

January 2024

## Innovation in the Field

### Using Geospatial Video to Enhance Data Collection



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# Agenda

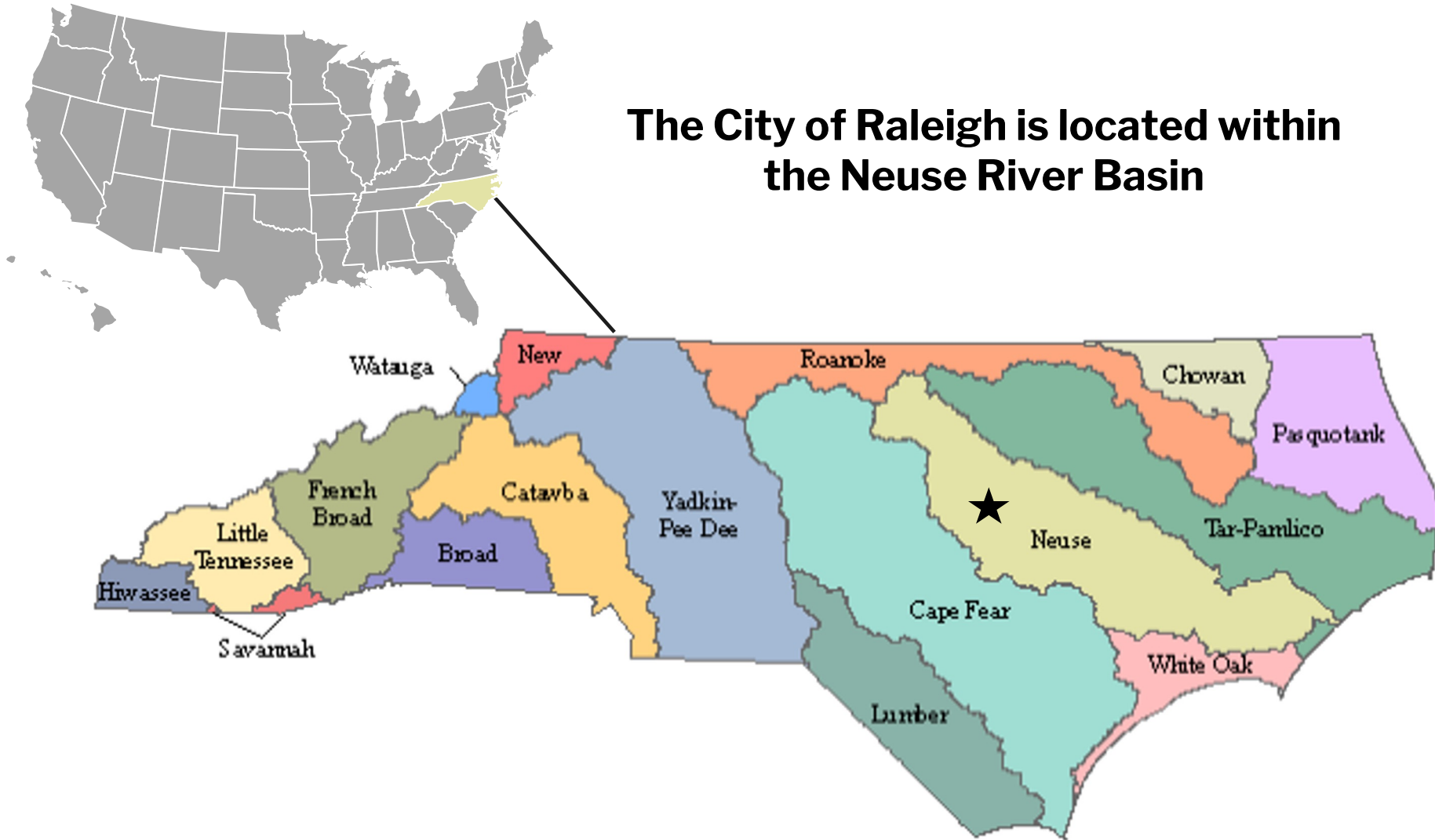


- Study Area
- Background & Project Drivers
- Watershed Studies
- Hare Snipe Creek Watershed
- Stream Assessment Approach
- Questions

Background

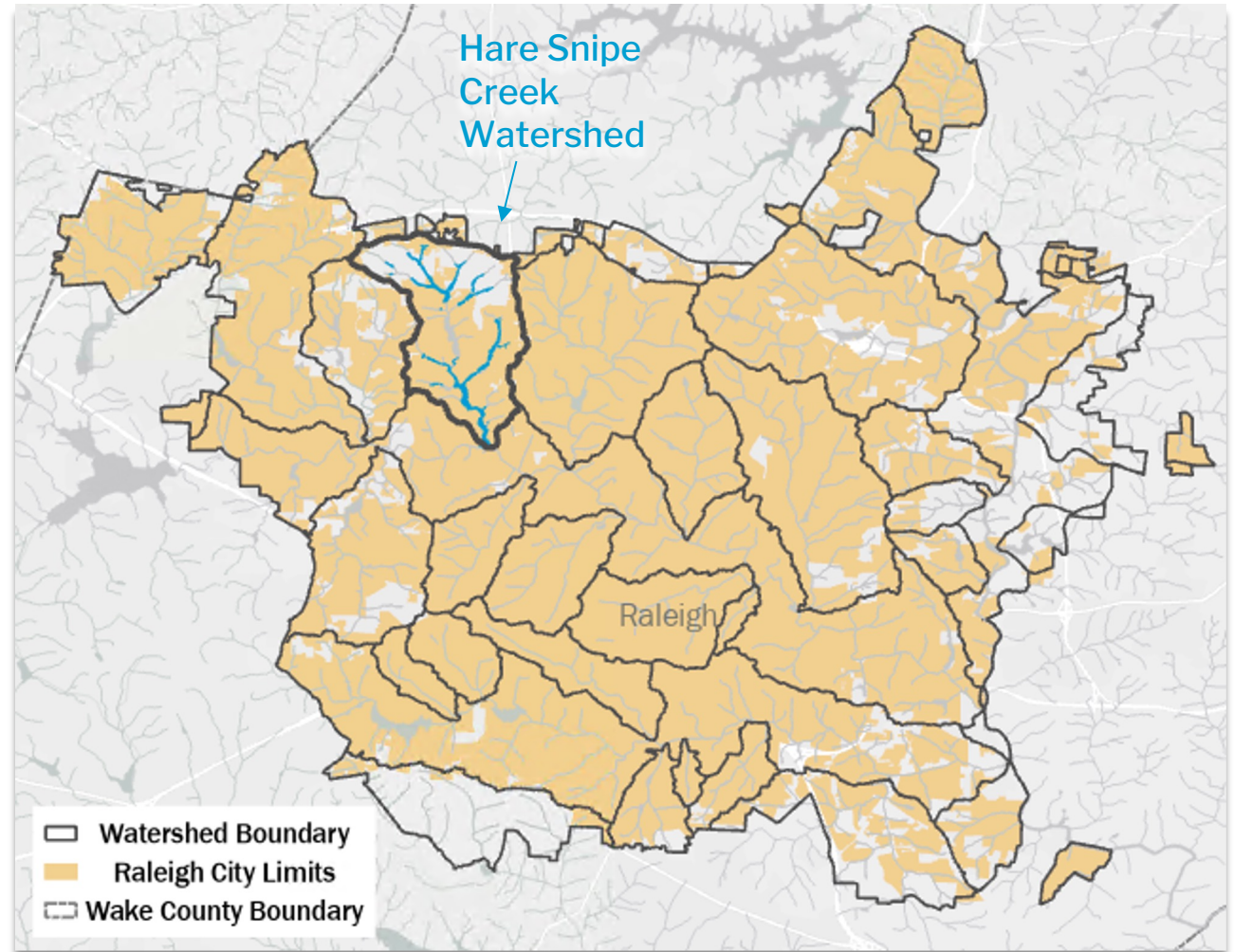
# Study Area

**The City of Raleigh is located within the Neuse River Basin**



# Hare Snipe Creek Watershed

- Hare Snipe Creek flows into a small lake before it's confluence with Crabtree Creek



