

Assessing the Pre-Dam Removal Ecological Functions of Blackwater Creek, 90 Years after the Construction of College Lake Dam: A High Hazard Dam

National Stream Restoration Conference

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Presented By:

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AECOM



LYNCHBURG
WATER
RESOURCES



University of
Lynchburg

PROJECT LOCATION | LYNCHBURG

- Located in Central Virginia in the Piedmont Region
- James River and Chesapeake Bay Watershed
- Population of 79,009

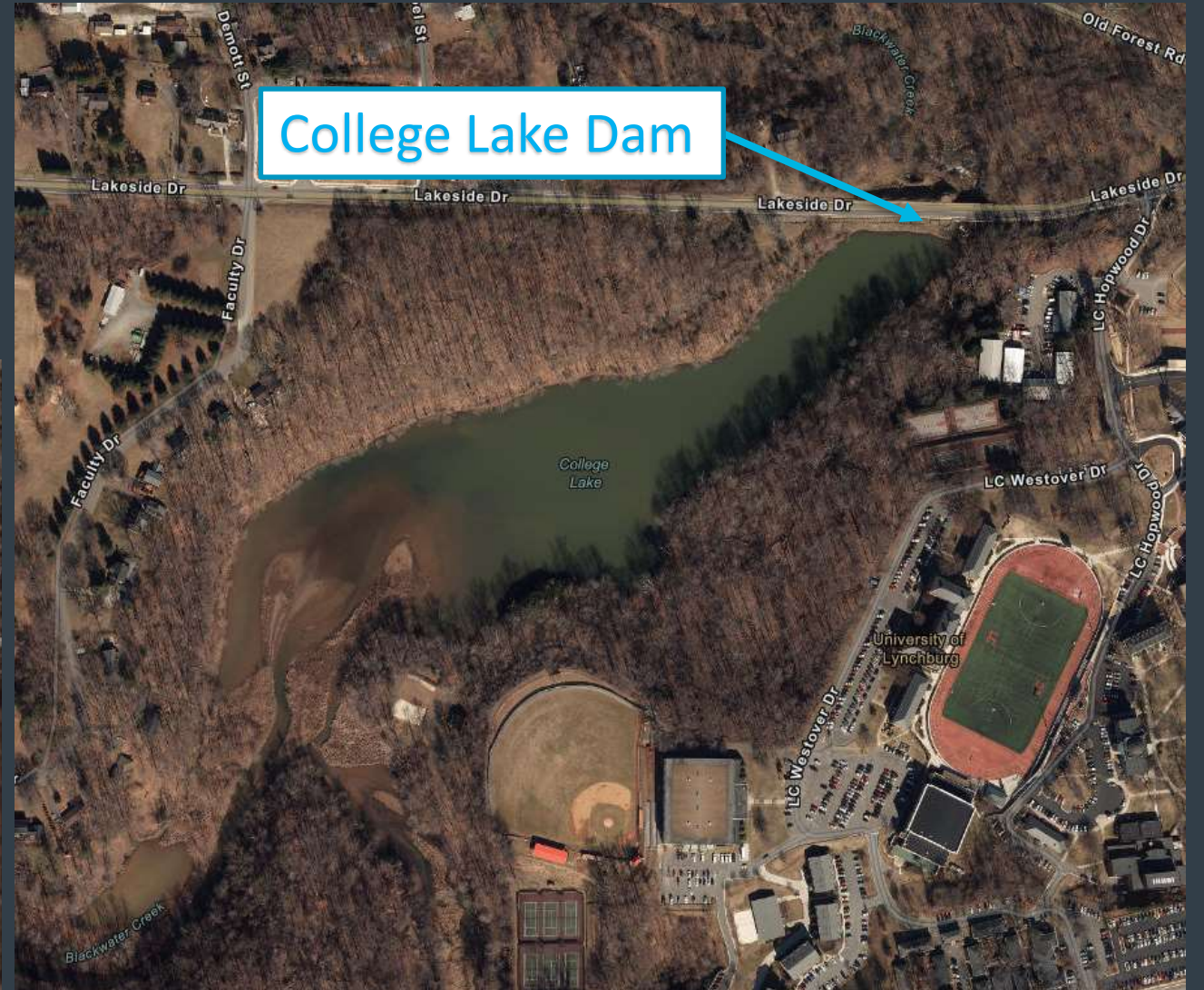


THE FIVE REGIONS OF VIRGINIA



WATERSHED STATS | COLLEGE LAKE

- 21.8 mi² Watershed
- Urban Watershed
- 22.4% Impervious Surface
- Sand Bed Dominated Streams



