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Urban Ecosystem Restoration: An Example of Stream and Lake Restoration in Metropolitan Atlanta, GA

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Agenda

- Background on Gwinnett County, Georgia's Watershed Improvement Program
- Example Project Selection and Implementation

Gwinnett County:

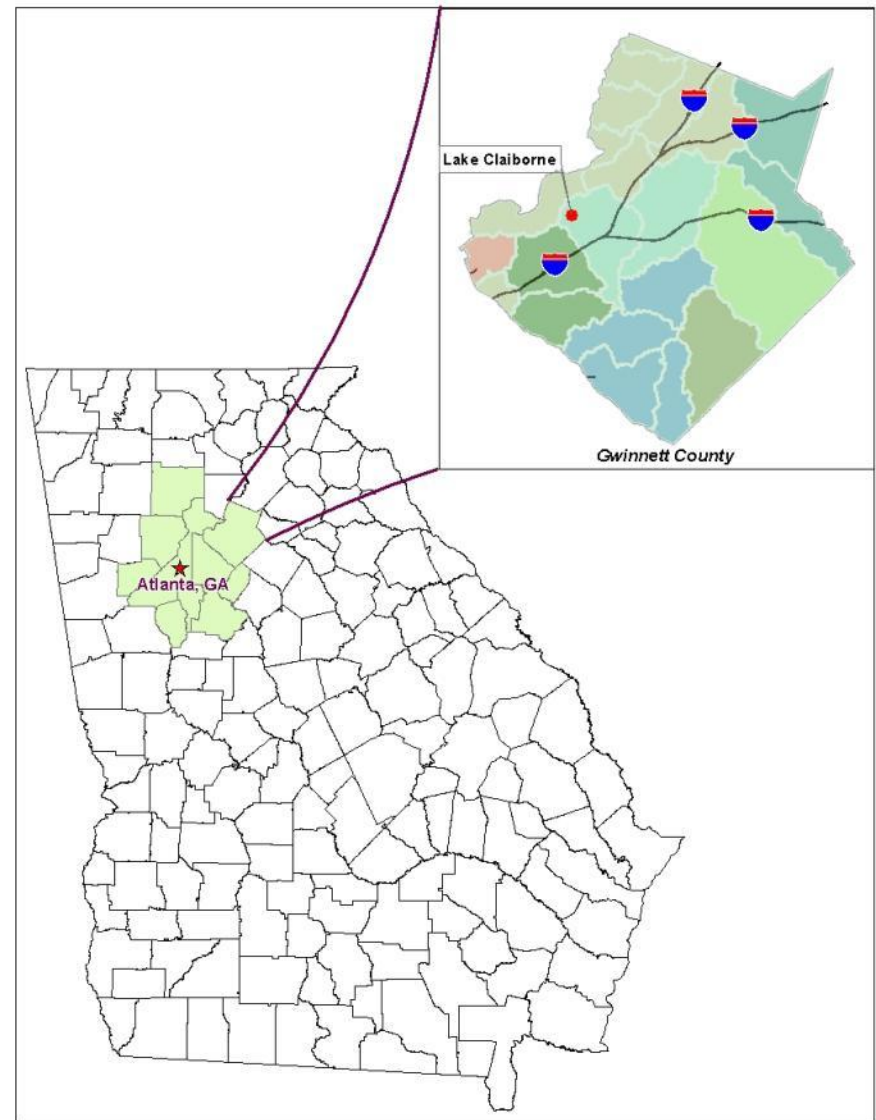
Population: 780,000

Area: 437 sq. miles

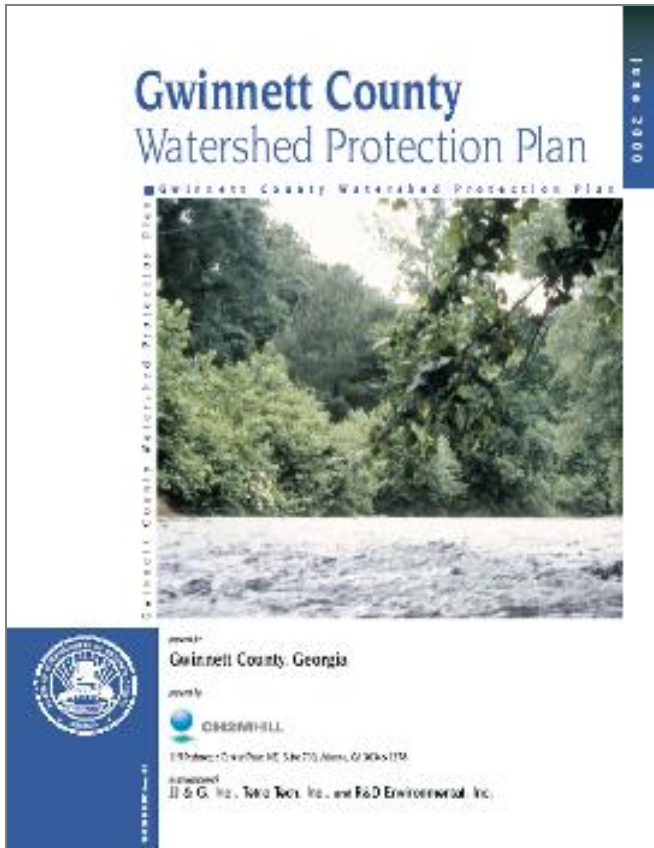
1,300 miles drainage system

80,000 structures maintained

SU income \$32M/yr



Gwinnett County: Watershed/Stormwater Program Management



County-Wide
Watershed Assessment



County-Wide
Watershed Protection Plan (WPP)