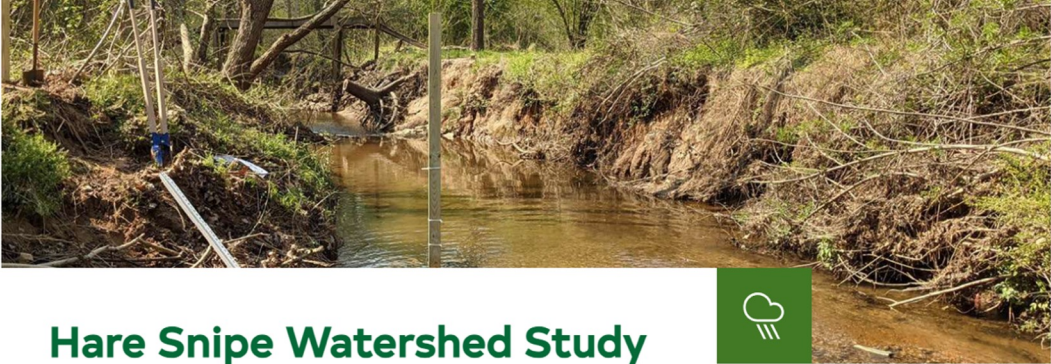
# Watershed Characteristics

- 7.3 square miles
- ~30% impervious cover
- ~ 22 miles of streams
- 6 waterbodies (including Lake Lynn)
- Impaired for benthos
- No TMDLs



# Background & Project Drivers

- The Hare Snipe Creek watershed study was conducted using new, standardized study methodologies
- **Study Goals:**
  - **Identify community concerns**
  - **Identify problem areas**
  - **Identify CIP projects**
    - **Reduce flooding**
    - **Improve water quality**
    - **Improve stream health**



## Hare Snipe Watershed Study

Northwest Raleigh Area

UPDATED: JUN 22, 2023

We are doing a study of the Hare Snipe [watershed](#). The goal is to better understand and improve flooding, water quality, and stream conditions in the area.

**Study Area:** Northwest Raleigh near [Lake Lynn](#) between Strickland Road, Leesville Road, NC 50, and US 70.

**CONTACT**

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919-996-3976

**LEAD DEPARTMENT:**  
[Engineering Services](#)

# Hare Snipe Watershed Study Components



Equity Framework



Public Outreach

Survey on flooding and erosion concerns  
Public meetings for resident feedback



Data Collection

Spatial Data  
Water Quality Data  
Previous Drainage Studies



Stream Assessments

Stream Condition  
Potential Project Identification



Water Quality and Quantity Modeling



Project Identification and Alternatives  
Analysis

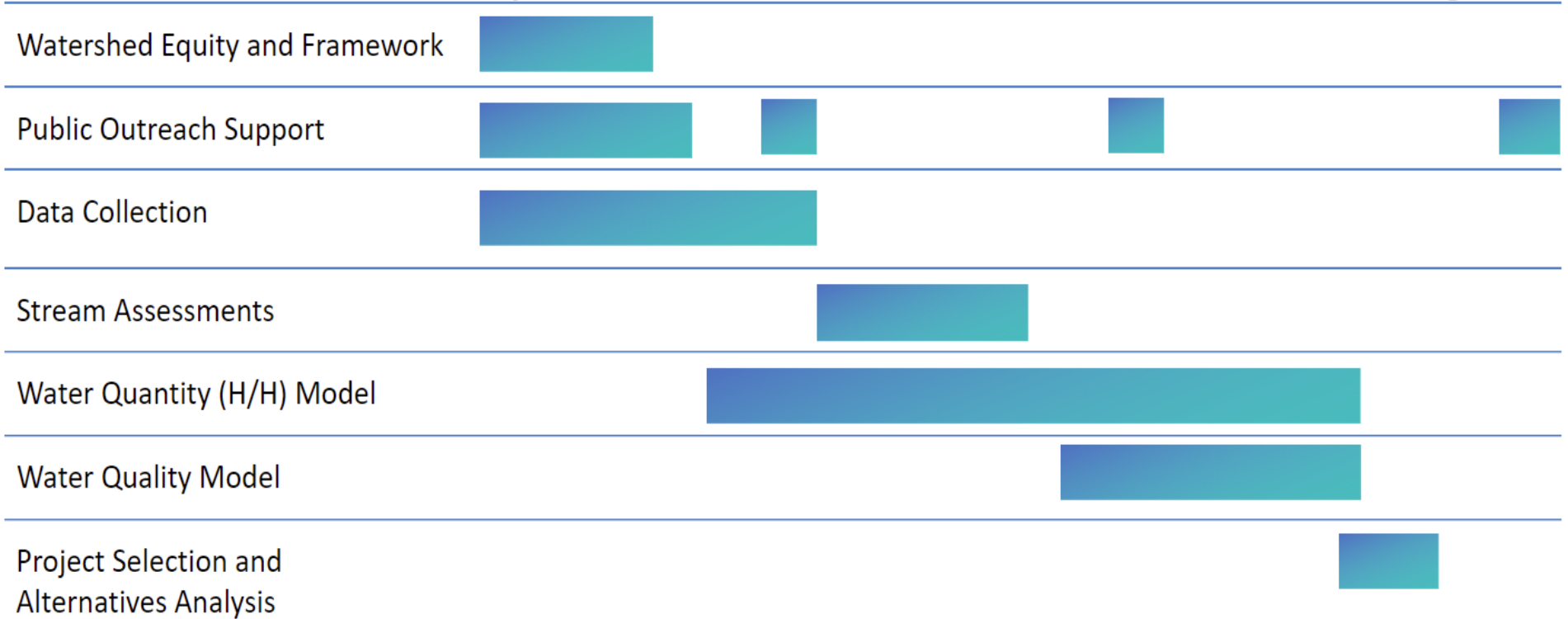
Modeling results, field observations, and resident concerns  
were all considered during this step



# Study Timeline

January 2021

August 2023



# Public Survey



## Hare Snipe Creek Watershed Study

You are receiving this survey because our records show that your home or business is within the watershed of Hare Snipe Creek ([see the watershed on this map](#)). This means that any rain that falls on your property find its way through dishes, pipes, and smaller streams to Hare Snipe Creek.

The City of Raleigh is conducting a [study](#), to help us learn where there may be flooding, stream erosion, aging or outdated stormwater pipes/drains, and other stormwater-related impacts in your neighborhood. We'll use this information to plan for future City projects.

If you have any questions about this study or the survey, please contact us at 919-996-3940 or [RaleighStormwater@raleighnc.gov](mailto:RaleighStormwater@raleighnc.gov).

Please take a few minutes to answer these questions.