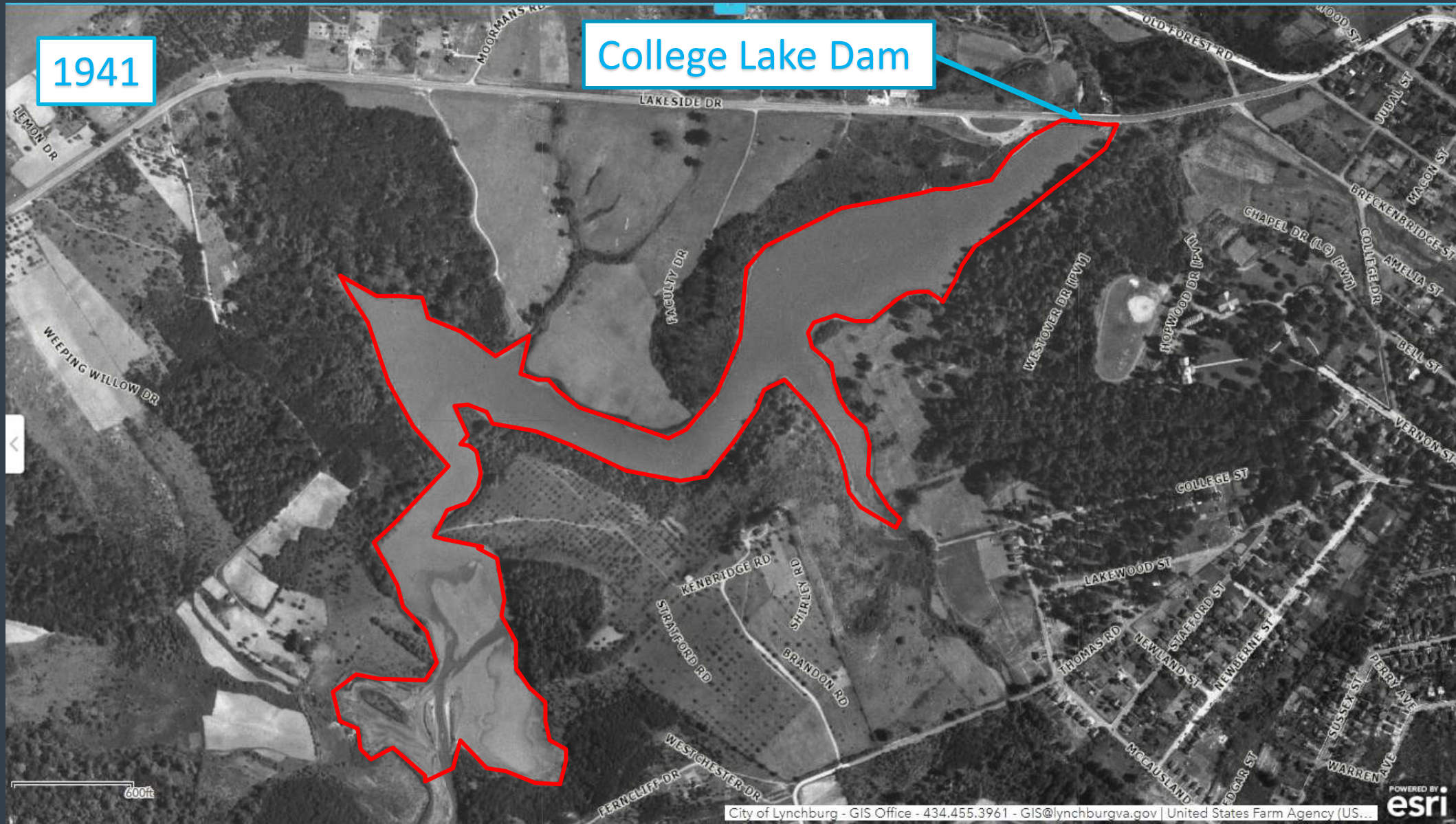
HISTORY | COLLEGE LAKE DAM



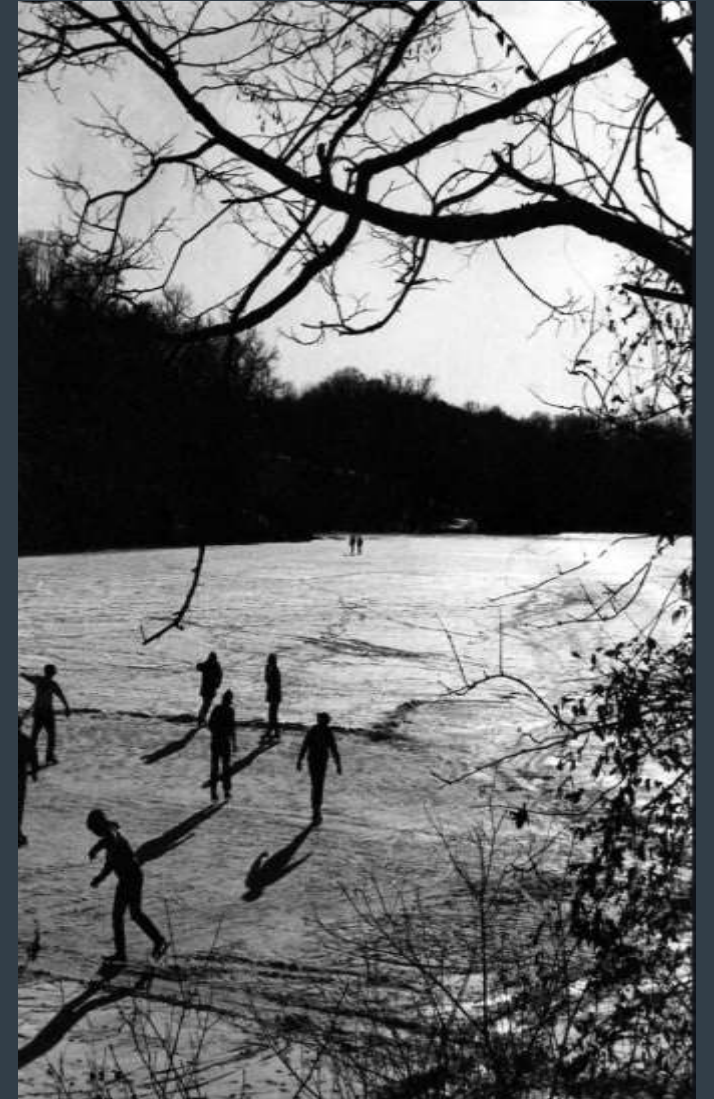
- **Constructed in 1934**
- **Part of Highway Construction for now US 221**
- **Originally 44-acres in size, with depth of 30 feet**



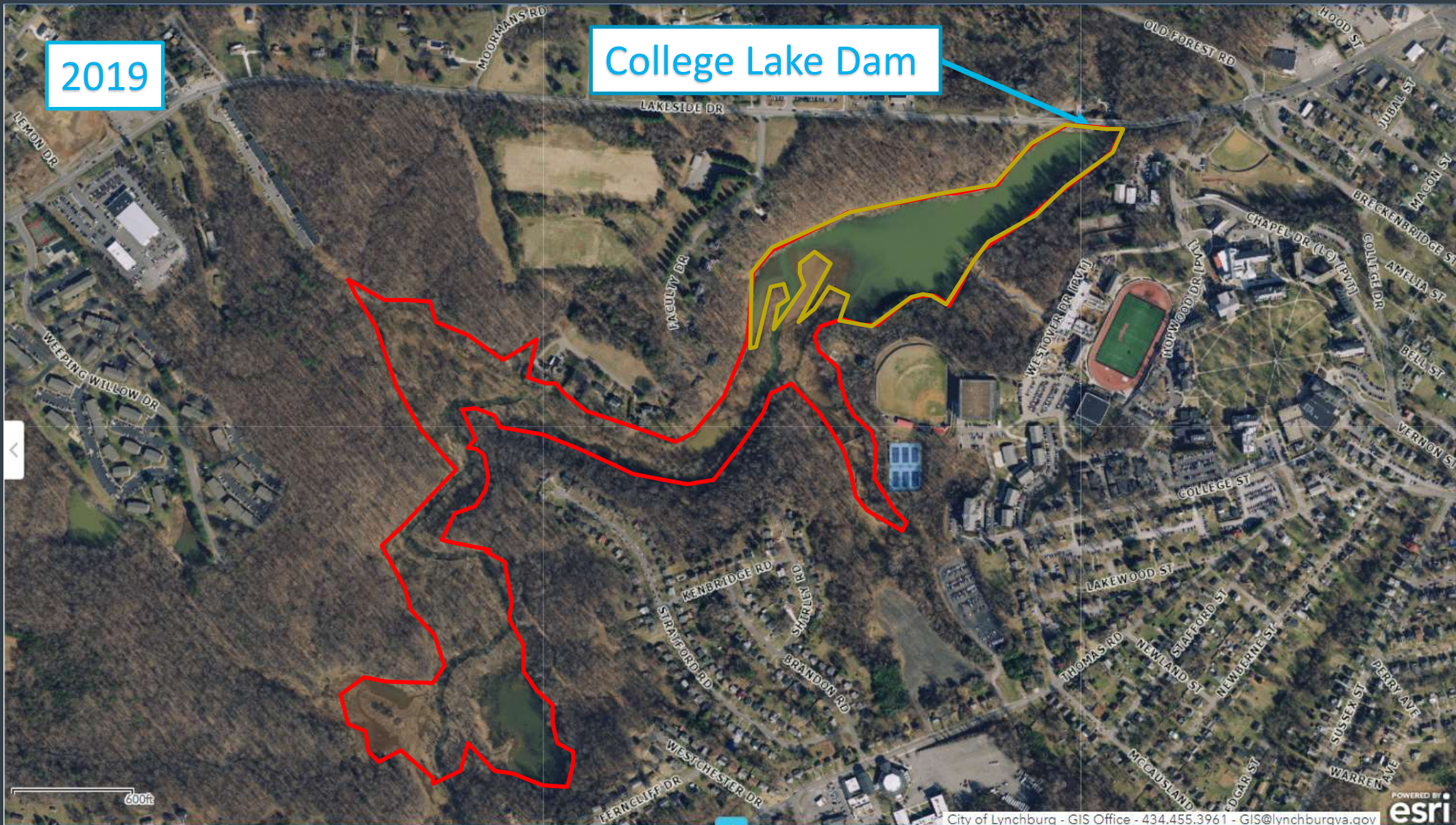
HISTORY | COLLEGE LAKE



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HISTORY | COLLEGE LAKE



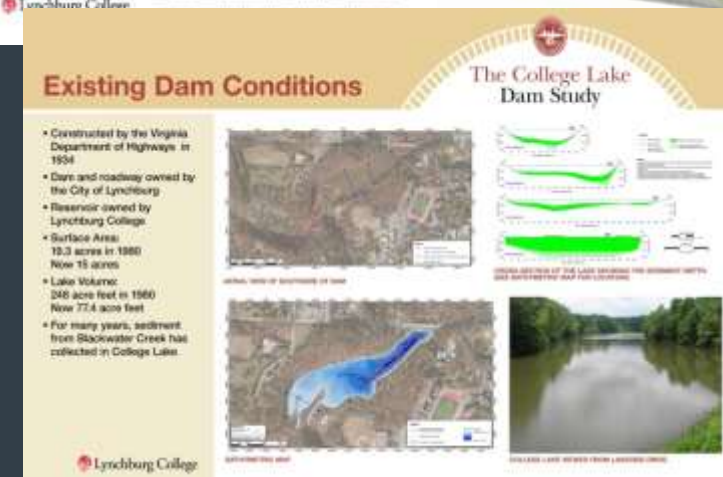
HISTORY | COLLEGE LAKE

2021



HIGH HAZARD | COLLEGE LAKE DAM

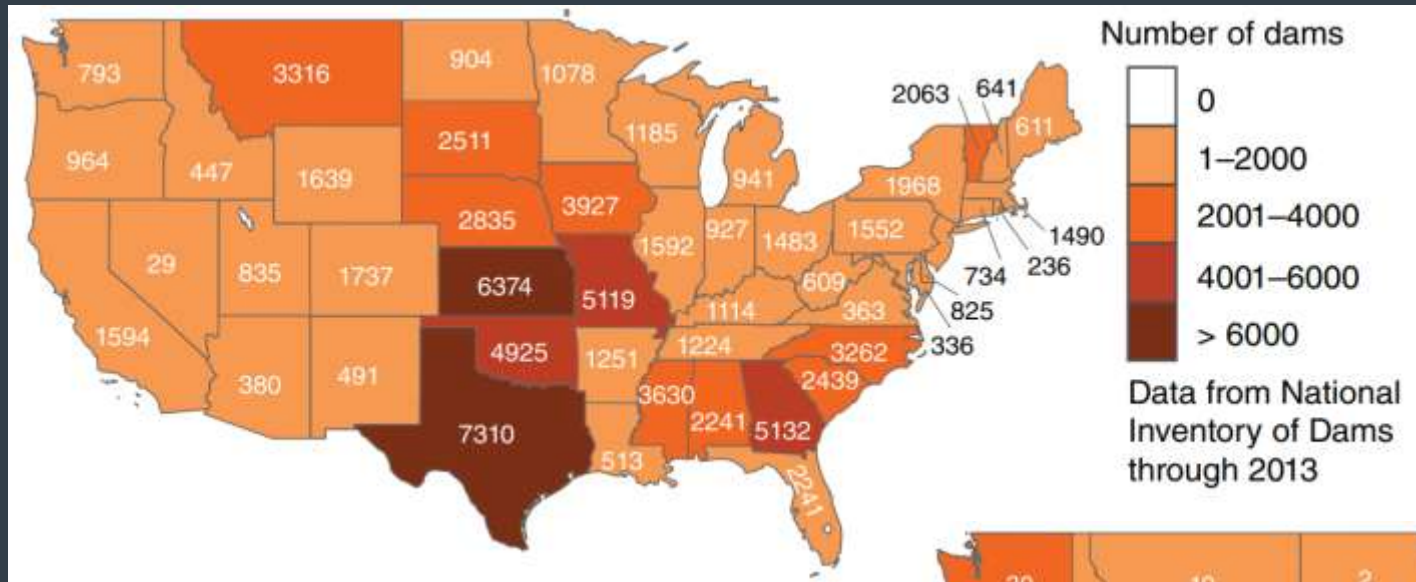
- Operating on a Conditional Dam Safety Permit
- High Hazard Dams – Upon Failure result in Probable Loss of Life or Serious Economic Damage
- Inadequate Spillway Capacity
- In 2014, the City began to assess how to meet the dam safety standards
- In 2017, URS presented the City with 2 options of Dam Removal or Hard-Armoring the Dam



