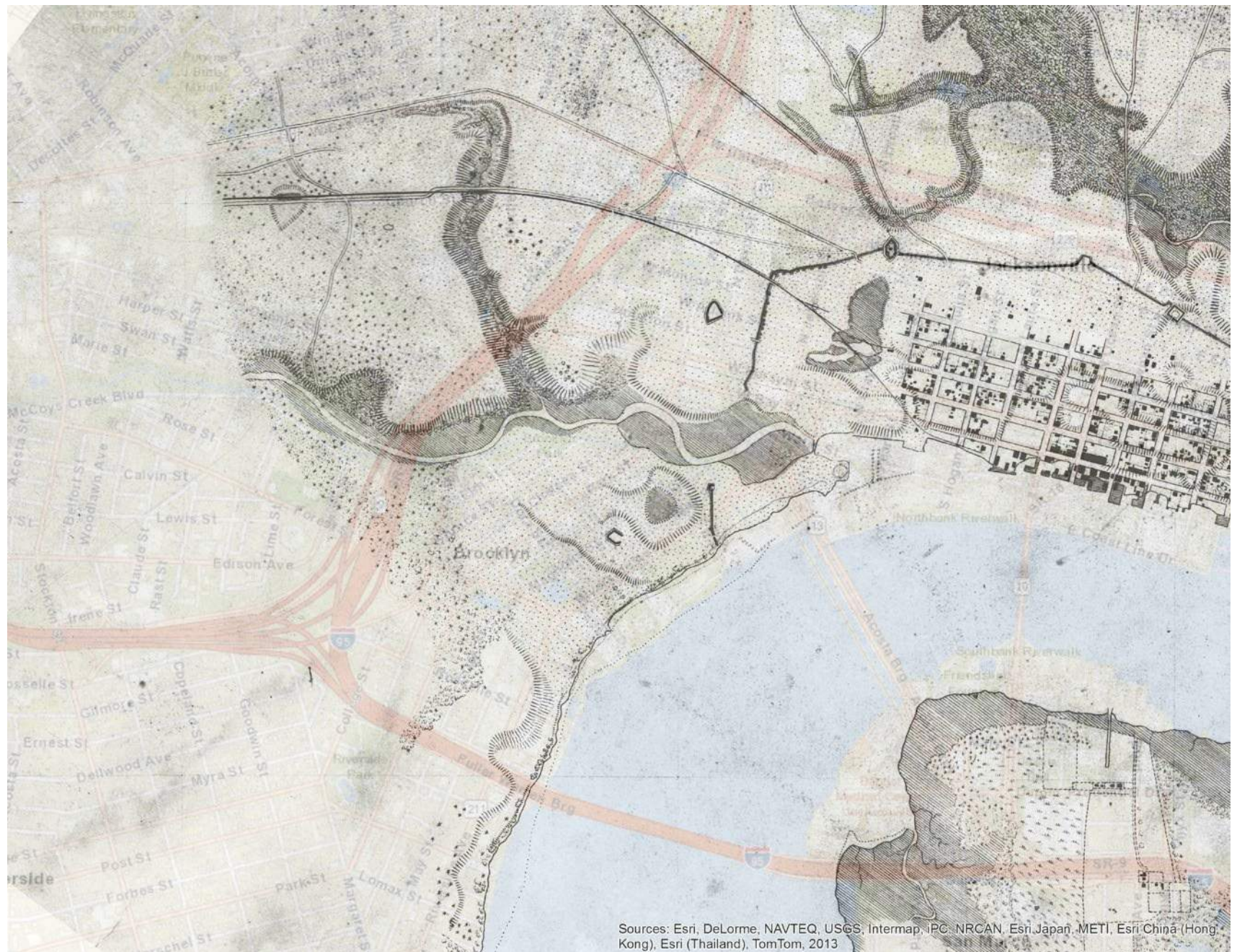




Case Study

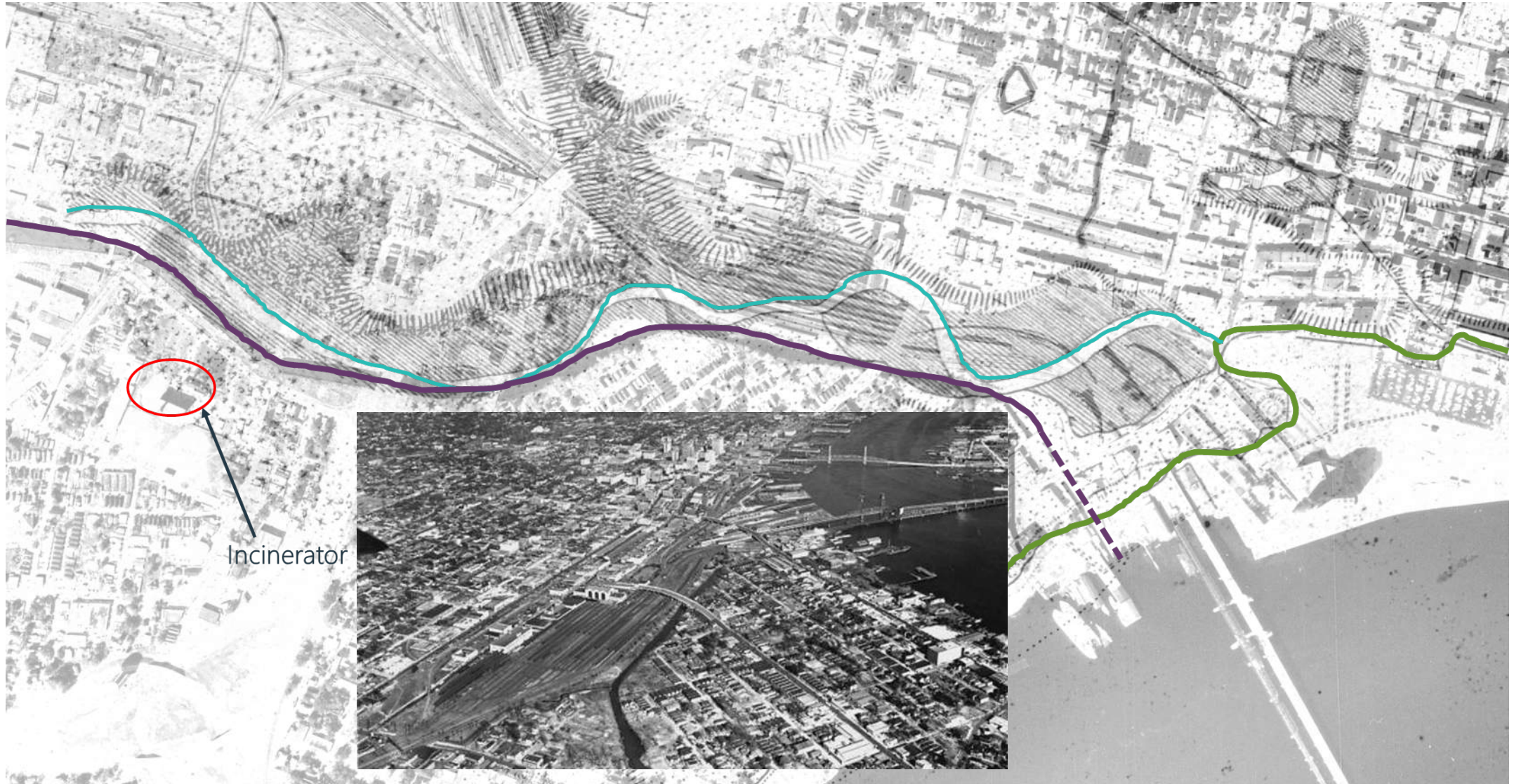
McCoys Creek

McCoys Creek 1864



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Valley Destruction (1920's through the 60's)