### About Your Watershed

A watershed is an area of land where rainwater collects, flows or drains to a larger body of water (i.e. a lake, stream, river or ocean). The watershed of Hare Snipe Creek is located in northwest Raleigh where water flows to Crabtree Creek and then to the Neuse River.

### What We're Study

We'd like to know if you see:

- Flooding;
- Stream erosion; and,
- Aging or outdated stormwater infrastructure.

### Flooding



### Stream Erosion



### Aging Infrastructure



### Definitions

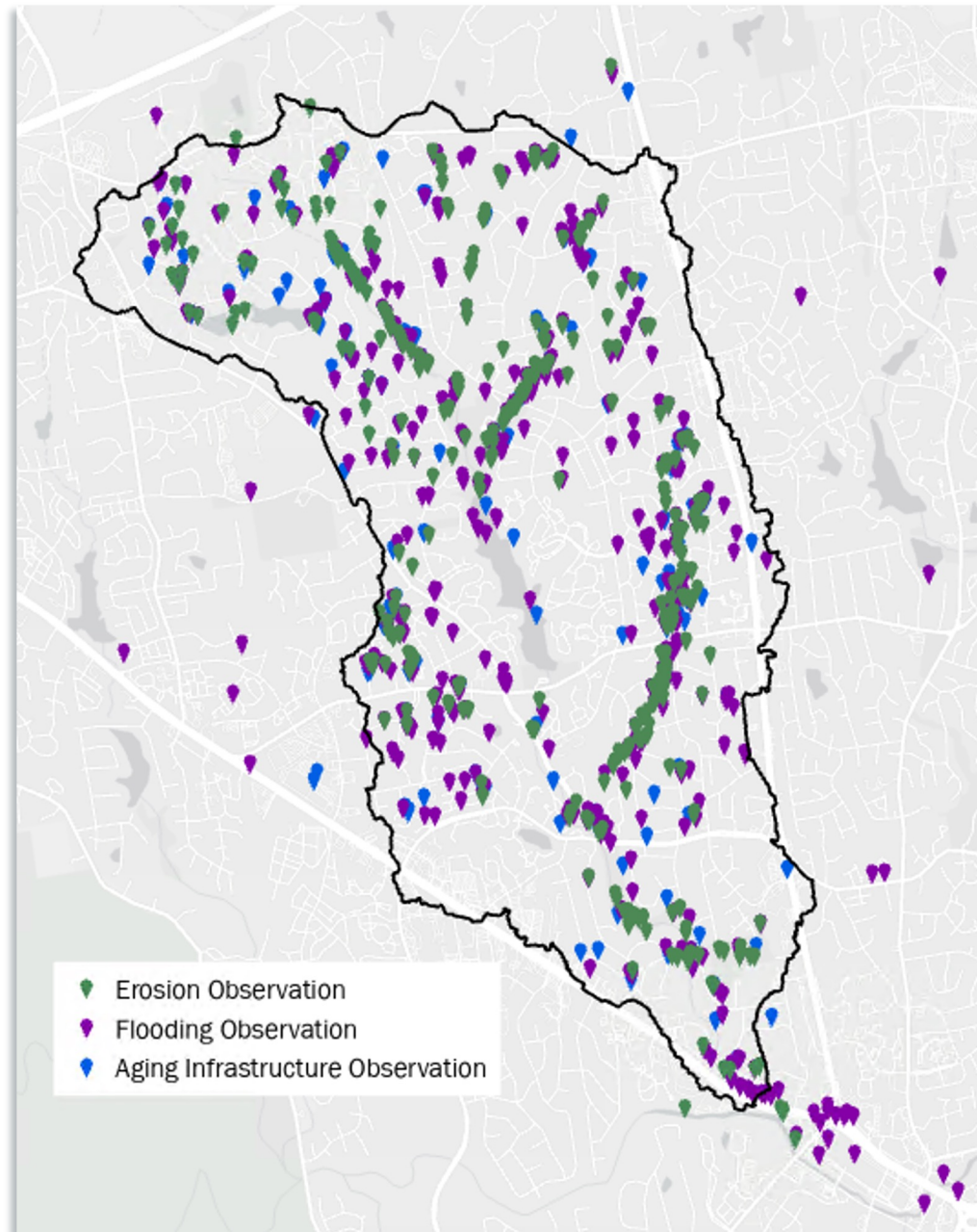
*Aging Infrastructure: Pipes, culverts or drains that need to be repaired/replaced because they are in poor condition and/or reached their lifespan.*

*Stream Erosion: When the power of the stream flow causes sediment to be dislodged, resulting in steep banks and channel widening. This typically happens as a result of increased runoff from urbanization.*

*Flooding: When stormwater submerges yards, roads, and homes. We see flooding when creeks and pipes cannot handle the amount of rain falling during a storm.*

1. What concerns you the most about conditions in your watershed that impact Hare Snipe Creek and nearby properties? Please rank your responses by listing the issues from most to least concern.

Use your mouse to click and drag each option in the order that best fits your concerns. Move each item into the "Your Top Priority" section.



# Resident Concerns - Property Flooding



March 27,  
5:12 PM



# Resident Concerns - Stream Erosion



Near roads →



← Near infrastructure



← Near structures



Streambanks →

# Resident Solutions



# Hare Snipe Watershed Study Components



Equity Framework



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Public meetings for resident feedback



Data Collection

Spatial Data  
Water Quality Data  
Previous Drainage Studies



Stream Assessments

Stream Condition  
Potential Project Identification



Water Quality and Quantity Modeling



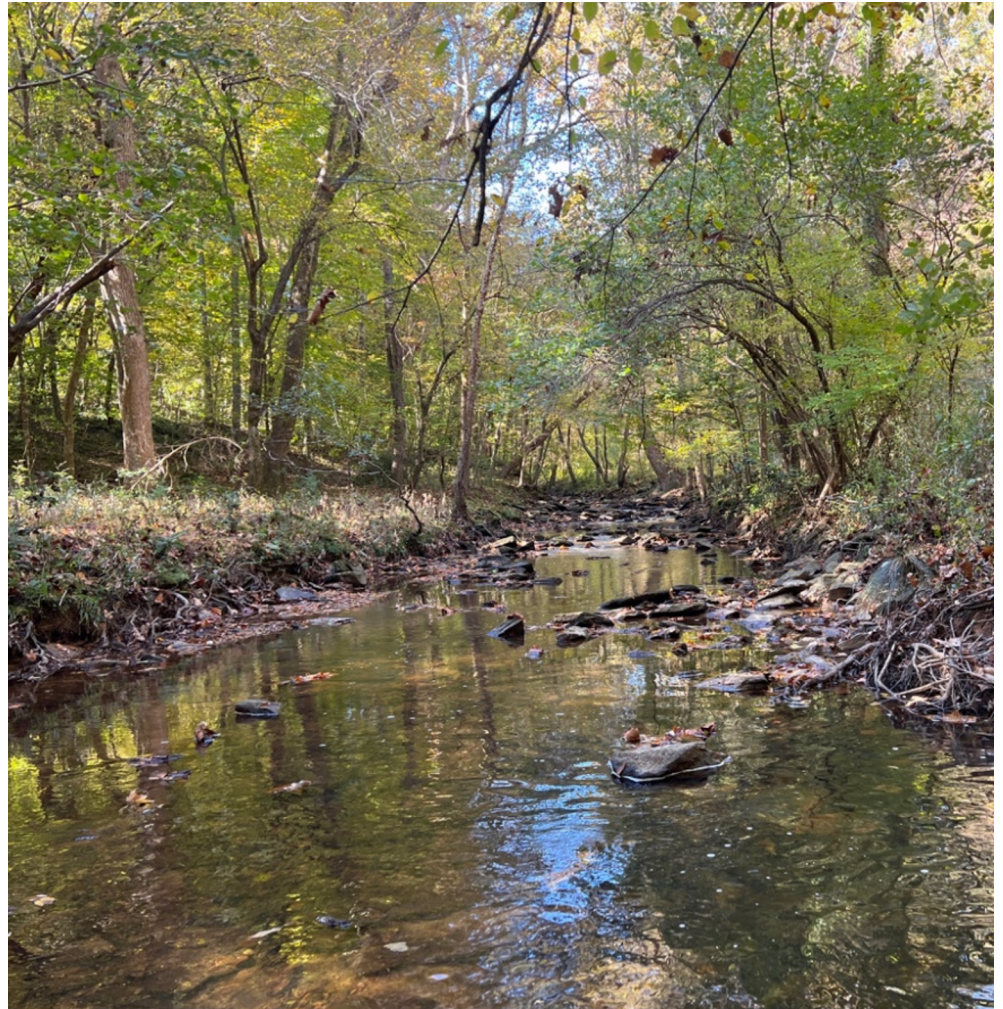
Project Identification and Alternatives  
Analysis