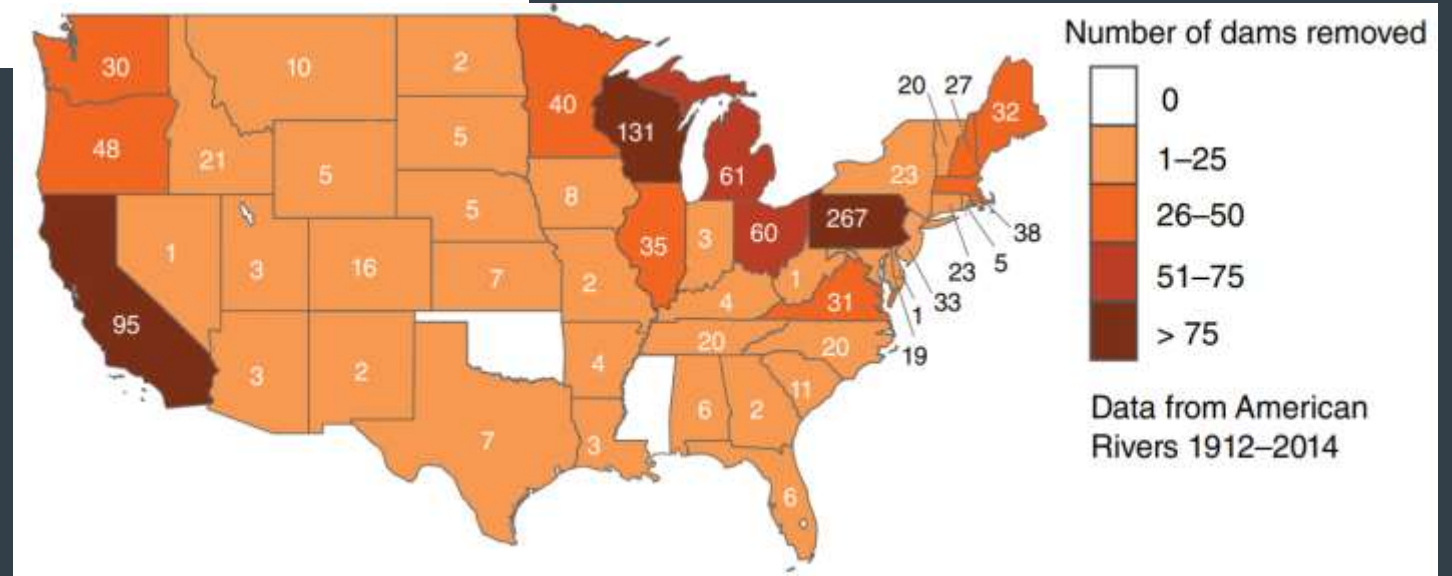
LAKE DRAINING | COLLEGE LAKE



NATIONAL INVENTORY | DAMS

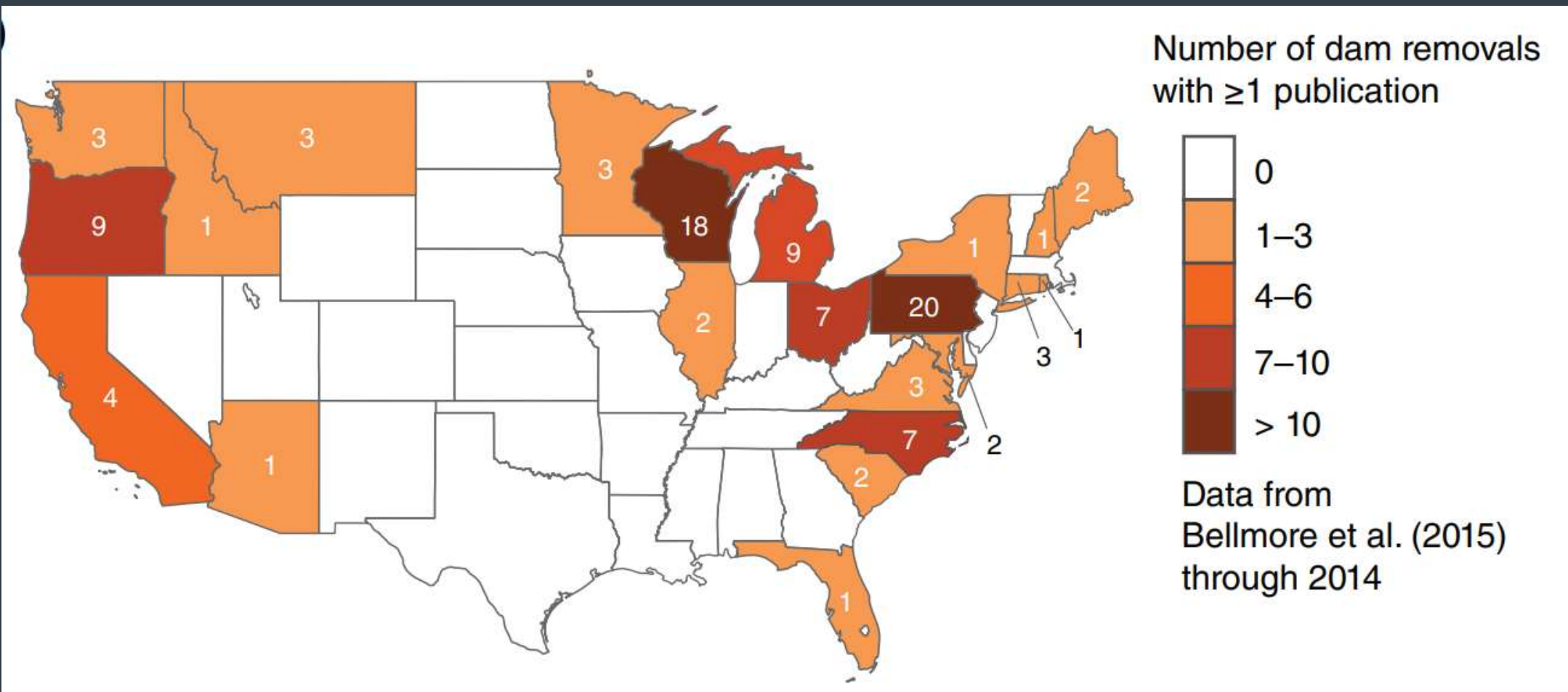


- Over 84,000 dams in the United States
- 363 Dams in Virginia
- 31 Virginia Dams Removed