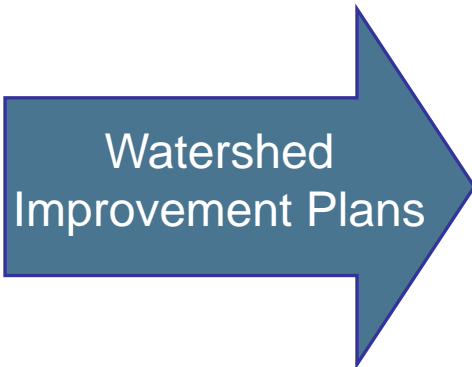


Goal: Streams meet
designated use

Establish WQ target
TSS <1,600 lbs/ac/yr

Gwinnett County: County-Wide Watershed Protection Plan

Watershed Protection Plan Outlined Three Strategies

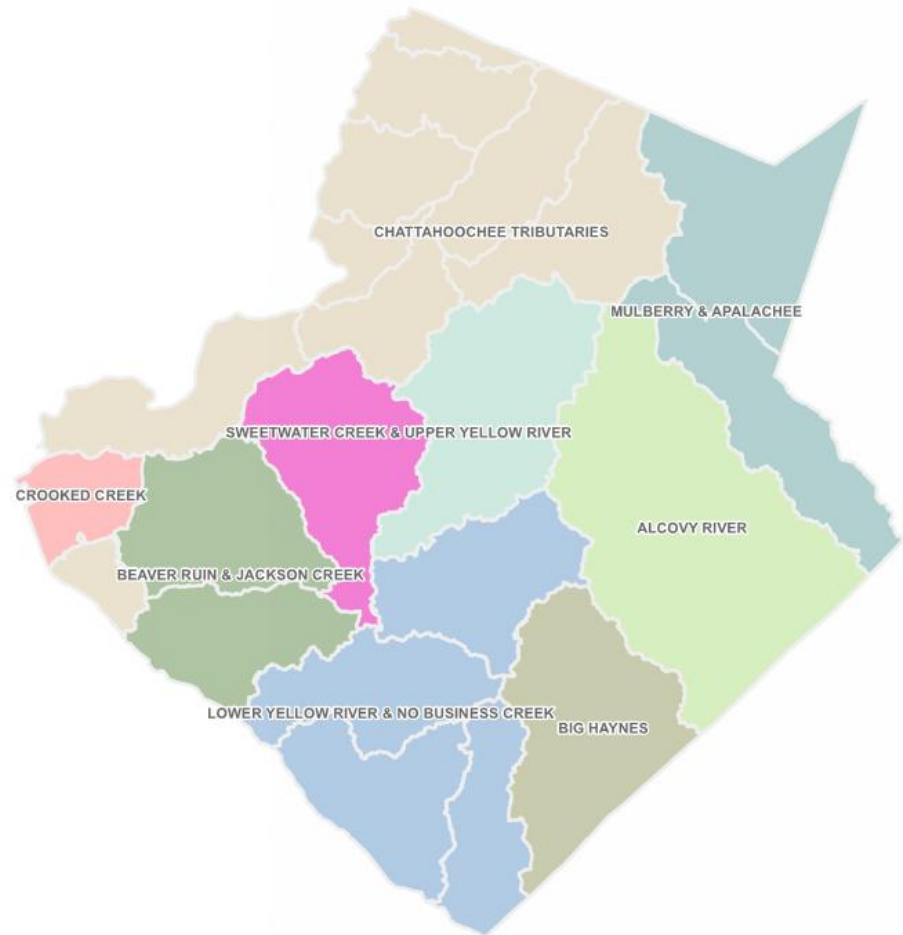


- New development and redevelopment requirements
- **Improving affected areas**
- Supporting activities to improve watersheds
- Meeting NPDES/TMDL Regulatory Requirements