Modeling results, field observations, and resident concerns  
were all considered during this step

# Stream Assessment Methodology

# General Approach

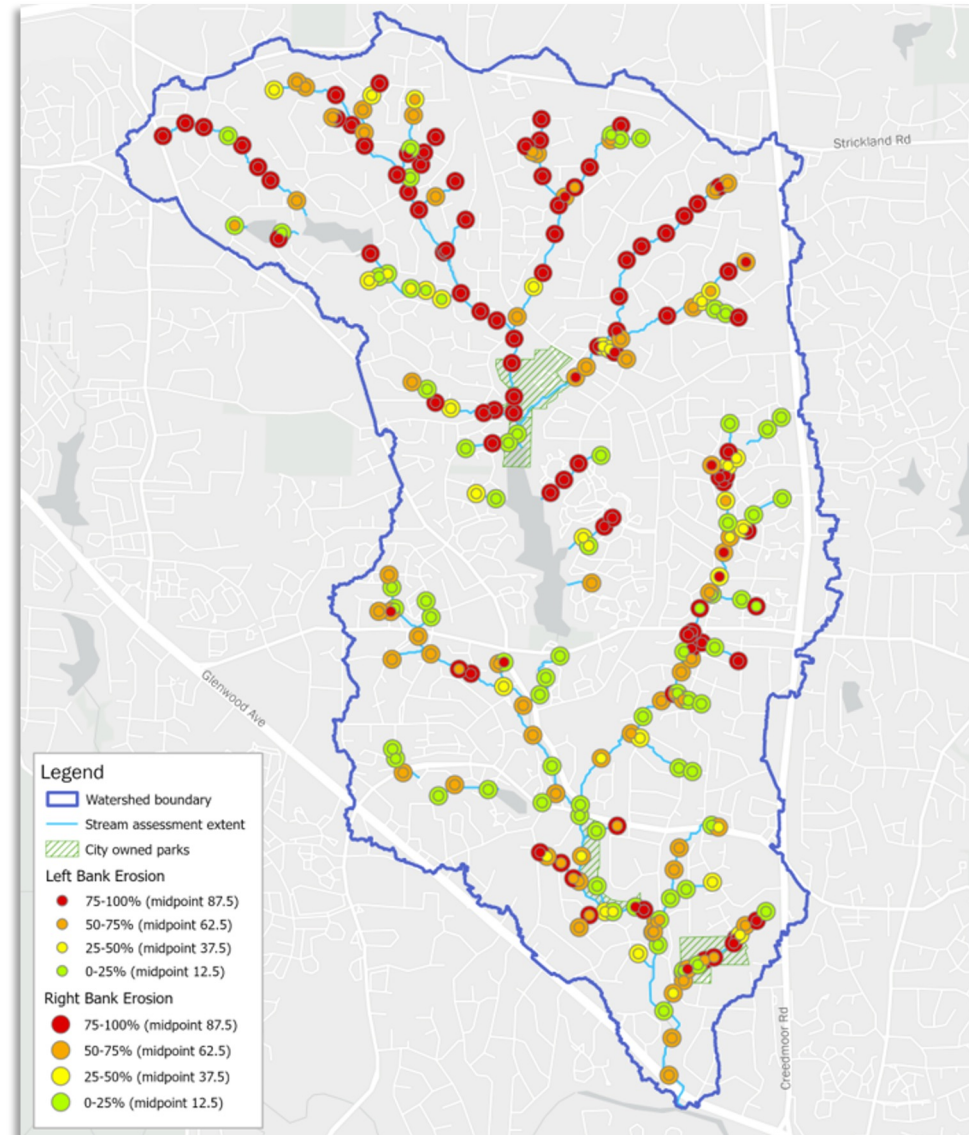
- Assessment goals:
  - Document stream condition and identify problem areas
  - Collect data for modeling and project identification efforts
  - Collect continuous footage of each stream segment





# Information Collected

- Bank erosion rates
- Riparian buffer encroachments
- Anthropogenic and hydrologic stream alteration
- Invasive species observations
- Potential impacts to water quality
- Potential stream restoration opportunities



# Additional Data Collection

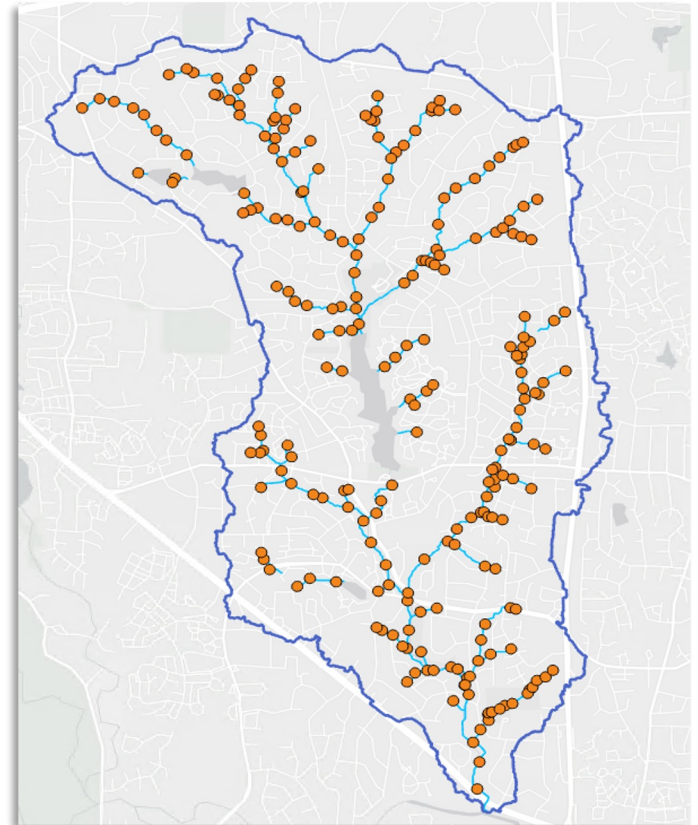
- Documented locations of:
  - Erosion near sewer infrastructure, roads, or structures
  - Debris blockages
  - Illicit discharges
- Stormwater infrastructure was assessed for blockages and structural issues




# Field Data Collection



The screenshot shows the ArcGIS Field Maps mobile application interface. At the top, the time is 11:42. Below the status bar, there are three buttons: "Cancel", "Collect", and "Submit". The main header displays the project name "StreamAssessment\_Upstre..." and its coordinates "35.875574°N 78.686150°W". Below the header, there are two buttons: "Take Photo" (with a camera icon) and "Attach" (with a paperclip icon). The form contains several input fields: "FACILITYID" (empty), "STREAM BANK EROSION" (dropdown menu), "LB\_Erosion" (text field with "No value"), "LB\_length" (text field), "LB\_Height" (text field), "RB\_Erosion" (text field with "No value"), "RB\_length" (text field), and "RB\_Height" (text field).