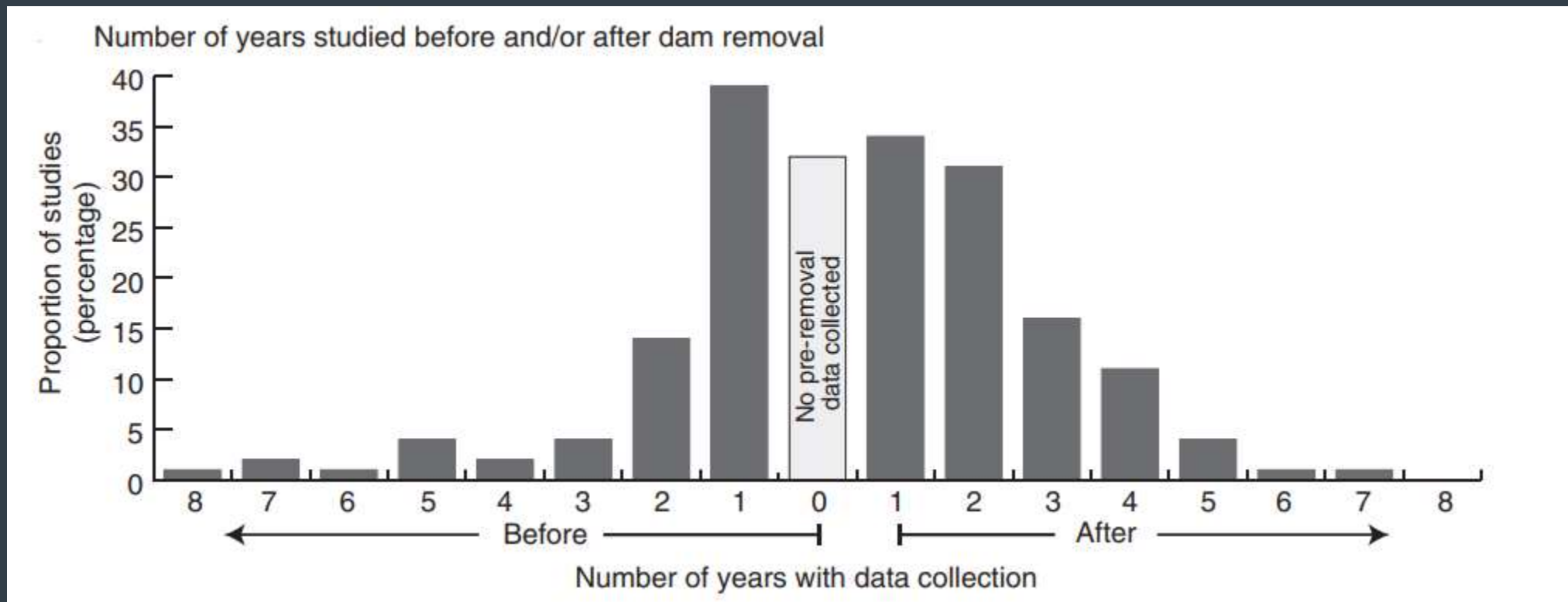
DAM STUDIES COMPLETED | DAMS

- Less than 9% of Dams Removed have Studies Completed

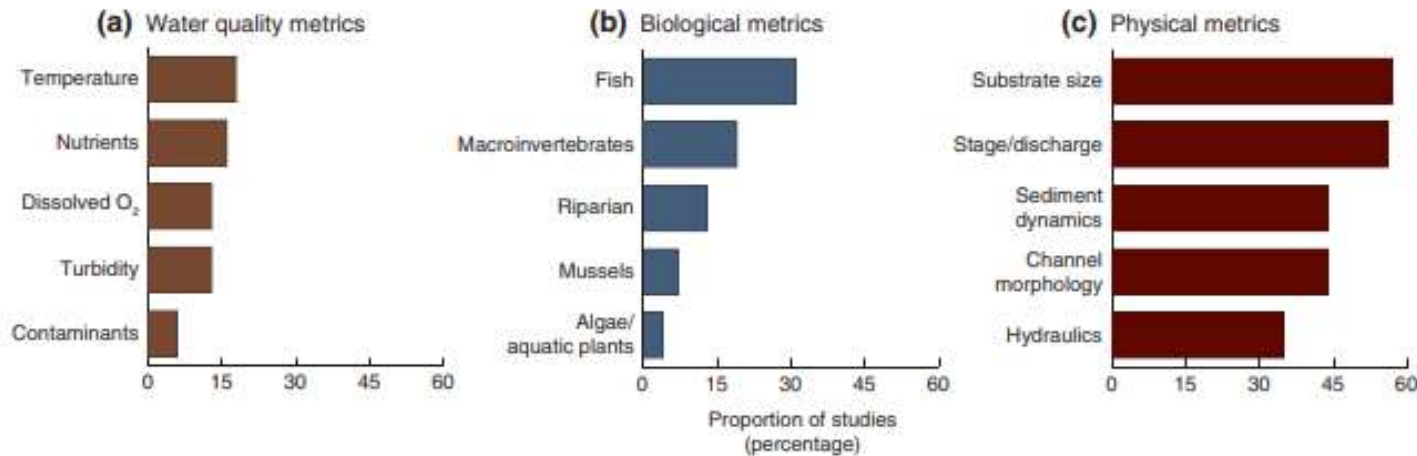


STUDY DURATION | DAM REMOVALS

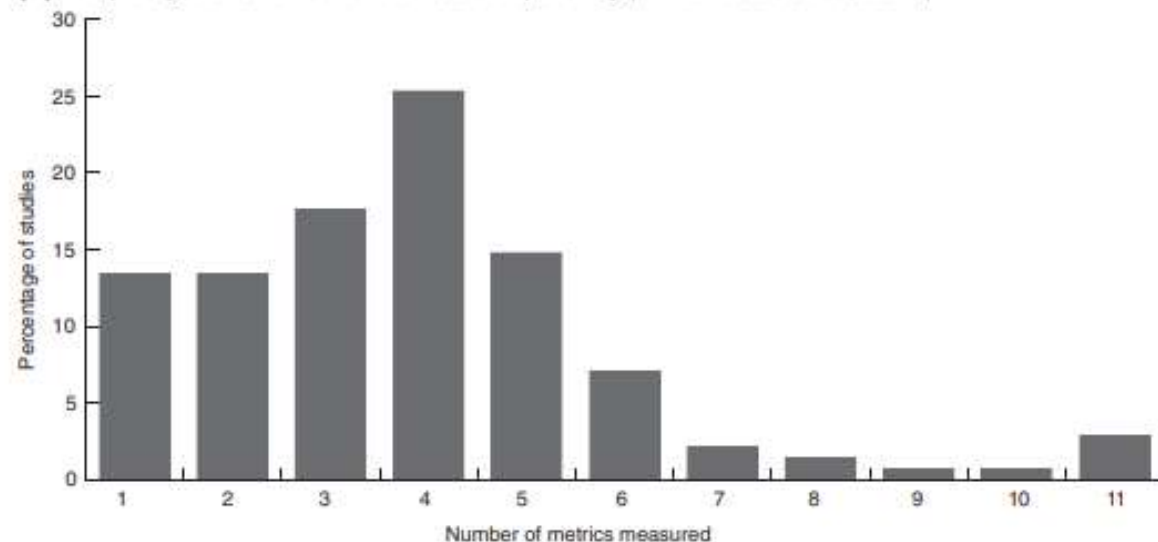
- 35% have No Pre- or Post- Removal Data
- Studies that exist are short in duration
- 65% of Studies were discontinued after 2 years



STUDY FOCUS | DAM REMOVALS



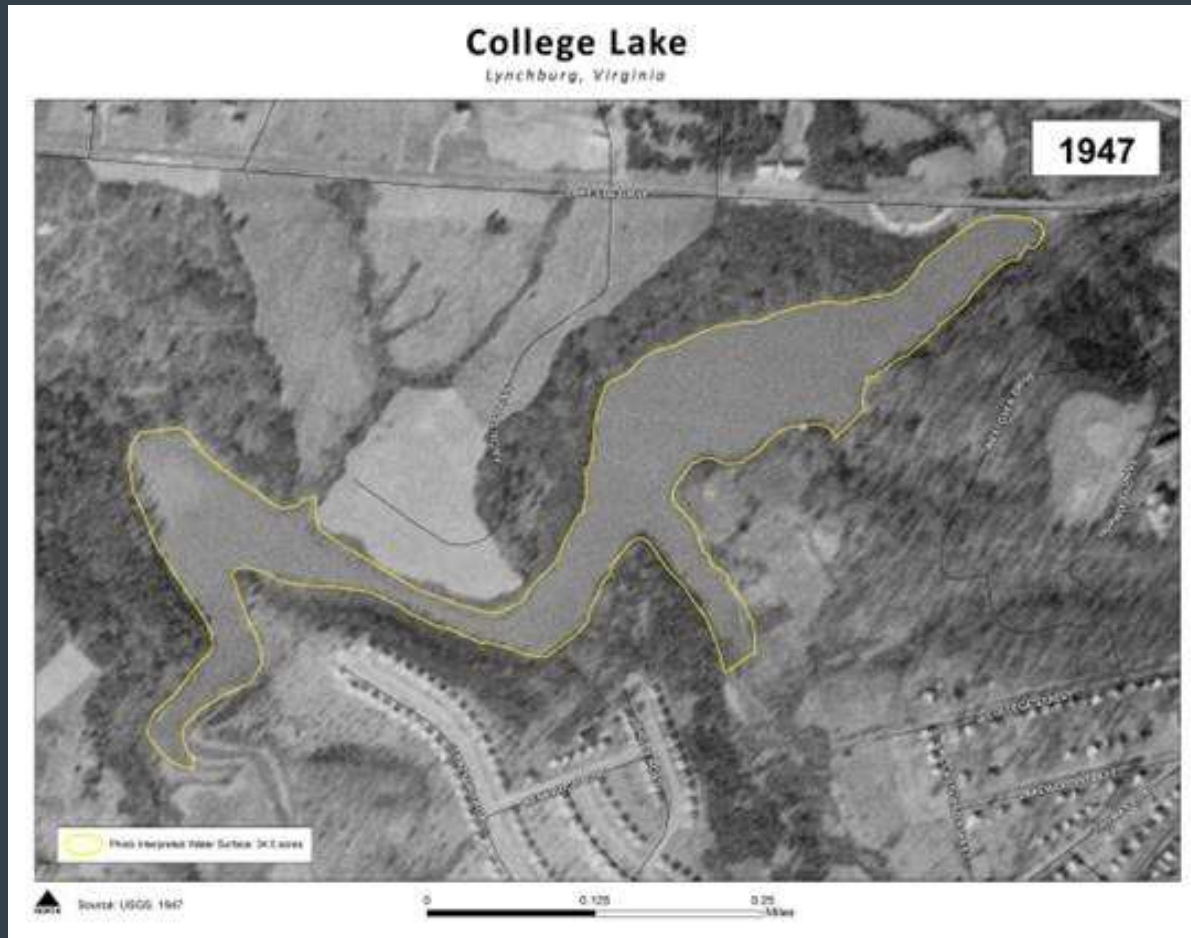
(d) Frequency distribution of metrics measured per study (in metric classes a-c, above)