Gwinnett County: Watershed Improvement Plans 2001–2010

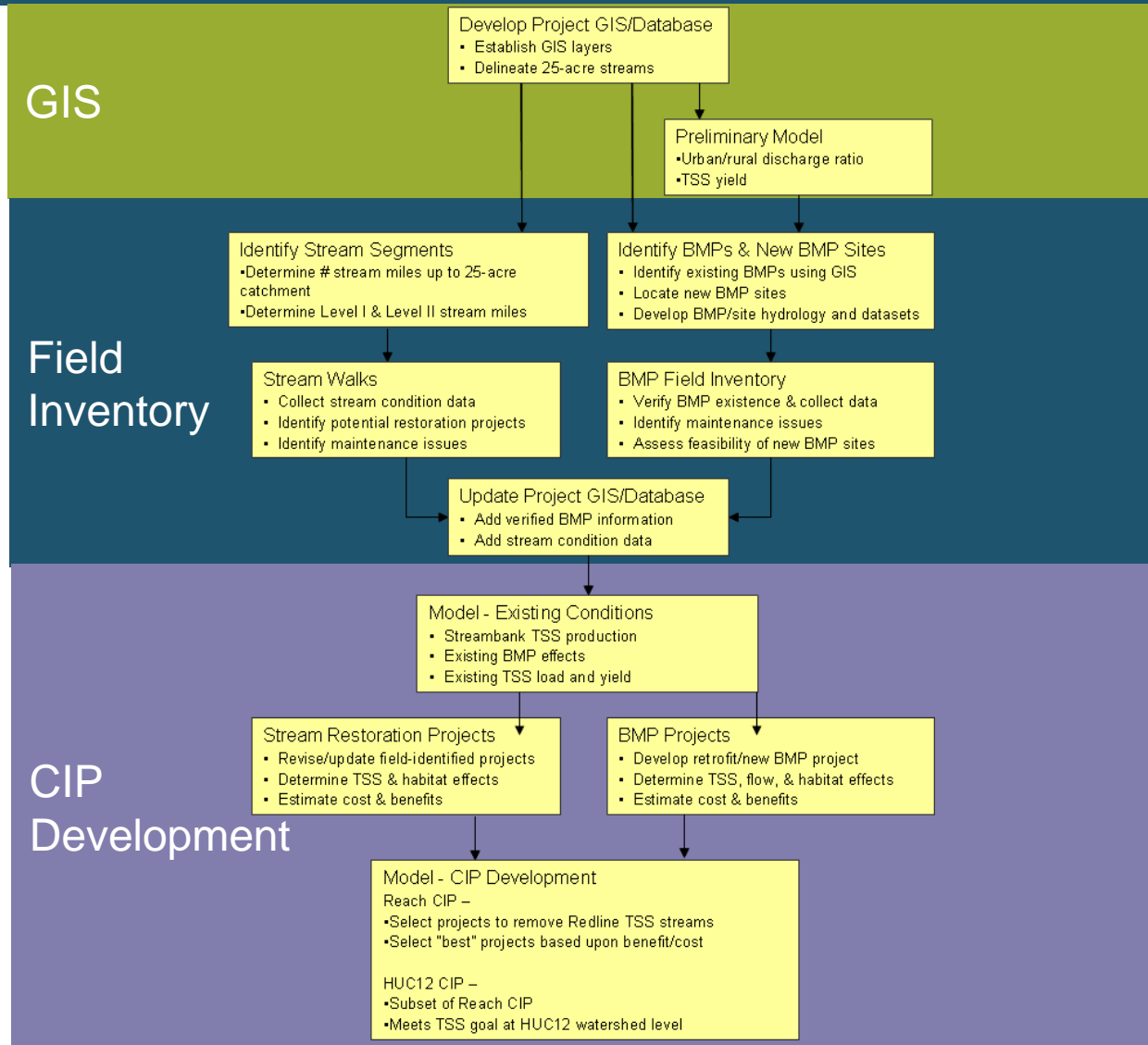
- Stream Walks
- BMP Inventory
- GIS WQ Modeling
- CIP Development

BC completed WIPs
for 60% of County
~ 300 sq. miles.