- Field staff dropped points at the upstream end of each assessed reach
  - Over 200 upstream points were added
- Stream condition observations were recorded using ArcGIS Field Maps








# Data Availability

Hare Snipe Stream Data Collection 


Open in Map Viewer Classic  

Legend

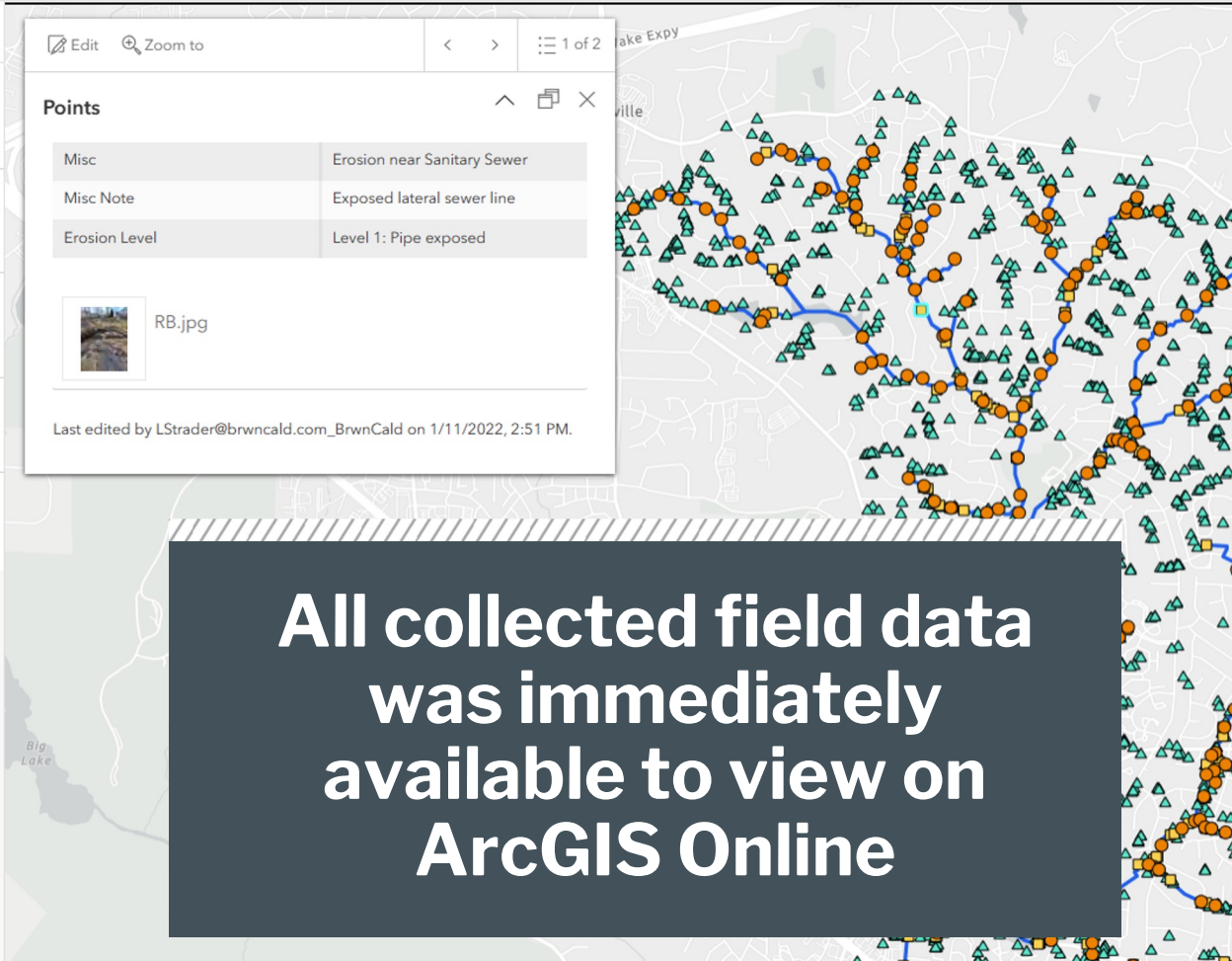
- StreamAssessment\_UpstreamPoints 
- StreamAssessment\_MiscPoints 
- StreamAssessment\_PipeIO 
- WQStreamsClipped 
- StreamAssessment\_Bridges 

Points

Misc	Erosion near Sanitary Sewer
Misc Note	Exposed lateral sewer line
Erosion Level	Level 1: Pipe exposed

 RB.jpg

Last edited by LStrader@brwnncald.com\_BrwnCald on 1/11/2022, 2:51 PM.



**All collected field data was immediately available to view on ArcGIS Online**

# Collection of 360° Stream Footage

- Two methods for recording footage of each assessed stream segment were tested:
  1. 360° camera mounted on a drone
  2. 360° camera mounted on a hardhat and worn by field staff



# Drone-Mounted Camera

- Benefits:
  - Footage could be recorded while stream assessments were being conducted
  - Did not require field staff to enter streams



# Drone-Mounted Camera

- Challenges:
  - Required specialized staff
  - Drones were difficult to maneuver in small, overgrown streams
  - Drones are not easy to replace if damaged



# Hardhat-Mounted Camera

- Benefits:
  - Footage could be collected by any field staff member
  - Camera was easy to install and was less likely to be damaged while recording footage





# 360° Camera Setup

- GoPro MAX camera
- Waterproof
- GPS Capabilities
  - Video footage is linked to specific locations along each stream segment