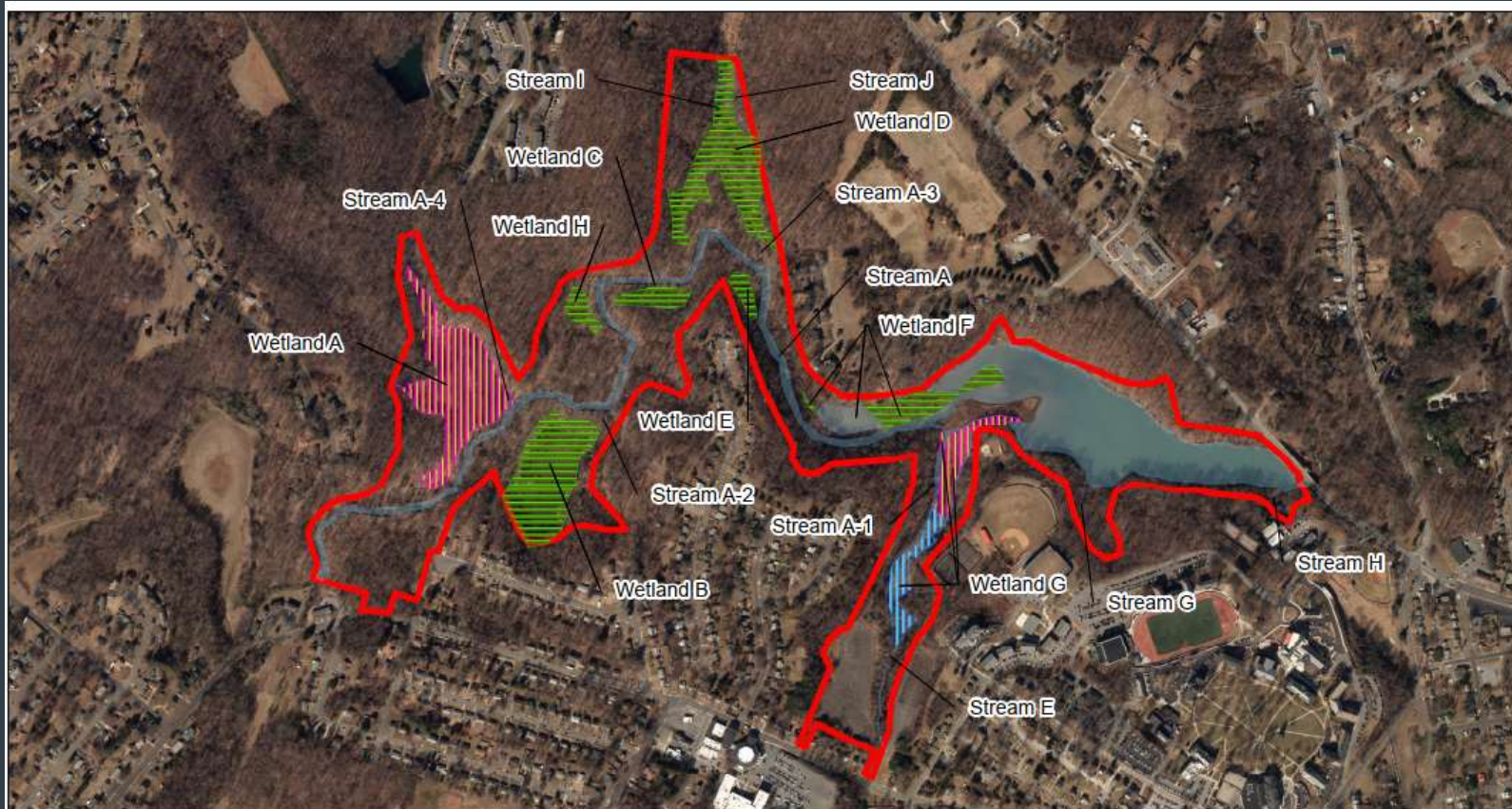
- Most Studies Focused on Physical Metrics
- Studies were also likely to focus on multiple Physical metrics

STUDY AREA | COLLEGE LAKE

Study area = 115 acres and includes historic lake extents

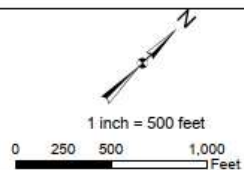


STUDY AREA | COLLEGE LAKE



- 11,975 LF Stream
- 18.22 Ac. Wetland
- 5.15 ac. Open Water
- 14.46 ac. College Lake

**College Lake Dam
Aerial Imagery Map
Lynchburg, Virginia**
NAD 1983 State Plane
This map is for reference only.



Legend

Project Area of Interest	Streams	PEM
City of Lynchburg	College Lake	PFO
	PSS	



FUNCTIONAL ASSESSMENTS | COLLEGE LAKE



- **Topographic/Bathymetric Survey**
- **Geomorphic Assessments**
- **Surface and Groundwater Level Monitoring**
- **Rapid Bioassessment Protocol (RBPs)**
- **Benthic Macroinvertebrates**
- **Wetland Attributes Assessments**
- **Unified Stream Methodology Assessment**
- **Flow/Discharge Analysis**
- **Water Quality and Bacteria Testing**

PHYSICAL METRICS | COLLEGE LAKE

College Lake 2020:

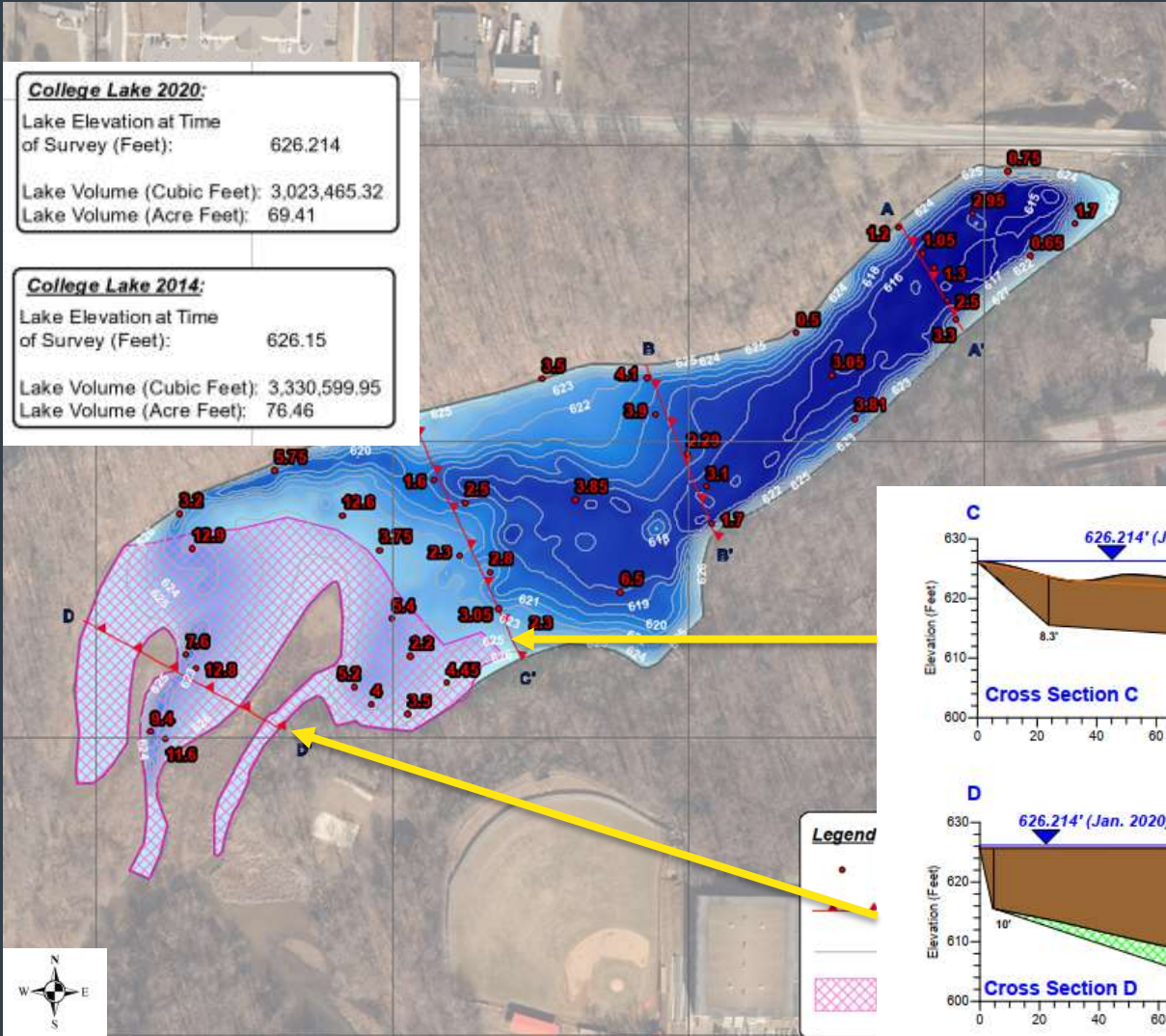
Lake Elevation at Time of Survey (Feet): 626.214