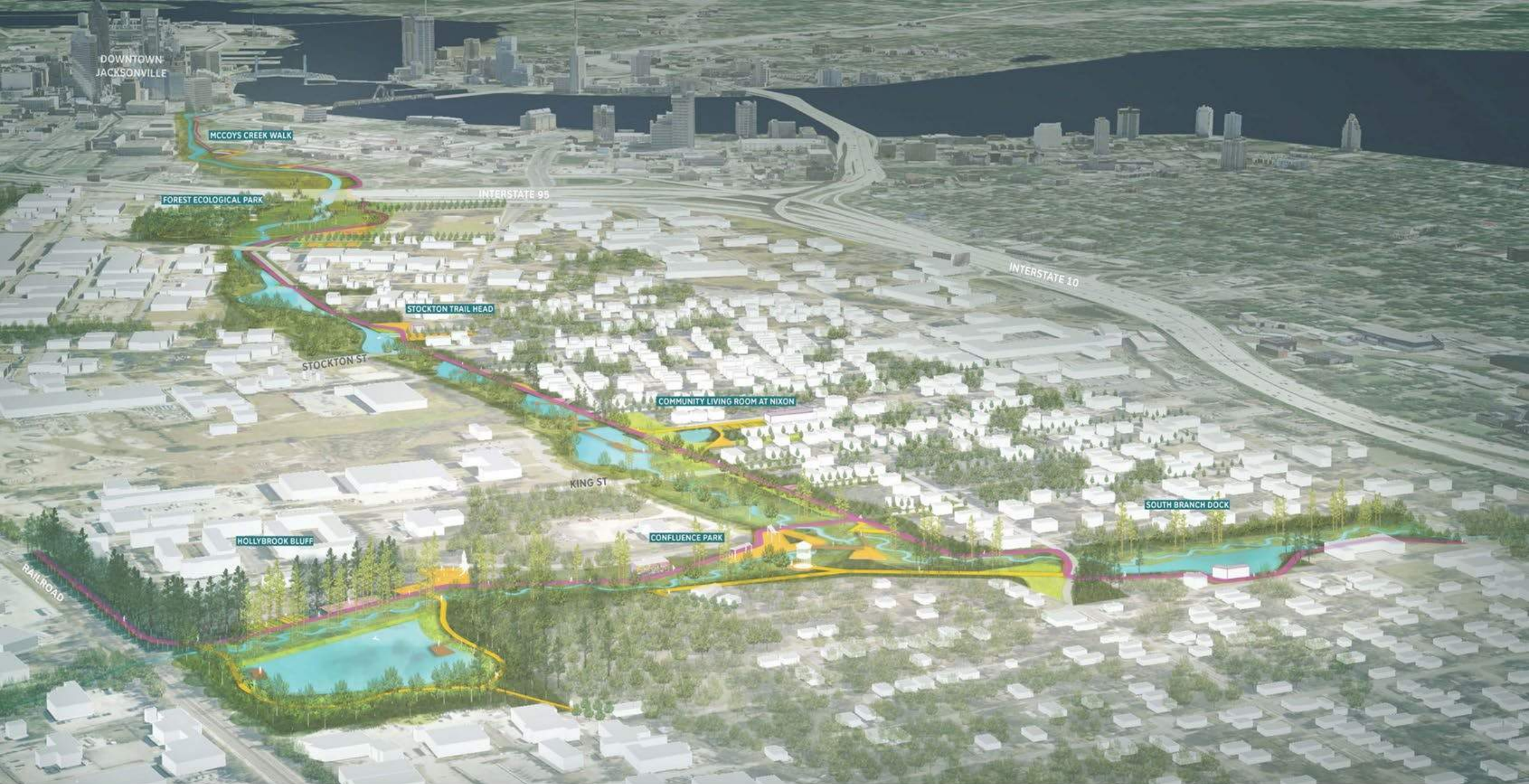


Community 2018

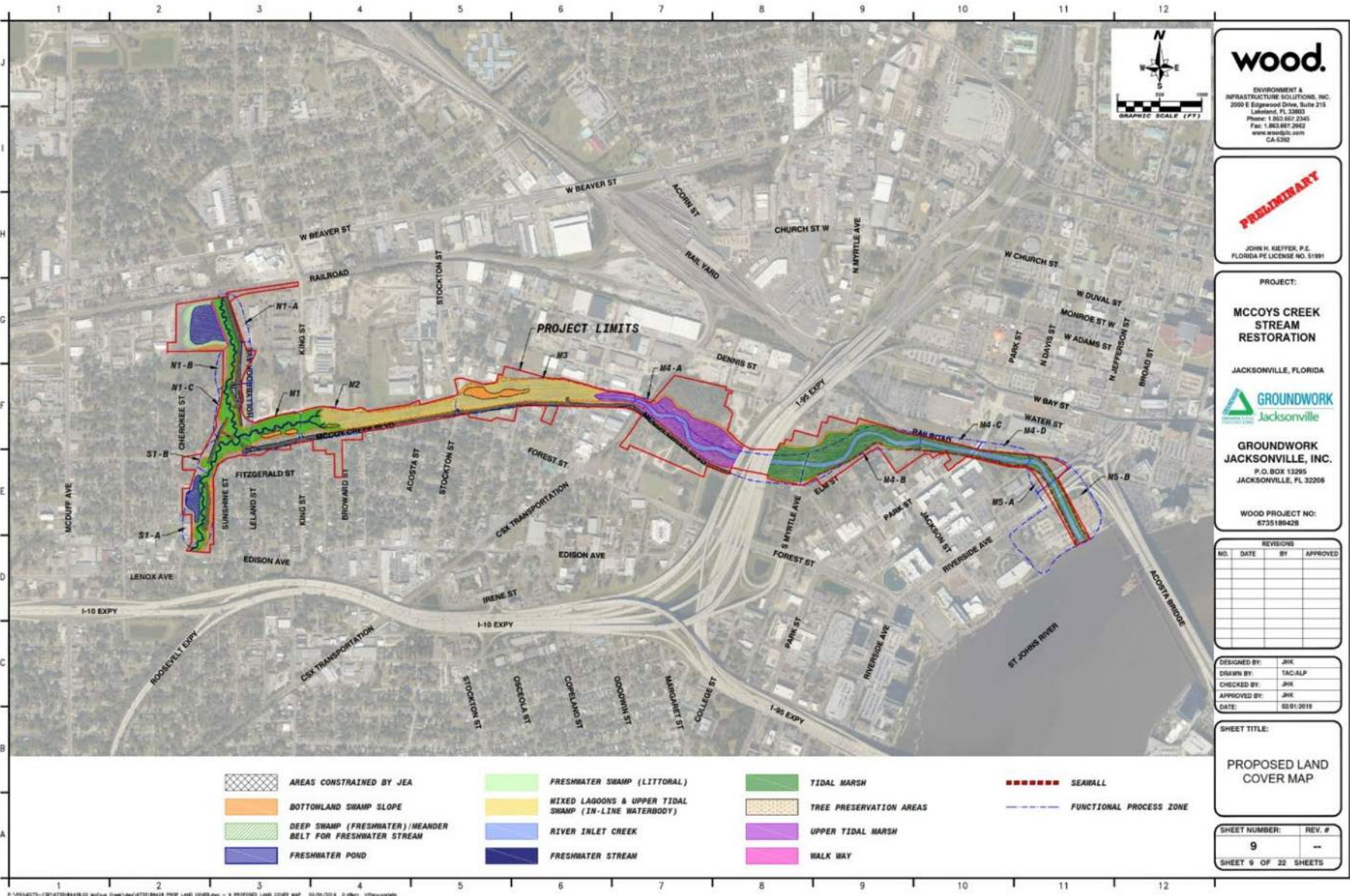


Urgency





Environmental Gradients: