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
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
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

GIS

- Develop Project GIS/Database
  - Establish GIS layers
  - Delineate 25-acre streams

- Preliminary Model
  - Unit runoff discharge ratio
  - TSS yield

Field Inventory

- Identify Stream Segments
  - Determine ≥ stream miles up to 25-acre catchment
  - Determine Level I & Level II stream miles

- BMPS & New BMPS Sites
  - Identify existing BMPS using GIS
  - Locate new BMPS sites
  - Develop BMPS site hydrology and datasets

- BMP Field Inventory
  - Verify BMPS existence & collect data
  - Identify maintenance issues
  - Assess feasibility of new BMPS sites

- Update Project GIS/Database
  - Add verified BMPS information
  - Add stream condition data

- Model - Existing Conditions
  - Streambank TSS production
  - Existing BMPS effects
  - Existing TSS load and yield

CIP Development

- Stream Restoration Projects
  - Revisit/evaluate field-identified projects
  - Determine TSS & habitat effects
  - Estimate cost & benefits

- BMP Projects
  - Develop retrofit/new BMPS project
  - Determine TSS, flow, & habitat effects
  - Estimate cost & benefits

- Model - CIP Development
  - Reach CIP –
    - Select projects to remove Redline TSS streams
    - Select “best” projects based upon benefit/cost
  - HUC12 CIP –
    - Subset of Reach CIP
    - Meets TSS goal at HUC12 watershed level

TSS
TN
TP
BOD
FC
Others

Brown AND Caldwell
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
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 tributaries, 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

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**ABBREVIATIONS:**
- LIQUID LIMIT (LL)
- PLASTIC LIMIT (PL)
- PLASTICITY INDEX (PI)
- LIQUIDITY INDEX (LI)
- SPECIFIC GRAVITY (Gs)
- MOISTURE (Mc)

**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
- 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

Off-line sediment pond

Littoral shelf

Stream

Trail

Lake

Post

Pre
Lake Claiborne Restoration
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