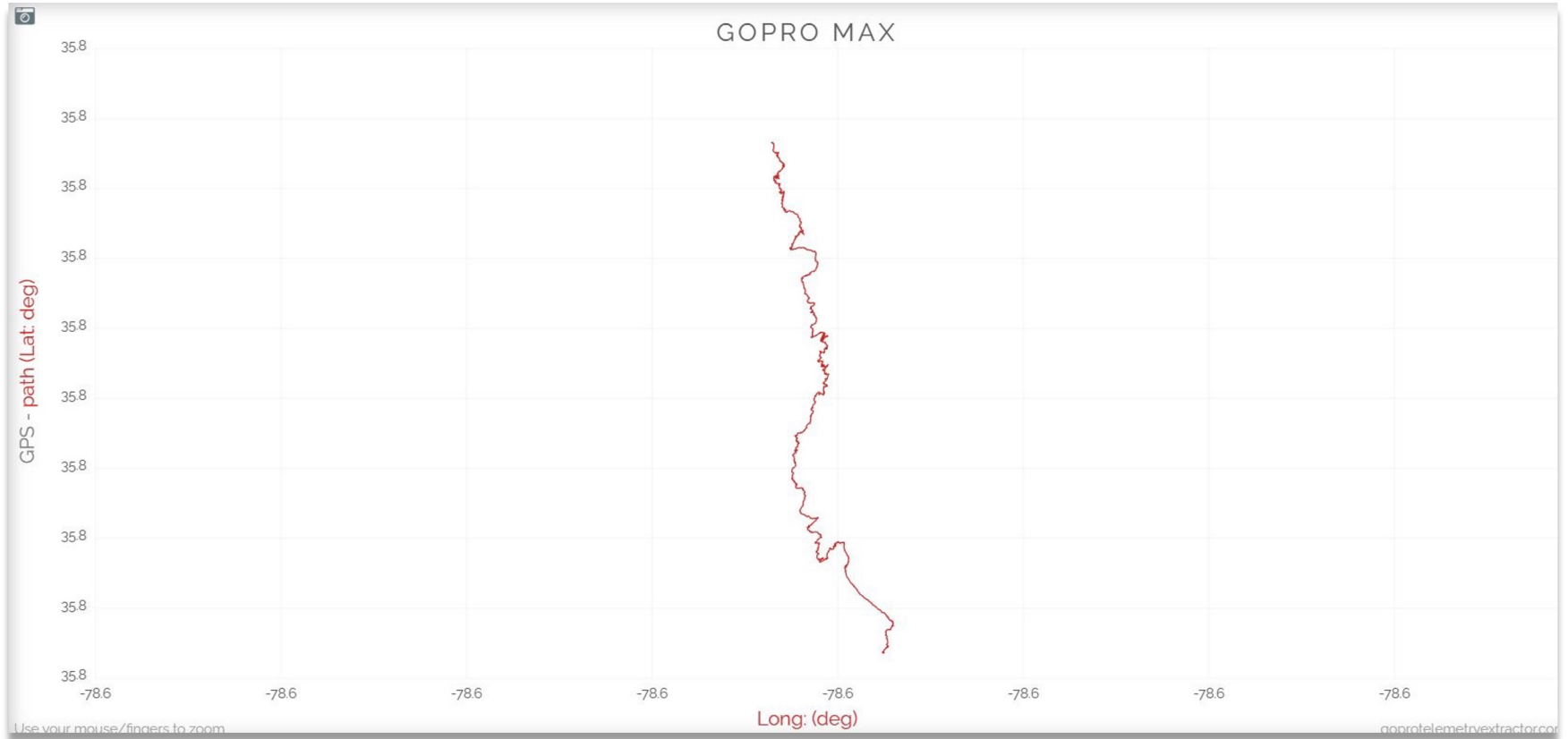


# Camera Methods



- Field staff collected stream condition information while walking upstream
- Footage of stream was recorded while walking downstream

# Telemetry Information



# Telemetry Information

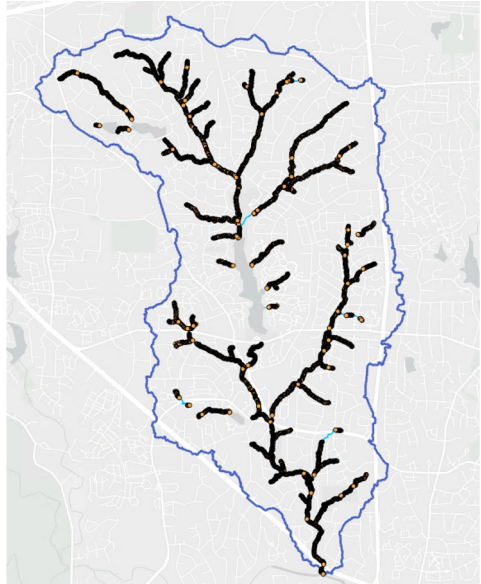


# Processing Workflow

Footage is recorded by field staff

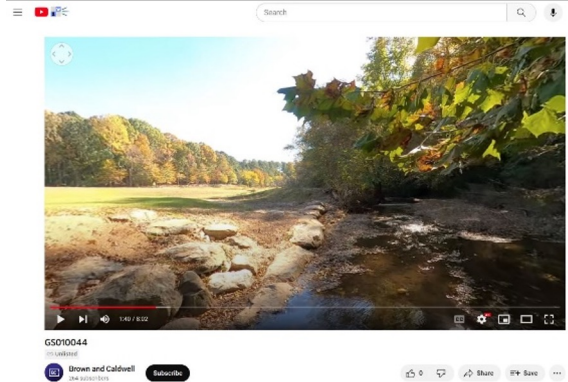


Telemetry information is extracted as a shapefile in GIS



Videos are converted to a new format and compressed

*Backup copies of all video footage is saved during this step*



Compressed 360 footage is uploaded to YouTube

YouTube links are incorporated into the shapefile

Shapefile is then shared to AGOL

# Accessing the Footage



Edit Zoom to < > 2 of 2

GS010044

GPS_Lat_	35.861641
GPS_Long_	-78.695442
GPS_Alt_	88.272000
GPS_2D_sp	1
GPS_3D_sp	1
fix	3
precision	216
altitude_s	MSLV
cts_date_G	
timestamp_	0.000000
Alt_ft	0.000000
VideoName	GS010044
timestamp1	100.000000
duplicate_	
is_duplica	0
VideoURL	<a href="#">View</a>



# Example

- [GS010044 - YouTube](#)

The image shows a screenshot of a YouTube video player. At the top, there is a search bar with the text "Search" and a microphone icon. Below the search bar is the video player itself, which displays a scenic view of a stream flowing through a dense forest. The water is calm, reflecting the surrounding greenery and the bright sunlight filtering through the trees. A large play button is centered over the video. Below the video player, the video title "GS010044" is displayed, along with the text "Unlisted". The channel name "Brown and Caldwell" is shown, along with a profile picture icon and the text "267 subscribers". A "Subscribe" button is located to the right of the channel information. At the bottom right of the player, there are icons for liking (0 likes), sharing, saving, and a menu icon.

# Benefits

- Continuous 360° footage allows users to view stream conditions from multiple angles along the entire stream length
- Footage is relatively easy to collect
- The City of Raleigh can reference this footage for future project identification efforts
- Residents were excited to learn about these new techniques