Pre-Emptively Self-Organizing



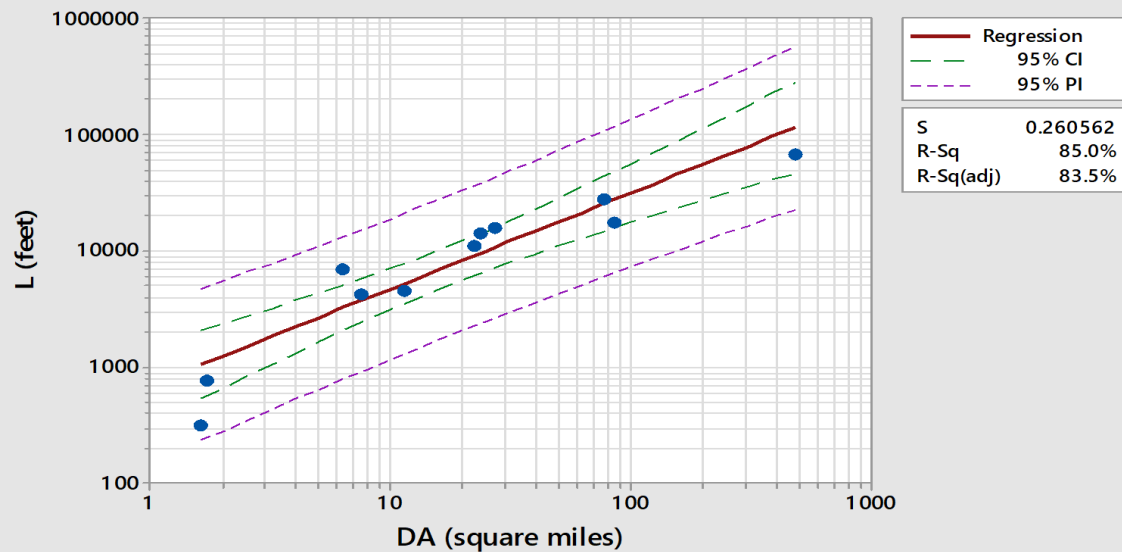
Resiliency

Place-for-Time Replacement

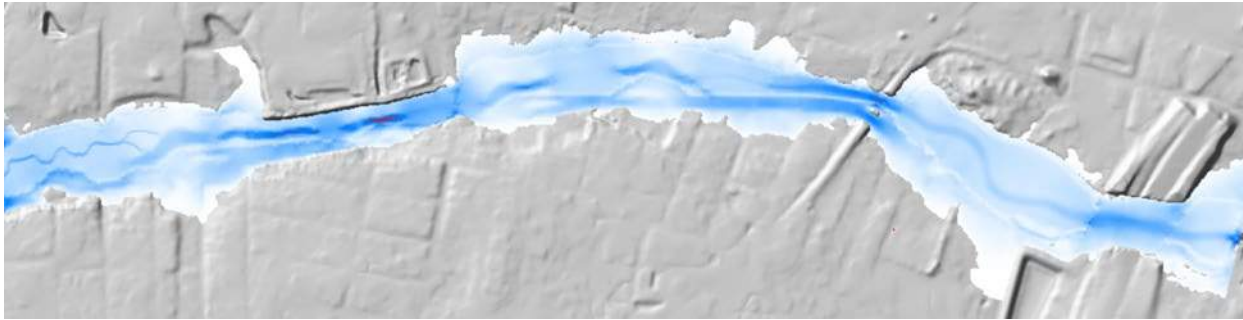


Inlet Length vs Drainage Area

$$L = 701.46 \cdot DA^{0.8244} \text{ or } \log_{10}(L) = 2.846 + 0.8244 \log_{10}(DA)$$