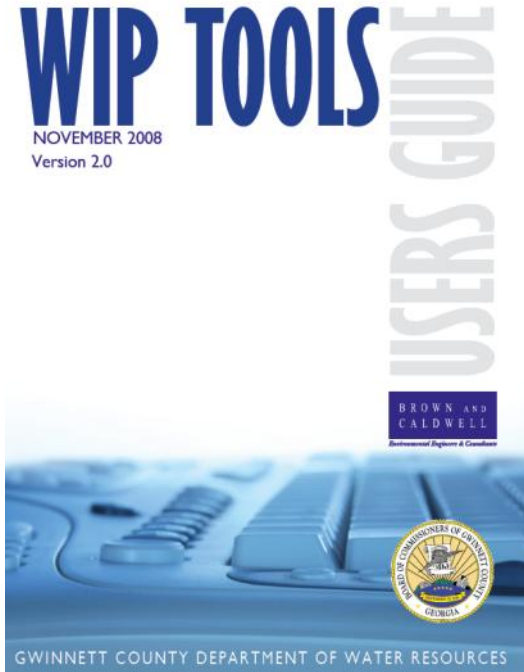


Watershed Analysis Using BC's GIS Based Watershed Improvement Plan (WIP) Tools

TSS
TN
TP
BOD
FC
Others

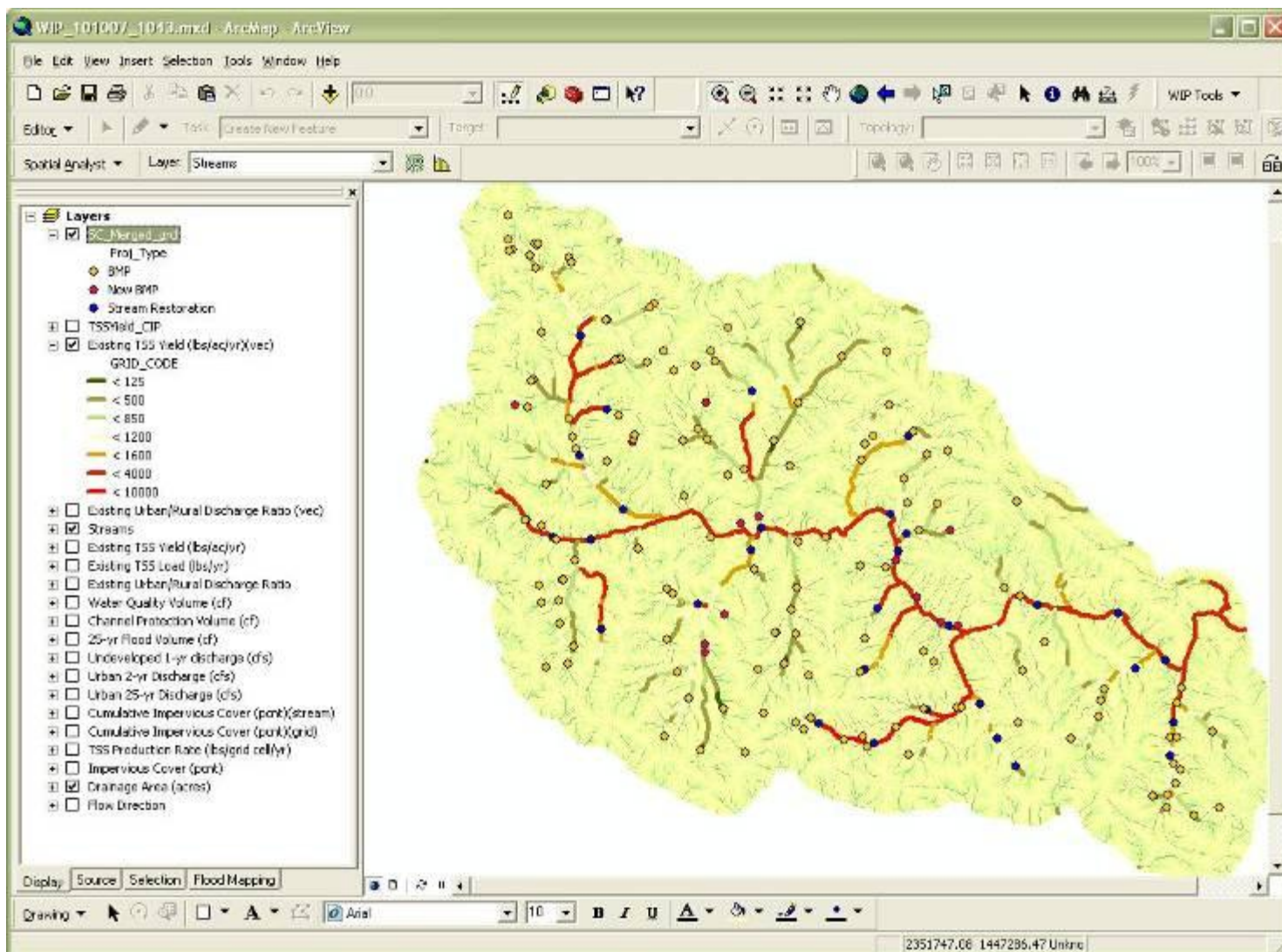


WIP Tools Overview



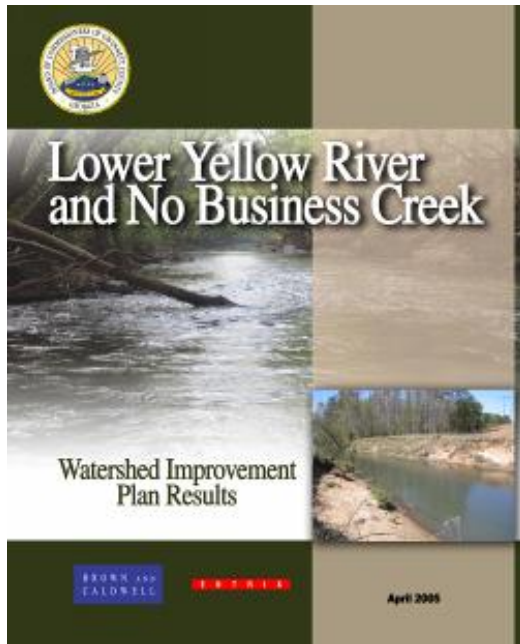
- Grid based, flow accumulation GIS model
- Develops hydrologic and water quality baseline conditions
- Evaluates stream restoration and best management practices (BMPs)
- Predicts improvements from projects based on baseline conditions
- Estimates in-stream erosion and pollutant loadings in addition to loadings from the contributing watershed
- Tool to develop CIP list in order to meet TSS loading goals for the County

WIP Tools Modeling / CIP Development



Gwinnett County: Project Report and Project Summary Sheets

- Overview of inventory results: BMPs and Streams
- Recommended CIP and costs: Reach and HUC-12
- Study area maps by subwatershed and project sheets



