

TENNESSEE STREAMS

- Most diverse aquatic fauna in the country
- Majority of West TN streams are channelized
- 36,000 miles of degraded stream are in need of restoration (USFWS)
- 20% of streams are impounded
- 10% do not meet designated uses
- 110 miles posted for high bacteria levels
- 150 miles posted for fish contamination

OVERVIEW

- Tennessee has more than 60,000 miles of streams and rivers within 13 major basins
- Economic, cultural, social, aesthetic and natural resource value
- Stream corridors perform many ecological functions: wildlife habitat and pollution filter
- Changes to the physical, chemical or biological components of a watershed affect the river system

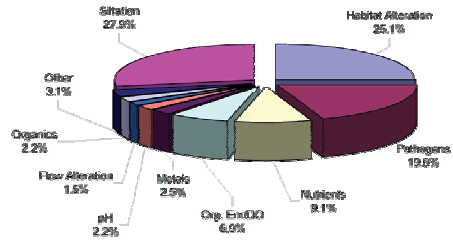
CLASSIFIED USES

- Fish and Aquatic Life
- Recreation
- Irrigation
- Livestock Watering and Wildlife
- Domestic Water Supply
- Navigation
- Industrial Water Supply

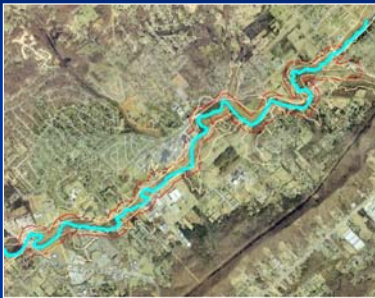


Causes of Pollution

Relative Causes of Impacts in Rivers and Streams



URBANIZATION



AGRICULTURE



STREAM IMPACTS

SEDIMENTATION



ENCAPSULATION



Channel Modifications



Stream Relocations



Water Quality Regulations

Federal Regulations

- §404 Clean Water Act - USACE
dredge and fill
- §26a TVA Act - TVA
TN River and tributaries

State Regulations

- §401 Clean Water Act
- TN Water Quality Control Act
- Rules of the Water Quality Control Board

STREAM RESTORATION AND ENHANCEMENT

- ## OBJECTIVES
- Reduce bed and bank erosion and sedimentation
 - Improve channel stability, water quality, habitat and overall function of significantly degraded streams
 - Restore, enhance and protect riparian wildlife corridors

STREAM RESTORATION

The process of returning a significantly degraded stream to "a close approximation of its condition prior to disturbance...the re-establishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics (NRC)".

RESTORATION BASICS

- Understand the cause of problems
- Identify the degree and nature of impairment
- Evaluate departure from stability
- Examine potential of river systems
- How to fix, stabilize, enhance amongst great complexity and risk
- Appropriate treatments to remedy causes

(Rosgen 2005)

DEFINITIONS

- ***Mitigation*** is the replacement of lost or adversely affected habitat with habitat having similar functions of equal or greater ecological value
- ***Stream restoration*** is an improvement to channel stability, water quality, habitat and overall function of a significantly degraded stream channel

DEFINITIONS CONTINUED

- ***Enhancement*** is the improvement to one or more of the structural or functional attributes of a stream
- ***Riparian restoration*** involves reforestation areas along streams and rivers that provide canopy, bank stabilization, pollution buffering, and wildlife habitat

RESTORATION PRINCIPLES

- Preserve and protect aquatic resources
- Restore ecological integrity
- Restore natural structure and function
- Address causes of degradation
- Develop clear, achievable and measurable goals
- Focus on feasibility
- Use reference sites
- Anticipate future changes
- Involve a multi-disciplinary team
- Design for self-sustainability
- Plant native species
- Use natural fixes and bioengineering
- Monitor and adapt where changes are necessary

(EPA Watershed Ecology Team)

STREAM CHANNEL STABILITY

- Ability of a stream over time, in the present climate, to effectively transport the flows and sediment from its watershed while neither aggrading or degrading and maintaining a stable dimension, pattern and profile. - Rosgen

CHANNEL STABILITY?



Maryland



N. Carolina

RESTORATION OPPORTUNITIES

- Channelized, dredged and/or straightened stream channels
- Actively eroding stream banks
- Impaired habitat
 - In-stream – absence of riffle/pool sequences
 - Lack of Riparian Buffer
- Channel instability
 - Lateral and vertical stability

Rules of the River – Cause and Effect



Harper's Ferry, WV - Confluence of Potomac & Shenandoah Rivers

CAUSE

- Disturbances in the watershed (i.e. development, change in land use, channel modifications)
- Morphology is related to hydraulic relationships



Turkey Creek Knoxville, TN

CONSEQUENCE

- River Destabilization
- Erosion
- Sedimentation
- Habitat loss
- Land loss
- Poor water quality



CORRECTION



- Change land management
- Change land use
- Stream restoration
- Stream enhancement



COMMUNICATION

- What activities cause impacts to streams and rivers?
- Teach others about activities that contribute to excessive erosion and sedimentation
- How can landowners and the general public change their land management practices to reduce impacts?
- Provide water resource planners with expertise to improve impacted watersheds.

STREAM RESTORATION

- Stream classification is a communication tool to aid in stream restoration projects
- Based on geomorphic classification, morphological description, stage of evolution, validation

TREATMENTS

DEGRADED STREAMS



ENHANCEMENT I



RIPARIAN RESTORATION

- Site Preparation
- Bare-root Seedlings
- Live Stakes
- Container Stock
- On-site Transplants
- Native Seed Mixture

ENHANCEMENT II



ROCK & LOG VANES



ROOT WADS & ROCK VANES



RESTORATION



Before

After

1 Year Later























STREAM RESTORATION

Chattahoochee Mitigation Bank – Register & Associates; Eco-South, Inc.

MULTI-DISCIPLINARY TEAM

- Forestry
- Hydrology
- Botany
- Landscape Ecology
- Aquatic Ecology
- Civil Engineering
- Hydraulics
- Wildlife Biology
- Fluvial Geomorphology
- Sedimentology
- Geology
- Soil Science
- Watershed Planning
- Sociology
- Communication

PROGRAMS

- TWRA TN Landowner Incentive Program (TNLIP)
- Natural Resource Conservation Service (NRCS)
- U.S. Fish & Wildlife Service Partners Program
- EPA 5-Star Grant Program
- TVA's Clean Water Initiative
- Adopt-a-Watershed
- Tennessee Stream Mitigation Program (TSMP)

TSMP PROJECTS

- **100% Cost-share**
- **Buffer Requirement**
 - 50 ft. or 3X stream width (100 ft.)
- **Land Preservation Agreement**
 - Prohibits (row crop, haying, grazing, logging, development, etc.)
 - Runs with deed



- <http://www.state.tn.us/environment/wpc/publications/StreamMitigationGuidelines.pdf>
- www.wildlandhydrology.com
- www.stream.fs.fed.us
- <http://tn.water.usgs.gov>
- <http://wmc.ar.nrcs.usda.gov/technical/HHSWR/Geomorphic/>
- www.bae.ncsu.edu/programs/extension/wqg/sri/

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