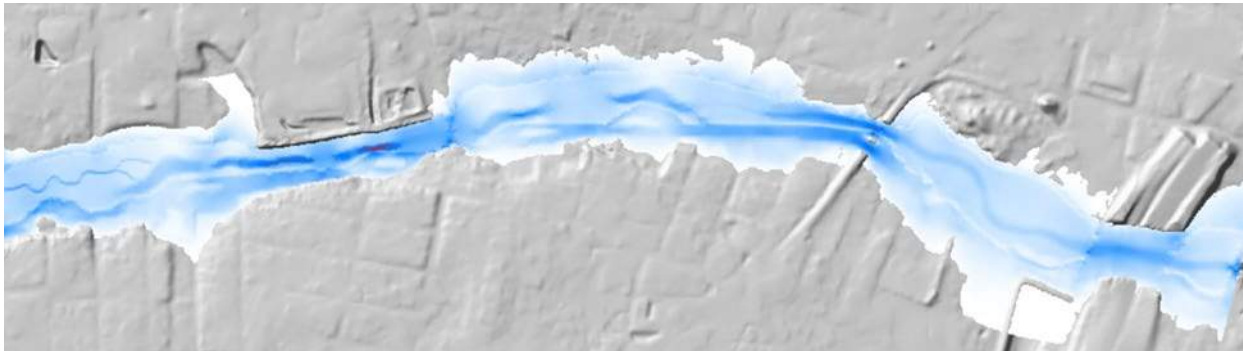
Energy Dissipation – Tractive Force Modeling