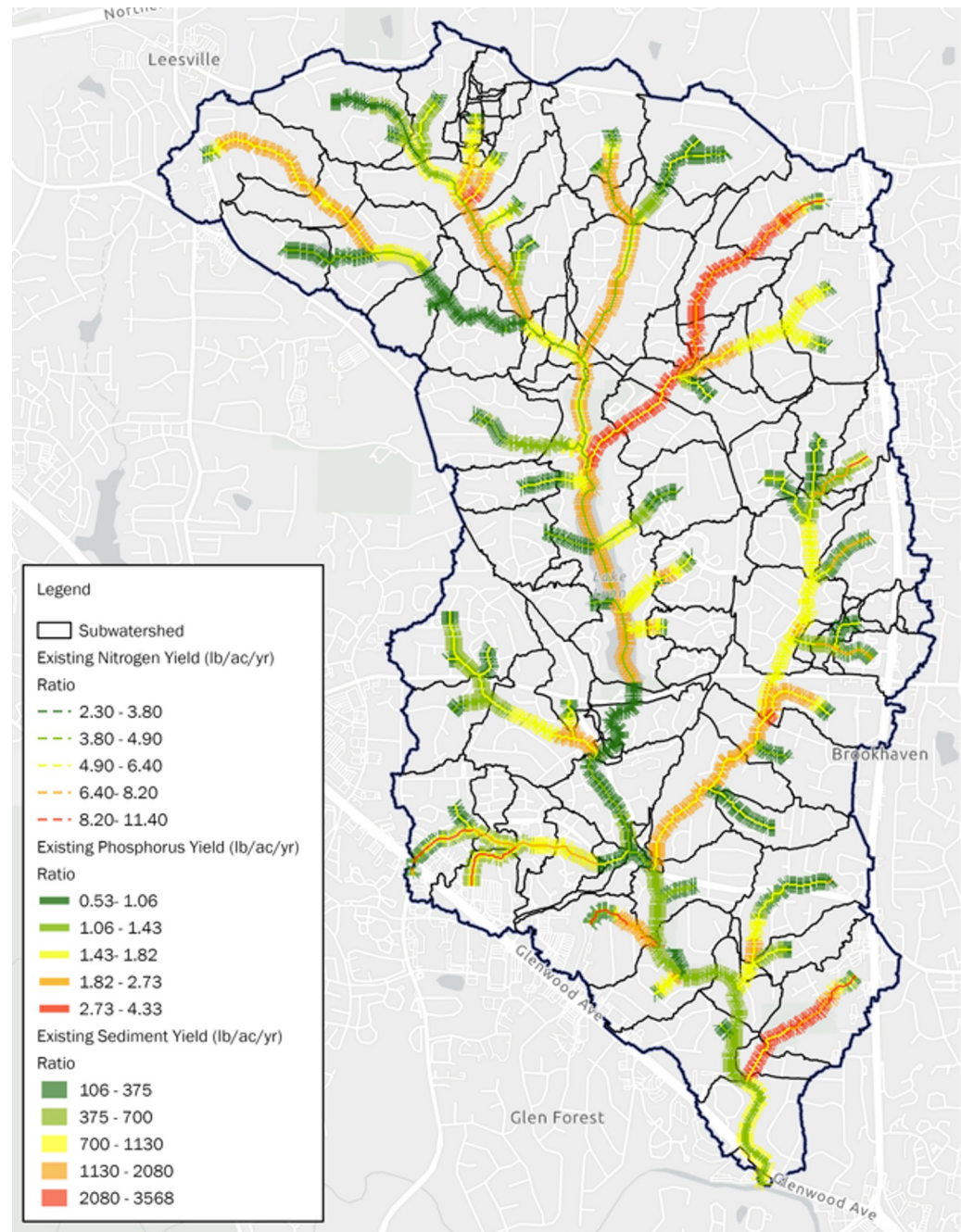
# Challenges

- Video files are large and difficult to share without post-processing
- Post-processing can be time-consuming and requires a large amount of computing power
- GPS capabilities of camera are affected by topography and tree cover
  - Assessments must be conducted in the winter
- Staff are required to walk each stream segment twice

Applications

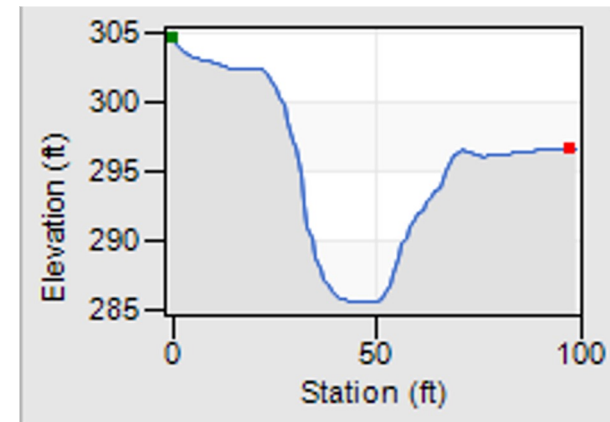
# Water Quality Modeling

Bank height and erosion observations were used to estimate sediment loading from streams

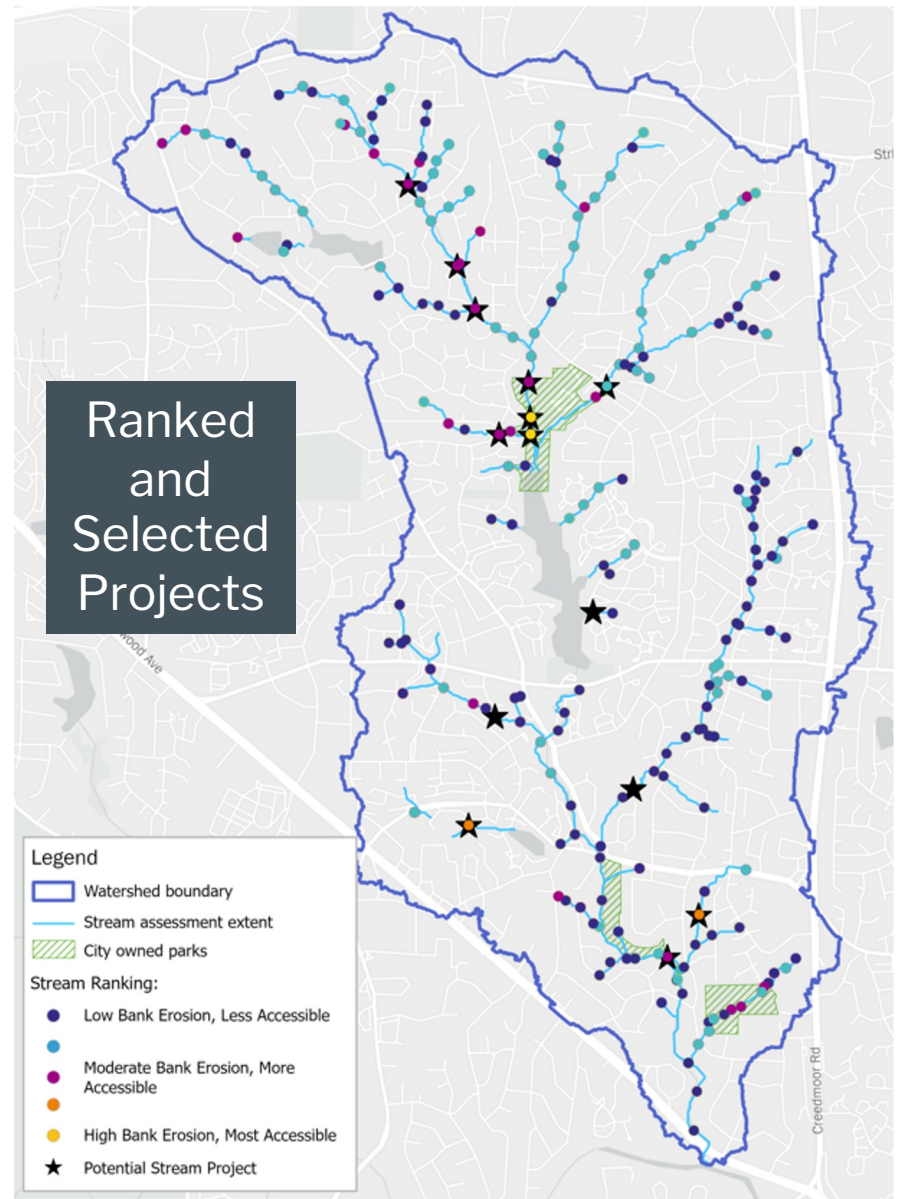
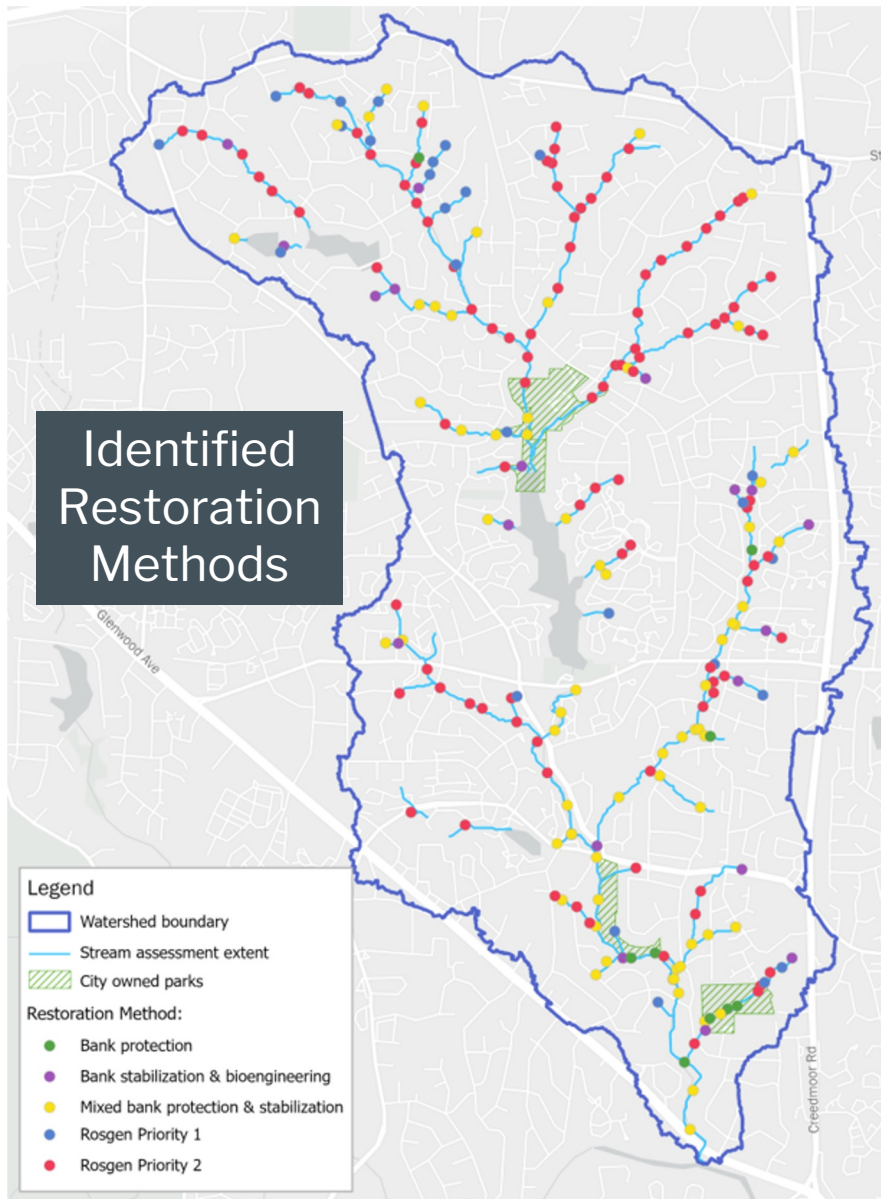