Lake Volume (Cubic Feet): 3,023,465.32
Lake Volume (Acre Feet): 69.41

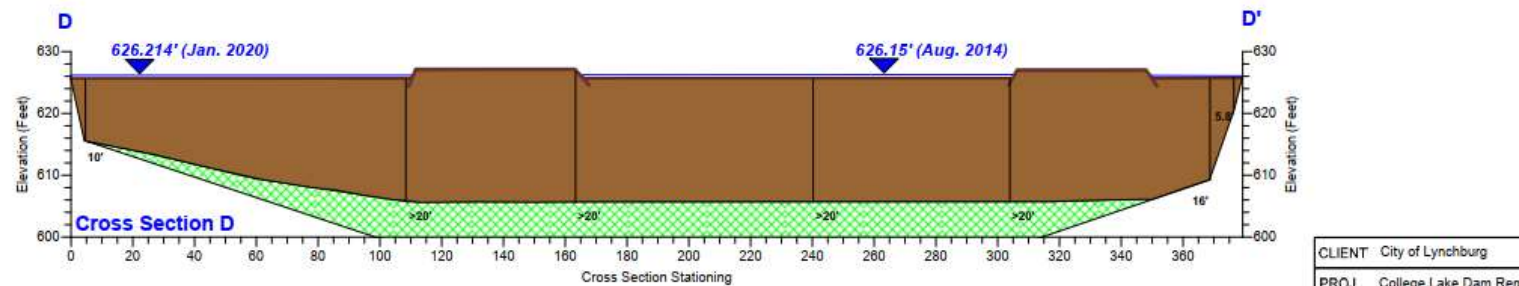
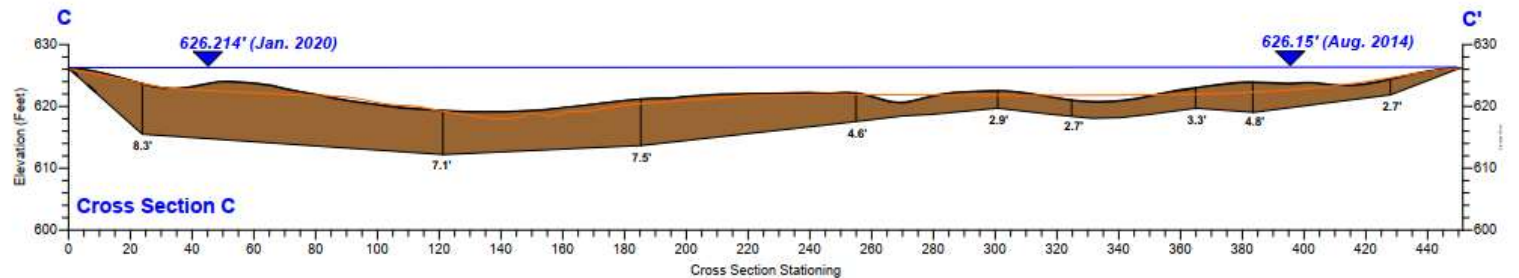
College Lake 2014:

Lake Elevation at Time of Survey (Feet): 626.15

Lake Volume (Cubic Feet): 3,330,599.95
Lake Volume (Acre Feet): 76.46

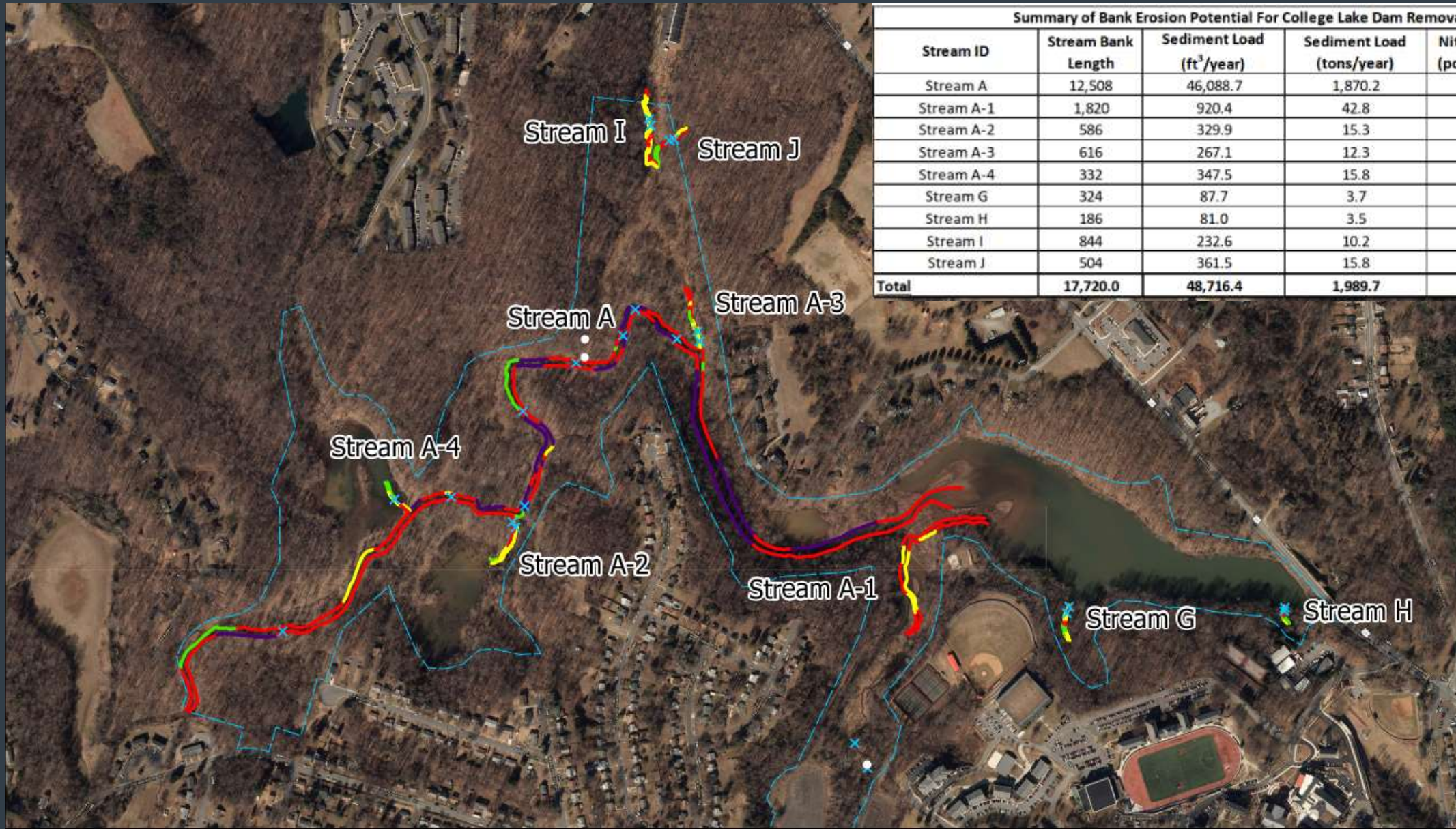


- Topographic Survey
- Bathymetric Survey
- Sediment Depth Probing
- Geotechnical Drilling/Seismic Refraction



CLIENT City of Lynchburg
PROJ College Lake Dam Rem

PHYSICAL METRICS | COLLEGE LAKE



Summary of Bank Erosion Potential For College Lake Dam Removal Study Area					
Stream ID	Stream Bank Length	Sediment Load (ft ³ /year)	Sediment Load (tons/year)	Nitrogen Load (pounds/year)	Phosphorous Load (pounds/year)
Stream A	12,508	46,088.7	1,870.2	4,264.0	1,963.7
Stream A-1	1,820	920.4	42.8	97.6	44.9
Stream A-2	586	329.9	15.3	35.0	16.1
Stream A-3	616	267.1	12.3	28.1	13.0
Stream A-4	332	347.5	15.8	36.1	16.6
Stream G	324	87.7	3.7	8.4	3.9
Stream H	186	81.0	3.5	8.1	3.7
Stream I	844	232.6	10.2	23.2	10.7
Stream J	504	361.5	15.8	36.0	16.6
Total	17,720.0	48,716.4	1,989.7	4,536.6	2,089.2