2-Year ~ 4.0" rain

~ 4.2" by 2040

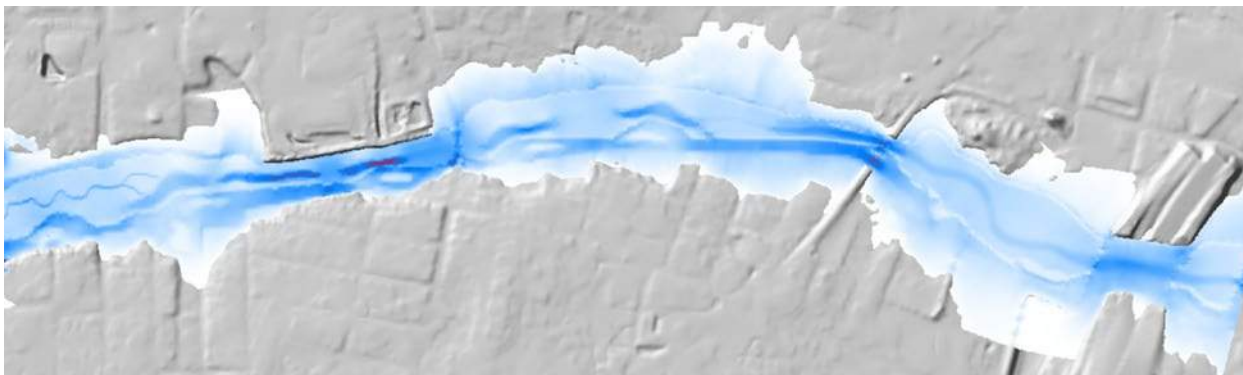
~ 4.5" by 2100



5-Year ~ 5.4" rain

~ 5.8" by 2040

~ 6.4" by 2100



100-Year ~ 11.7" rain

~ 13.0" by 2040

~ 15.7" by 2100

McCoys Creek Construction Kings Street Bridge Demolition



Adaptive Management During Construction



McCoys Creek under construction, City of Jacksonville, 2023

Mapping

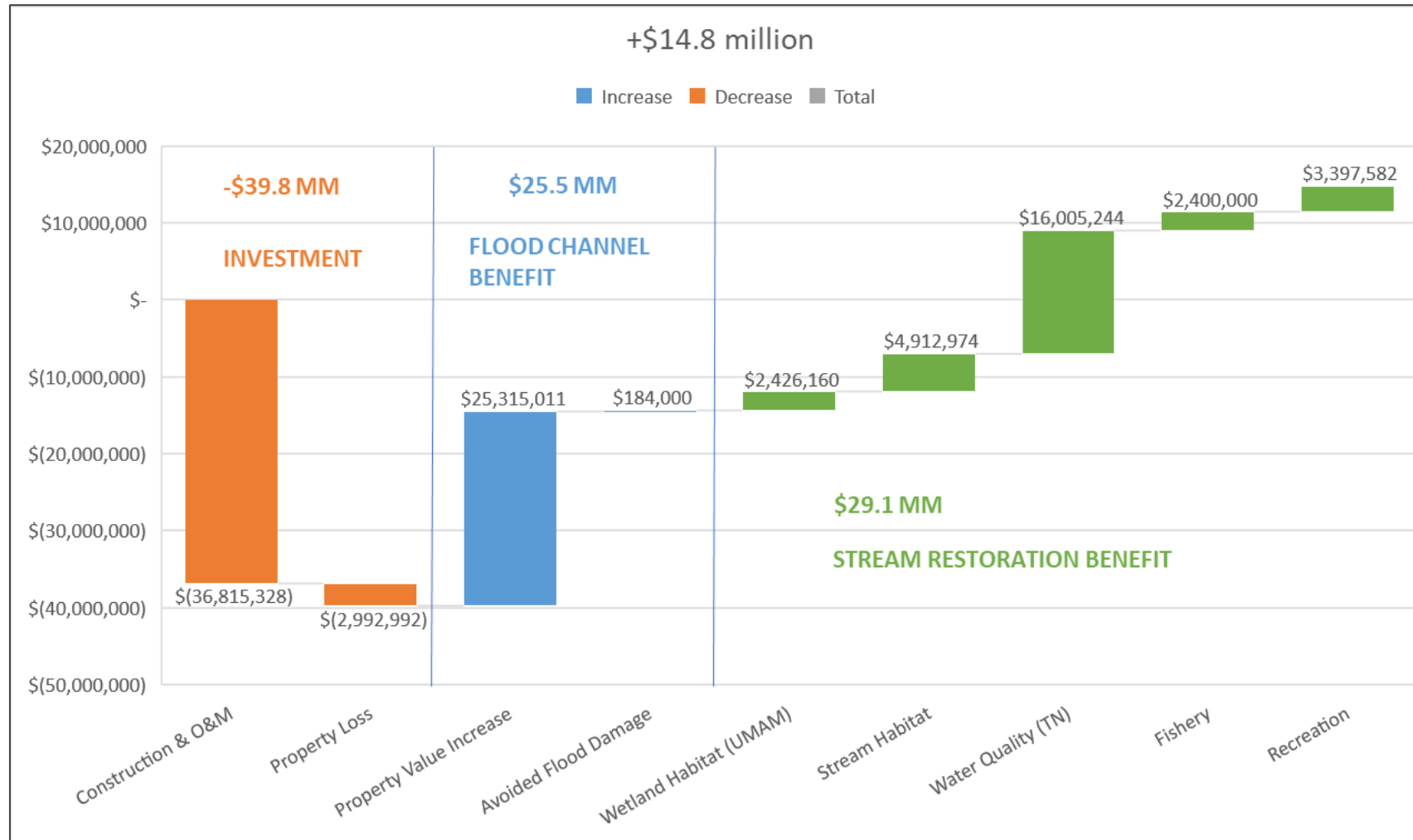
- ✓ Undeveloped real-estate
- ✓ Ownership/jurisdiction

Due Diligence

- ✓ Access to corridor
- ✓ Utility conflicts
- ✓ Alignment easements
- ✓ Hazardous waste/difficult fill
- ✓ Public will
- ✓ Downstream flooding

Triple Bottom Line

McCoys Creek – Flood Control via Urban Core Stream Restoration



It Sometimes Only Takes Open Eyes and Ears

McCoys Creek – Flood Control via Urban Core Stream Restoration

“I’ve been managing the McCoy’s Creek Restoration project since 2019. The City of Jacksonville is investing more than \$100M in this effort to reduce flooding, improve resilience, and create a linear park/greenway. We are replacing a channelized, bulkheaded stream that is prone to flooding with a widened flood plain filled with native vegetation. Last week I visited the project site with EOR John Kiefer and the team. **That was the light at the end of the tunnel that I needed to see. The meander belt of the new channel is in. The plants are thriving. And the fish nurseries are taking shape. Trying to recreate a natural creek after decades of neglect, in the middle of a heavily developed area seems crazy. But we’re doing it!**”

Nikita Reed, PE

Engineering Operations Manager

City of Jacksonville, Florida





Closing Remarks

Calls to Action

- Advance and Engage the Science
- Make Knowledge Actionable
- Elevate Collaboration





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