# Water Quantity Modeling

- Stream observations used to identify potential stream constrictions
- 360° footage used to validate elevation data
  - Verified that steep streambanks were being captured in the model

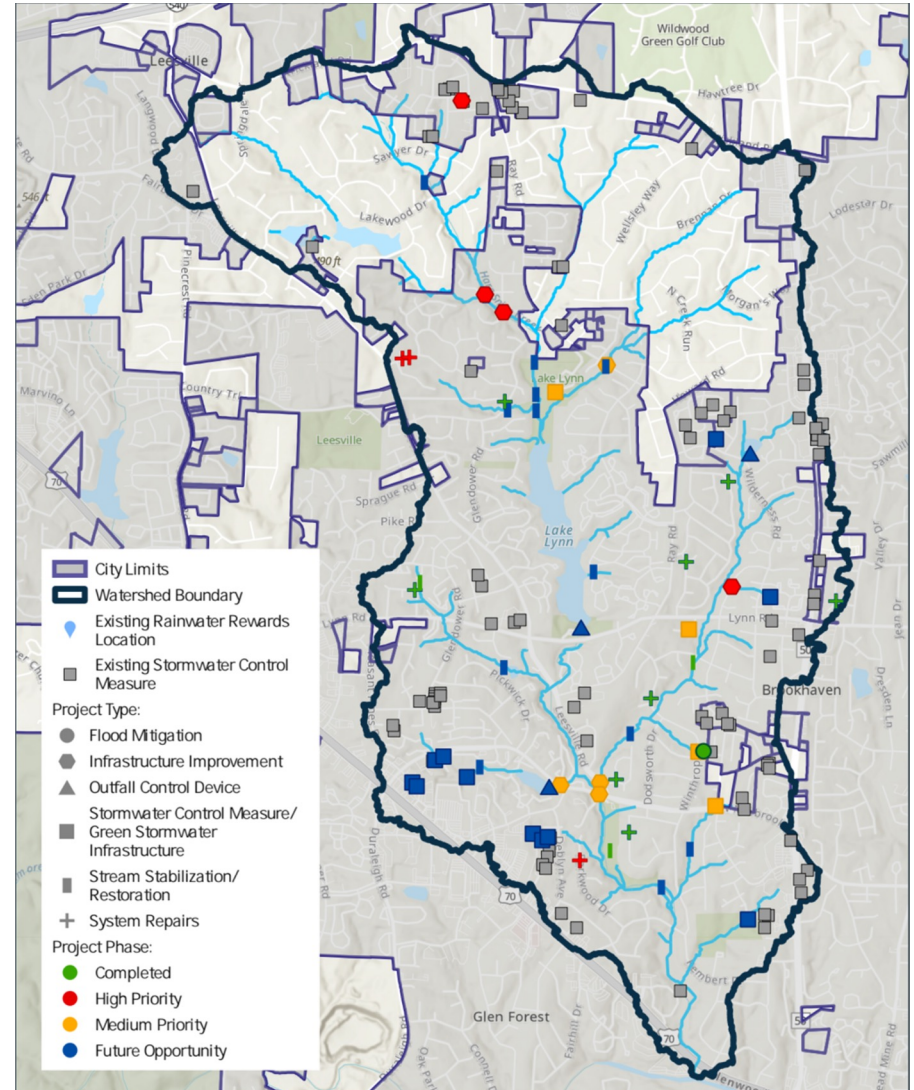


# Project Identification



# Project Locations

- Official locations selected by the City and presented to the public



# Public Meeting – Potential Projects



100+ Attendees



# Other Potential Applications

- Verify model output
- Monitor changes in stream condition over time
- Allows a highly detailed review by various experts and stakeholders





# Overview

Development of a standardized watershed study approach

Stream condition assessments conducted as part of that approach

Innovative and rapid assessment approach developed to increase efficiency when collecting stream condition data

Water quality and water quantity models used stream assessments results

Identification of potential improvement projects used modeling results coupled with stream assessment observations



Questions?