PHYSICAL METRICS | COLLEGE LAKE

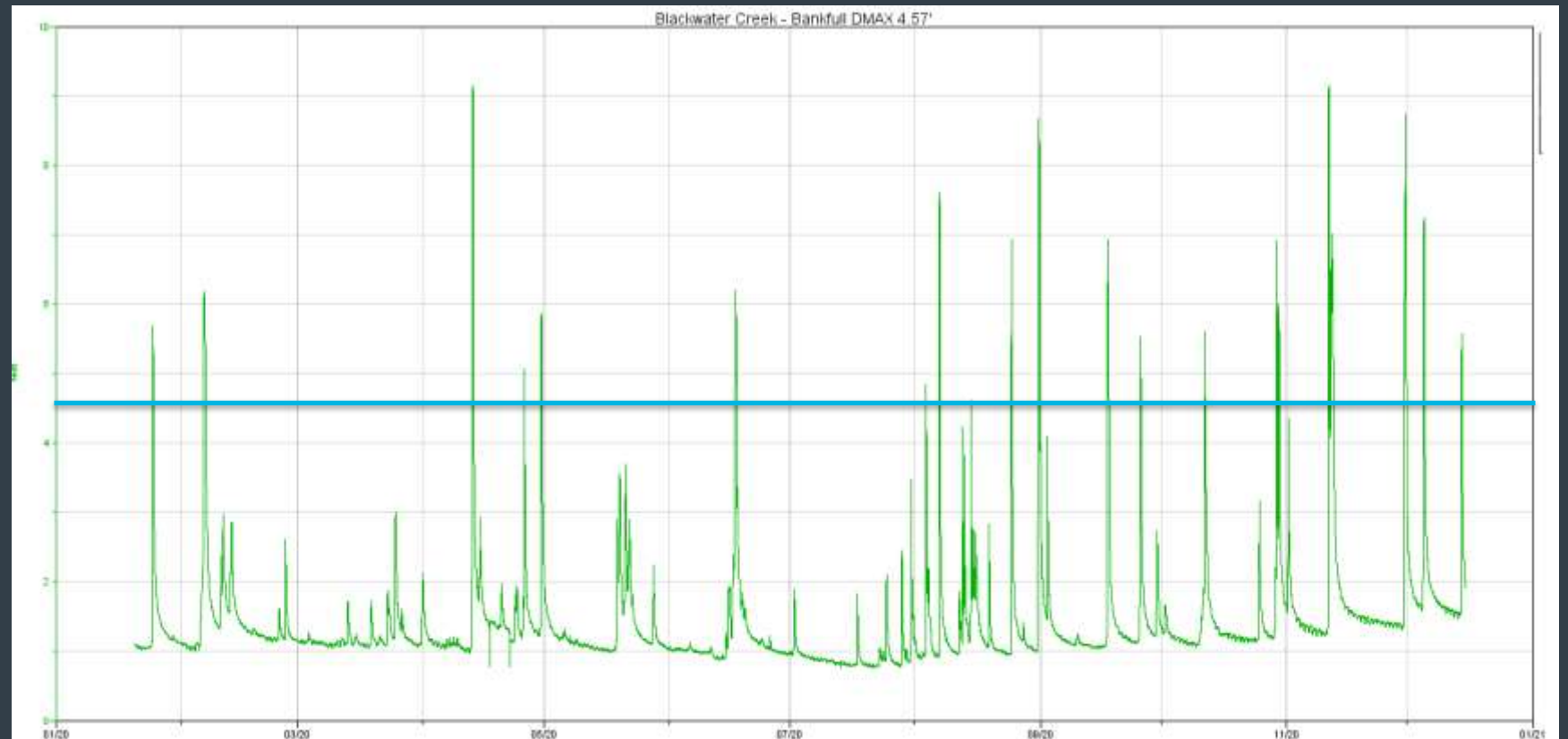
Majority of Stream Banks were classified as Very High/Extreme erodibility.