Project Description & Evaluation Sweetwater Creek Watershed		BMP ID: SC-3404-0273 Proposed Retrofit	
BMP Characteristics			
Existing BMP: Wet Pond		TSS Removal: 664,788 lbs/yr	
Recommendation: S4		TSS Removal: 80 %	
V2		TP Removal: 50 %	
Volume: 1,745,517 cubic feet		TN Removal: 30 %	
Volume Increase: 882,465 cubic feet		Fecal Removal: 70 %	
Maximum Area: 441,233 square feet		Metals Removal: 50 %	
Estimated Cost: \$399,684		O&M Burden: Low	
Cost Add on:			
Site Characteristics			
Land use: PAVE	Soil Class: W		
Zoning: R75	SCS Hydrologic Soil Group:		
City/County: County	Located in NRT Wetland: TRUE		
	In how many parcels: 16		
Description: No structure Present, Outfall is spillway with (2) 4 x 10' box culverts under the road.			
Watershed Characteristics			
Drainage Area: 549.5 acres	Tributary or Sub-watershed: SW06		
Impervious Cover: 25.3 %	WQ Volume: 664,384 cubic feet		
Urban 2-Year Q: 355 cfs	CP Volume: 2,940,152 cubic feet		
Rural 2-Year Q: 166 cfs	25-Year Volume: 3,777,887 cubic feet		
Urban 25-Year Q: 775 cfs	TSS Yield: 1,662 lbs./acre/yr		
Rural 25-Year Q: 303 cfs	TSS Load: 913,419 lbs/yr		

Figure 1 Plan View of Proposed Retrofit BMP

Project Description & Evaluation Sweetwater Creek Watershed		BMP ID: SC-3404-0273 Proposed Retrofit					
Figure 2 Location of Proposed Retrofit BMP							
Retrofit BMP Evaluation							
Issue	Score	TSS		Habitat			
		Multiplier	Score	Multiplier	Score		
Water Quality Benefits							
Fecal Coliform:	2.5	0.1	0.5	0.3	0.1	0.5	0.3
TSS:	2.5	0.1	0.5	0.3	0.1	0.5	0.3
Phosphorus:	2.5	0.1	0.5	0.3	0.1	0.5	0.3
Metals:	2.5	0.1	0.5	0.3	0.1	0.5	0.3
Hydlogic Control							
Flood Protection:	0.0	0.2	1.0	0.0	0.2	1.0	0.0
Channel Protection:	4.3	0.2	1.0	0.9	0.2	1.0	0.9
Property Protection							
Property Protection:	2.7	0.4	2.0	1.1	0.4	2.0	1.1
Habitat and Biological Integrity							
Habitat/Biology:	3.7	0.4	2.0	1.5	0.4	2.0	1.5
Implementation Issues							
Site Constraints:	5.0	0.08	0.4	0.4	0.08	0.4	0.4
County Program Compatibility:	5.0	0.08	0.4	0.4	0.08	0.4	0.4
Neighborhood Acceptance:	4.0	0.08	0.4	0.3	0.08	0.4	0.3
Environmental Impacts:	5.0	0.08	0.4	0.4	0.08	0.4	0.4
Relative Ease of O&M:	5.0	0.08	0.4	0.4	0.08	0.4	0.4
Benefit/Cost Considerations							
Pounds TSS removed/\$	5.0	18.0	90.0	90.0	-	-	-
Habitat protected or restored/\$	2.7	-	-	-	18.0	90.0	49.3
Total Project Score:					96.4		55.7

Lake Claiborne Restoration Project

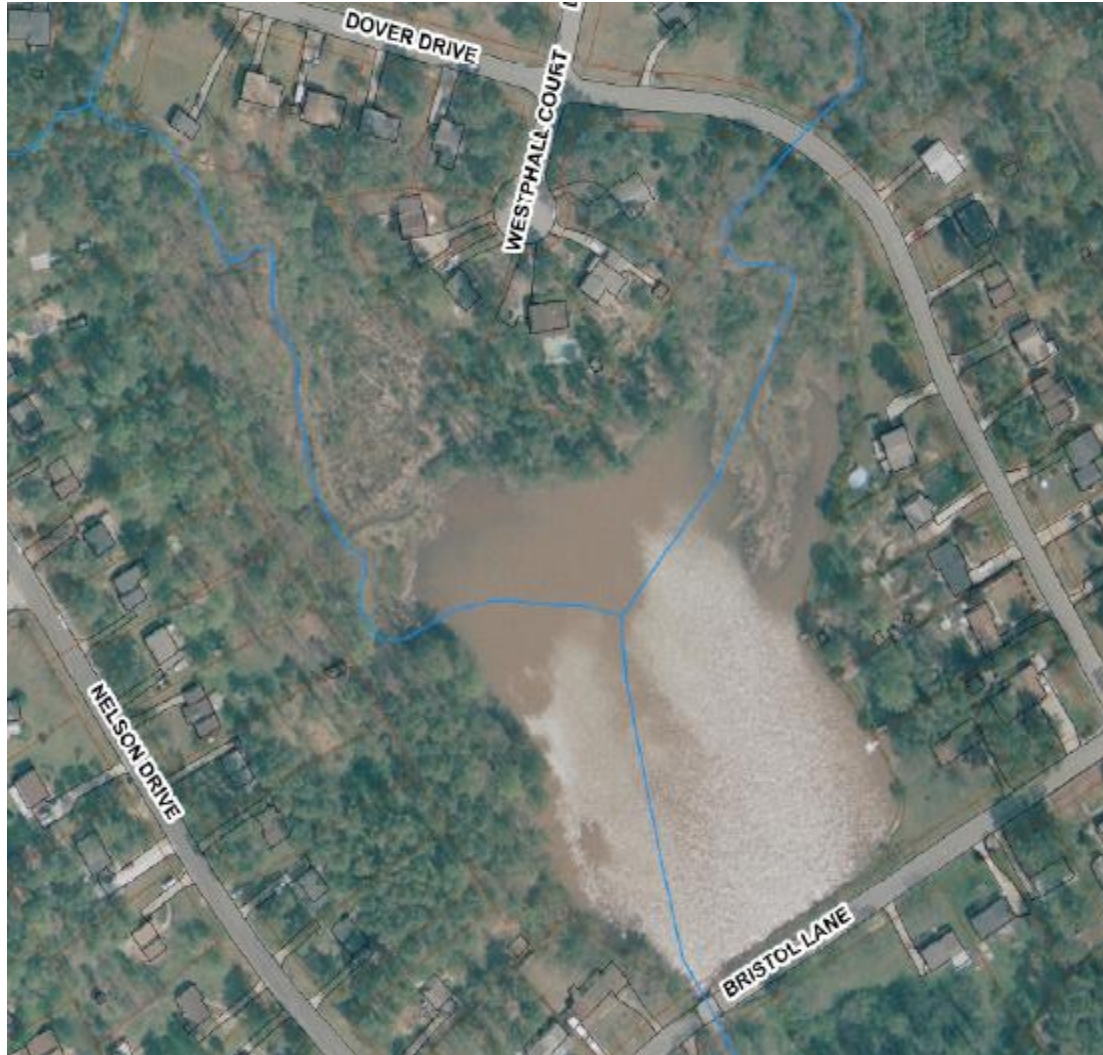
- Identified as BMP retrofit in the WIP – determined to need an outlet control structure and additional water quality and channel protection volume storage
- Lake silted in due to upstream development
- Homeowner complaints
- County-owned parcel



Lake Claiborne – 1972 and 2007



Lake Claiborne Restoration



- 2 tribs, 600 acre developed watershed
- 5 acre lake
- Water depth = <1-5 ft
- Filled sediment thickness 1-4 ft
- ~40,000 cy sediment
- 2 wetlands delineated

Completed Survey and Sediment Measurement and Testing



Sediment Testing Results

Sample Identification		Sample Type	Sample Depth	Soil Classification	As R'cd Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		G _s	Unit Weight		Permeability (cm/sec)	Organic Content %	Additional Tests Conducted (See Notes)
Borehole Number	Sample ID					% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %	L.L.	P.L.	P.I.	L.I.		Moisture %	Dry (lb/cuft)			
NEP-1	COMBO	Bulk	1.0-7.0'	ML	44.9	32	27	5	3.52	99.4	64.2	-	103.7	17.7	-	-	-	-	-	-
NEP-1	NEP-1-1	Bag	1.0'	(ML)	45.4	-	-	-	-	100.0	58.2	-	-	-	-	45.4	73.5	-	5.7	-
NEP-1	NEP-1-3	Bag	3.0'	(ML)	51.7	-	-	-	-	99.8	75.1	-	-	-	-	51.7	67.7	-	6.8	-
NEP-1	NEP-1-6	Bag	6.0'	(ML)	50.1	-	-	-	-	99.2	64.2	-	-	-	-	50.1	70.7	-	5.9	-
NEP-1	NEP-1-7	Bag	7.0'	(ML)	33.6	-	-	-	-	98.5	51.9	-	-	-	-	33.6	88.1	-	3.4	-
NEP-2	COMBO	Bulk	1.0-4.0'	ML	52.1	41	34	7	2.74	99.9	80.3	-	100.8	15.1	-	-	-	-	-	-
NEP-2	NEP-2-1	Bag	1.0'	(ML)	52.0	-	-	-	-	100.0	86.9	-	-	-	-	52.0	50.8	-	6.9	-
NEP-2	NEP-2-4	Bag	4.0'	(ML)	28.1	-	-	-	-	99.9	70.0	-	-	-	-	28.1	92.5	-	2.6	-
NWP-1	COMBO	Bulk	1.0-5.0'	ML	43.6	36	29	7	2.09	100.0	78.6	-	99.1	20.4	-	-	-	-	-	-
NWP-1	NWP-1-1	Bag	1.0'	(ML)	58.9	-	-	-	-	100.0	81.5	-	-	-	-	58.9	62.0	-	8.4	-
NWP-1	NWP-1-5	Bag	5.0'	(ML)	29.1	-	-	-	-	100.0	67.7	-	-	-	-	29.1	91.4	-	2.3	-
NWP-2	COMBO	Bulk	1.0-7.0'	CL-ML	29.7	27	21	6	1.51	99.6	62.5	-	109.8	14.8	-	-	-	-	-	-
NWP-2	NWP-2-1	Bag	1.0'	(ML)	30.0	-	-	-	-	99.5	69.0	-	-	-	-	30.0	89.3	-	4.1	-
NWP-2	NWP-2-2	Bag	2.0'	(ML)	30.1	-	-	-	-	99.6	60.1	-	-	-	-	30.1	89.2	-	2.6	-
NWP-2	NWP-2-7	Bag	7.0'	(ML)	28.3	-	-	-	-	99.7	72.4	-	-	-	-	28.3	92.5	-	1.9	-