PHYSICAL METRICS | COLLEGE LAKE



- Multiple HOBOTM Data Loggers
- 18 Events Exceeded Bankfull Depth in 12 months



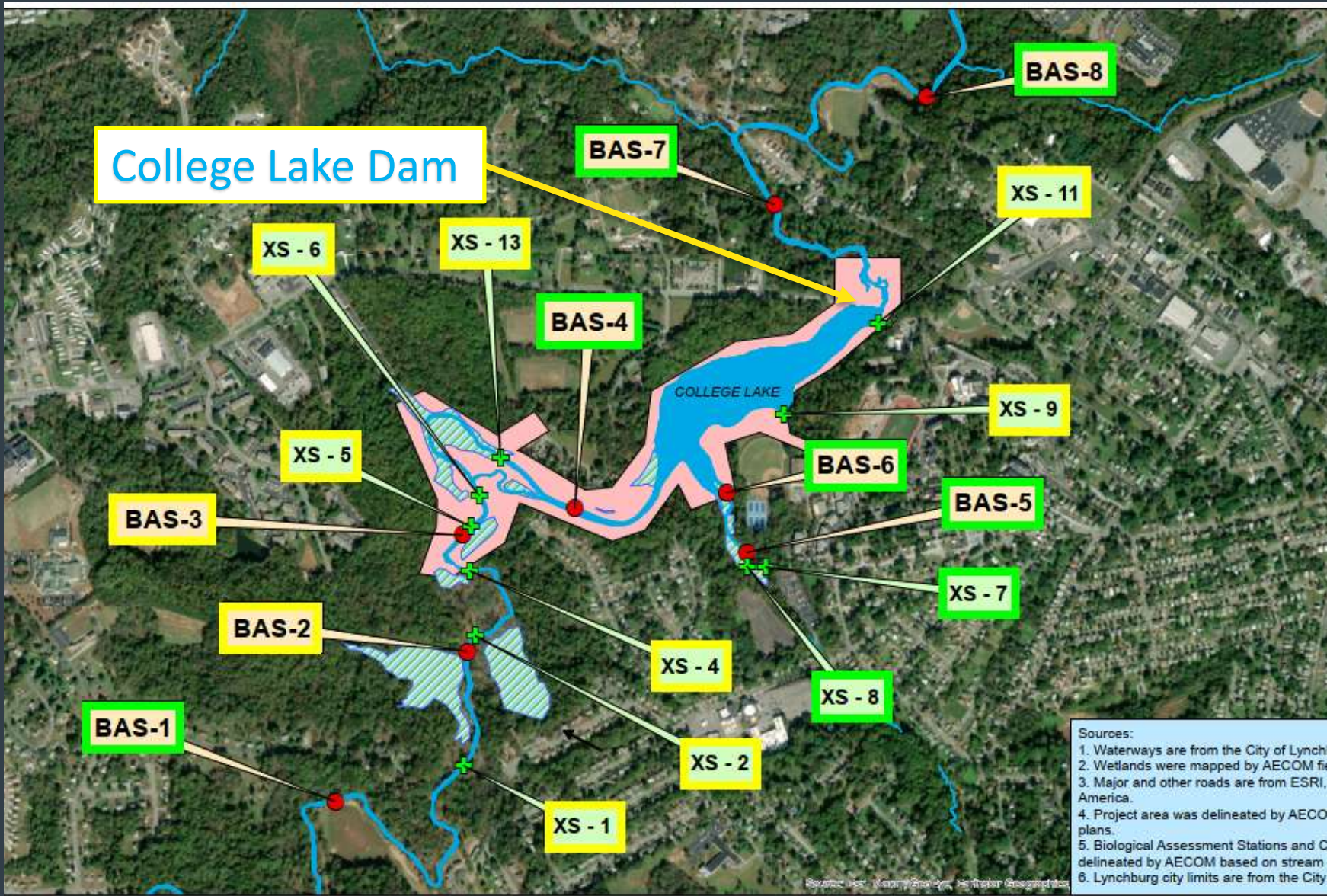
PHYSICAL METRICS | COLLEGE LAKE



- Incised Channel
- Sand Dominated Channel

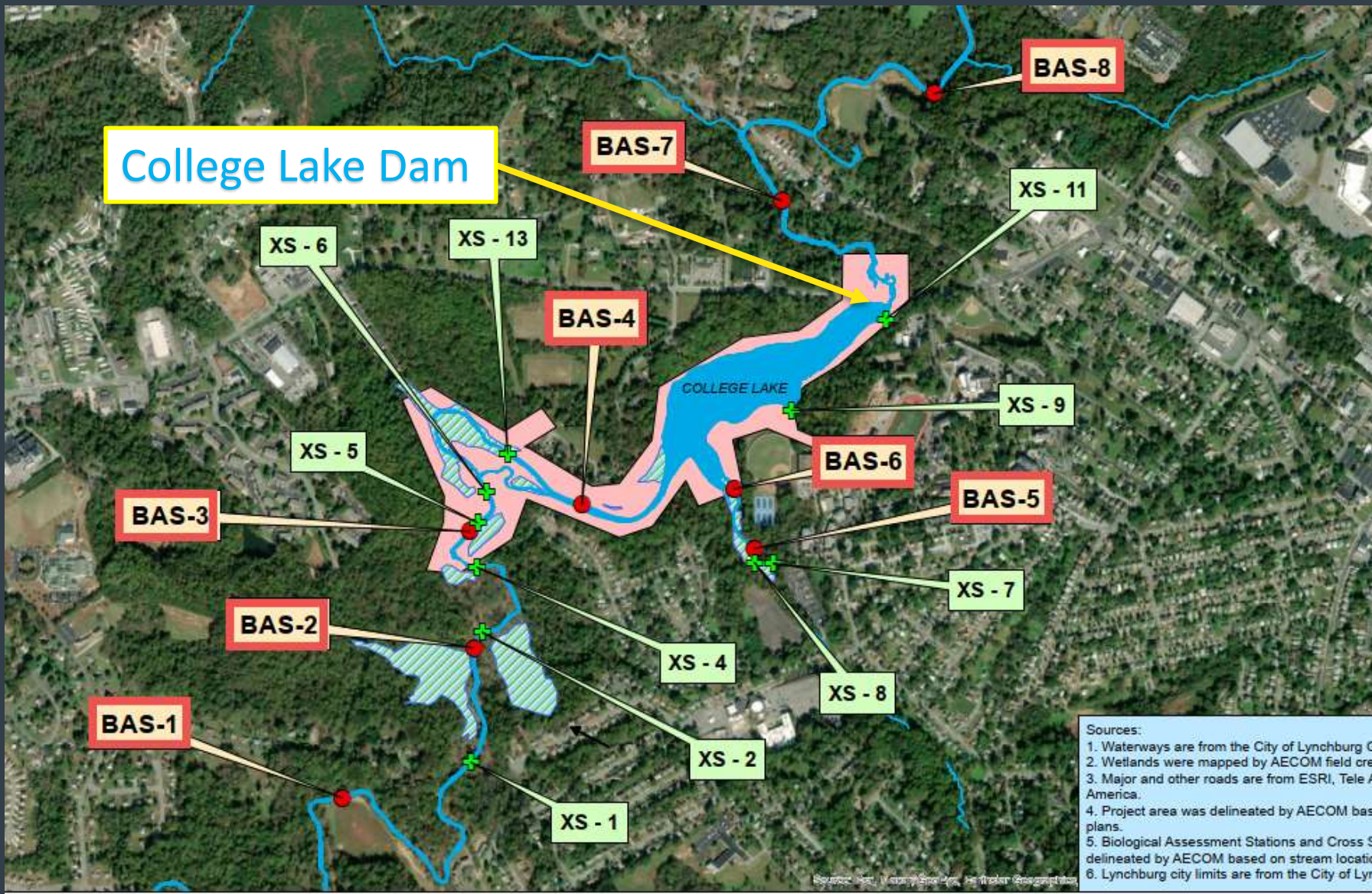


PHYSICAL METRICS | COLLEGE LAKE



	TOTAL Habitat Score	Quality Rating
BAS-6	134	Suboptimal
XS-7	148	Suboptimal
BAS-5 / XS-8	136	Suboptimal
Stream G	107	Marginal
Stream H	108	Marginal
BAS-1	120	Suboptimal
BAS-4	112	Suboptimal
BAS-7	132	Suboptimal
BAS-8	143	Suboptimal
XS-1	100	Marginal
BAS-2 / XS-2	92	Marginal
XS-4	92	Marginal
BAS-3 / XS-5	87	Marginal
XS-6	90	Marginal
Stream A-3	87	Marginal

BIOLOGICAL METRICS | COLLEGE LAKE



Sample Site	VSCI Score	VSCI Ranking
BAS-1	23.82	Impaired - Severe Stress
BAS-2 / XS-2	24.02	Impaired - Severe Stress
BAS-3 / XS-5	19.26	Impaired - Severe Stress
BAS-4	21.01	Impaired - Severe Stress
BAS-5 / XS-8	42.15	Impaired - Severe Stress
BAS-6	26.35	Impaired - Severe Stress
BAS-7	32.33	Impaired - Severe Stress
BAS-8	38.12	Impaired - Severe Stress

Sources:
 1. Waterways are from the City of Lynchburg GIS
 2. Wetlands were mapped by AECOM field crew
 3. Major and other roads are from ESRI, Tele Atlas
 4. Project area was delineated by AECOM based on plans
 5. Biological Assessment Stations and Cross Sections were delineated by AECOM based on stream locations
 6. Lynchburg city limits are from the City of Lynchburg GIS

BIOLOGICAL METRICS | COLLEGE LAKE

- All sites were Impaired – Severe Stress
- All samples dominated by pollution tolerant taxa
- Scores increased away from Dam and were lowest in frequent backwater areas



Ephemeroptera



Plecoptera



Tricoptera

BIOLOGICAL METRICS | COLLEGE LAKE



TREE OF HEAVEN



JAPANESE STILTGRASS



BAMBOO FOREST

WATER QUALITY METRICS | COLLEGE LAKE

pH	Specific Conductance ($\mu\text{s}/\text{cm}$)	Dissolved Oxygen (ppm)	Total Dissolved Solids (mg/L)
7.55	203	8.02	209

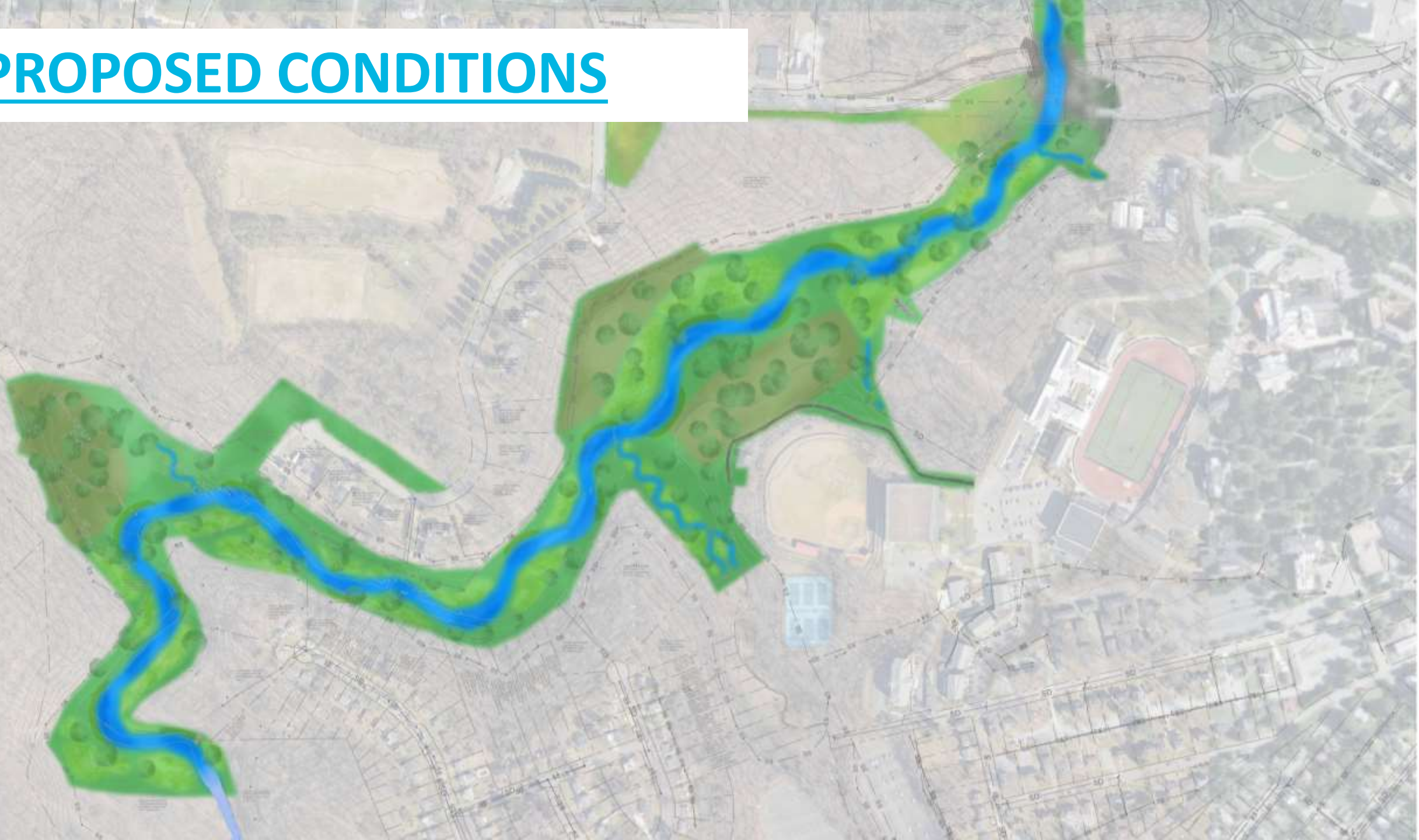
- Good water quality
- Absent of odors, surface oils, with no significant turbidity.
- Elevated Bacteria Levels were observed in the Study Area





- Natural Channel Design
- Wetland Creation
- Native Seed and Tree Mix

PROPOSED CONDITIONS



INTO THE FUTURE | COLLEGE LAKE



- UofL Faculty and Student Research/Classroom
- In-Situ Aqua TROLL[®] 500 and VuLink Data Logger
- 5 Year Compliance Monitoring





Thank You!

Any Questions?