ABBREVIATIONS: LIQUID LIMIT (LL)
 PLASTIC LIMIT (PL)
 PLASTICITY INDEX (PI)
 LIQUIDITY INDEX (LI)
 SPECIFIC GRAVITY (G_s)
 MOISTURE (M_c)

NOTES: T = TRIAXIAL TEST
 U = UNCONFINED COMPRESSION TEST
 C = CONSOLIDATION TEST
 DS = DIRECT SHEAR TEST
 O = ORGANIC CONTENT
 P = pH
 * = one point proctor

Prefer to analyze incremental sediment depths.

Pre-construction Monitoring

- Water Quality Sampling
 - High bacteria, high TSS during storms, high nitrogen, low DO
- Habitat Assessment
 - Suboptimal
- Benthic macro-invertebrate assessment
 - Poor
- Geomorphic measurements
 - Aggraded, high organics, backwater effects



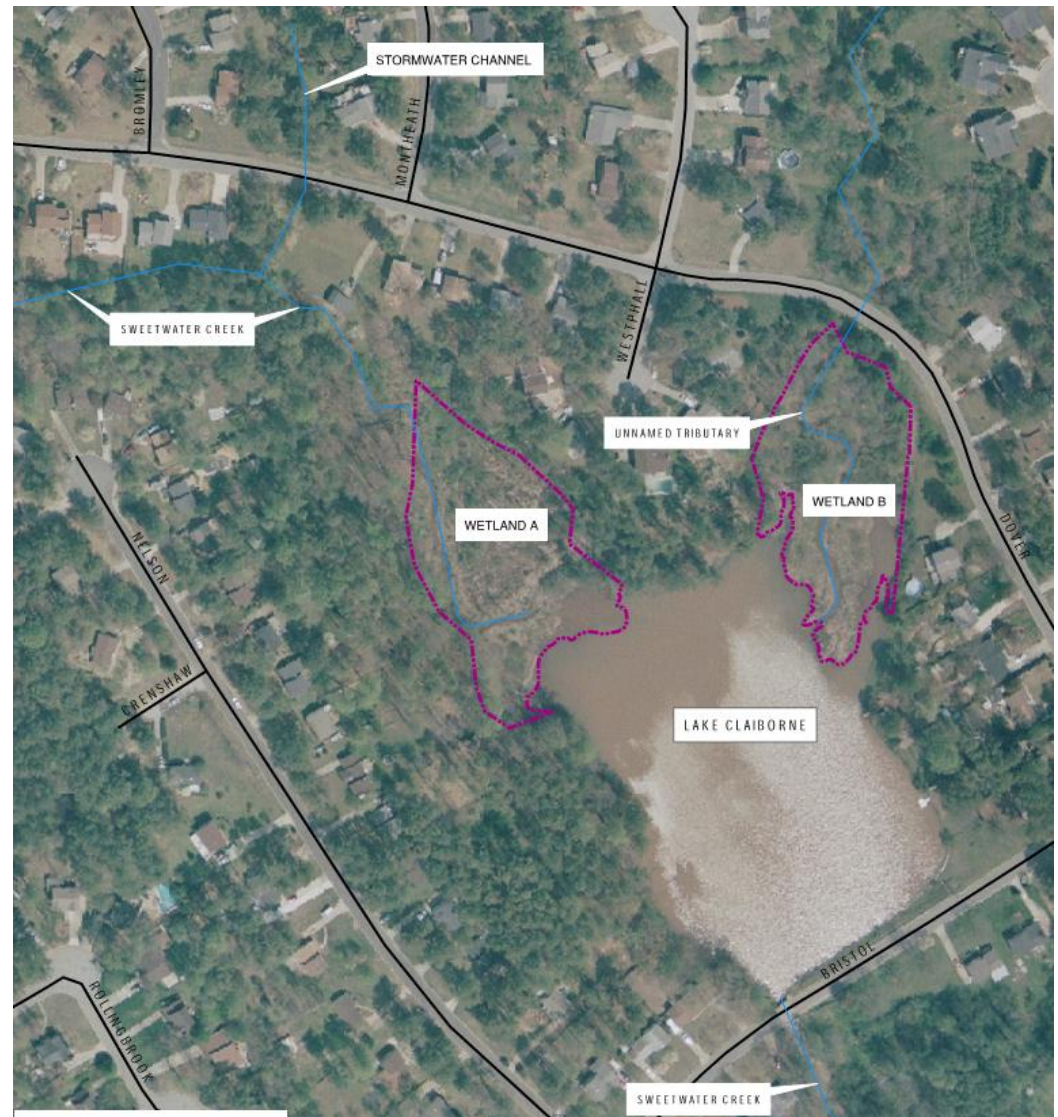
Developed Concept Plan and Bidding Documents



- 1,200 LF stream restoration
- 2 off-line sediment ponds
- Double 6'x6' CBC on trib
- 13,000 plants
- Created submerged island
- Removed 40,000 cy
- Water depth = 5-9 ft
- New outfall with operable gate; lowered NWL 0.9 ft; additional flood protection
- Walking trail
- Restocked fish

Lake Claiborne Restoration - Permitting

- Two wetlands delineated – each ~1.2 acres
- Located within original footprint of the lake
- Aggraded areas of lake
- Two streams – 1,590 lf
- NWP 43 and 27



Contractor Elected to Dewater and Excavate



Issue - Discharge Water Turbidity Control

Polymer addition.

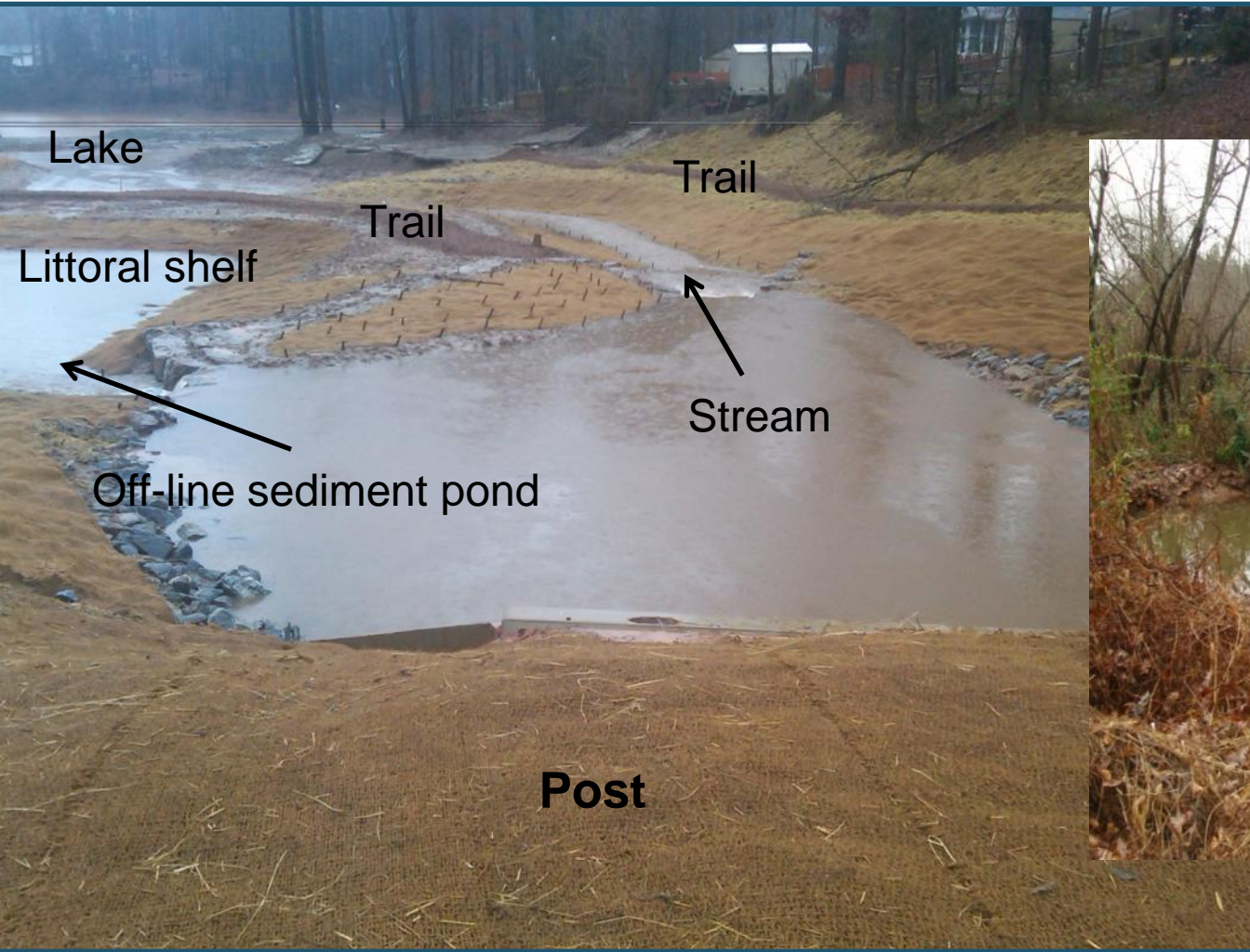


Filter bag.



**Minor issue with hauling of wet sediment.
Dump truck incident.**

Lake Claiborne Restoration



Pre

Lake Claiborne Restoration



Construction



Lake Claiborne Restoration

- Removes 442,043 lbs/yr TSS
- Completed in 6 months
- \$1.2M Construction Cost
- \$3.68/lb TSS
- County average cost per pound is \$10/lb TSS
- Homeowners happy
- Will monitor for WQ and habitat improvements



Post-Construction Monitoring

- Vegetation
- Water Quality
- Macro Invertebrates
- Habitat
- Geomorphology



Urban Restoration Issues

- Easements
- Traffic
- Utilities
- Trash and Debris
- Maintenance
- Downstream
- Neighbors



Brown AND
Caldwell

advancing*innovation™