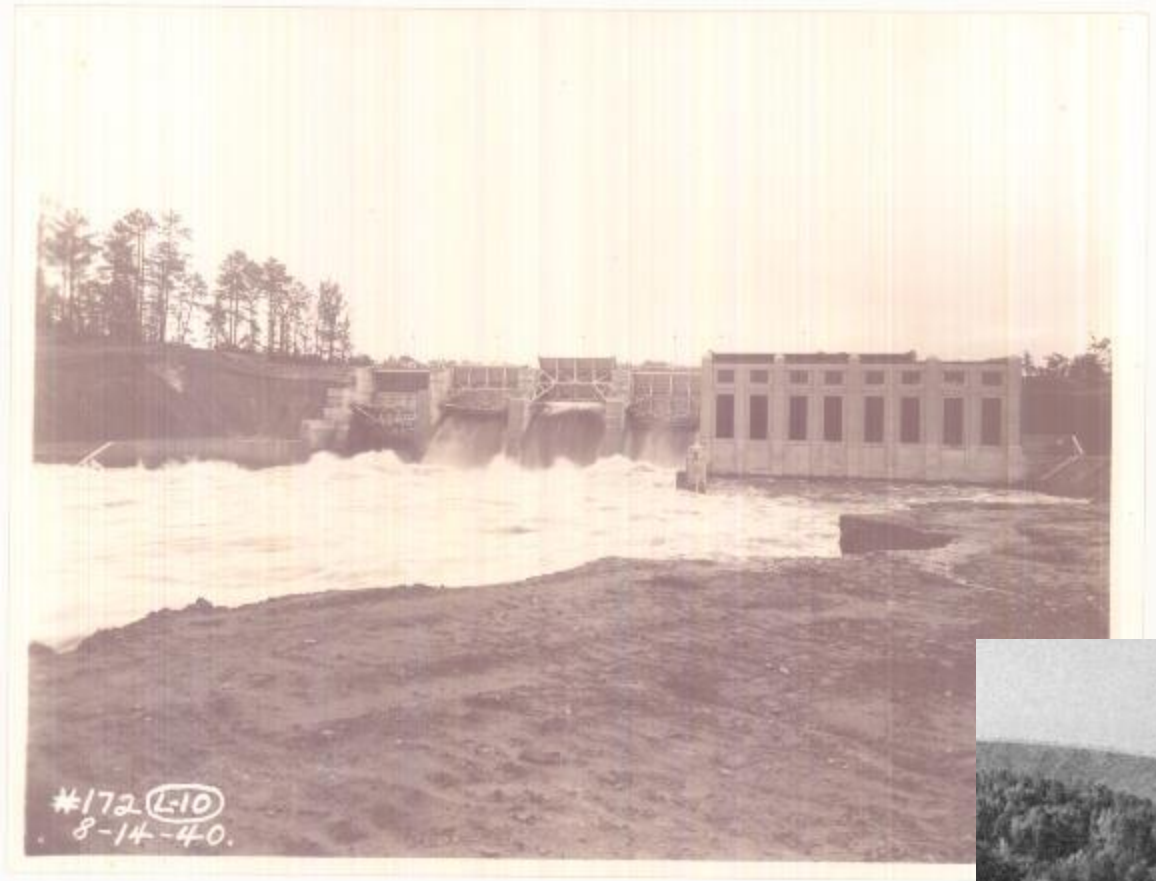


Buzzards Roost Hydroelectric Facility
Lake Greenwood, SC

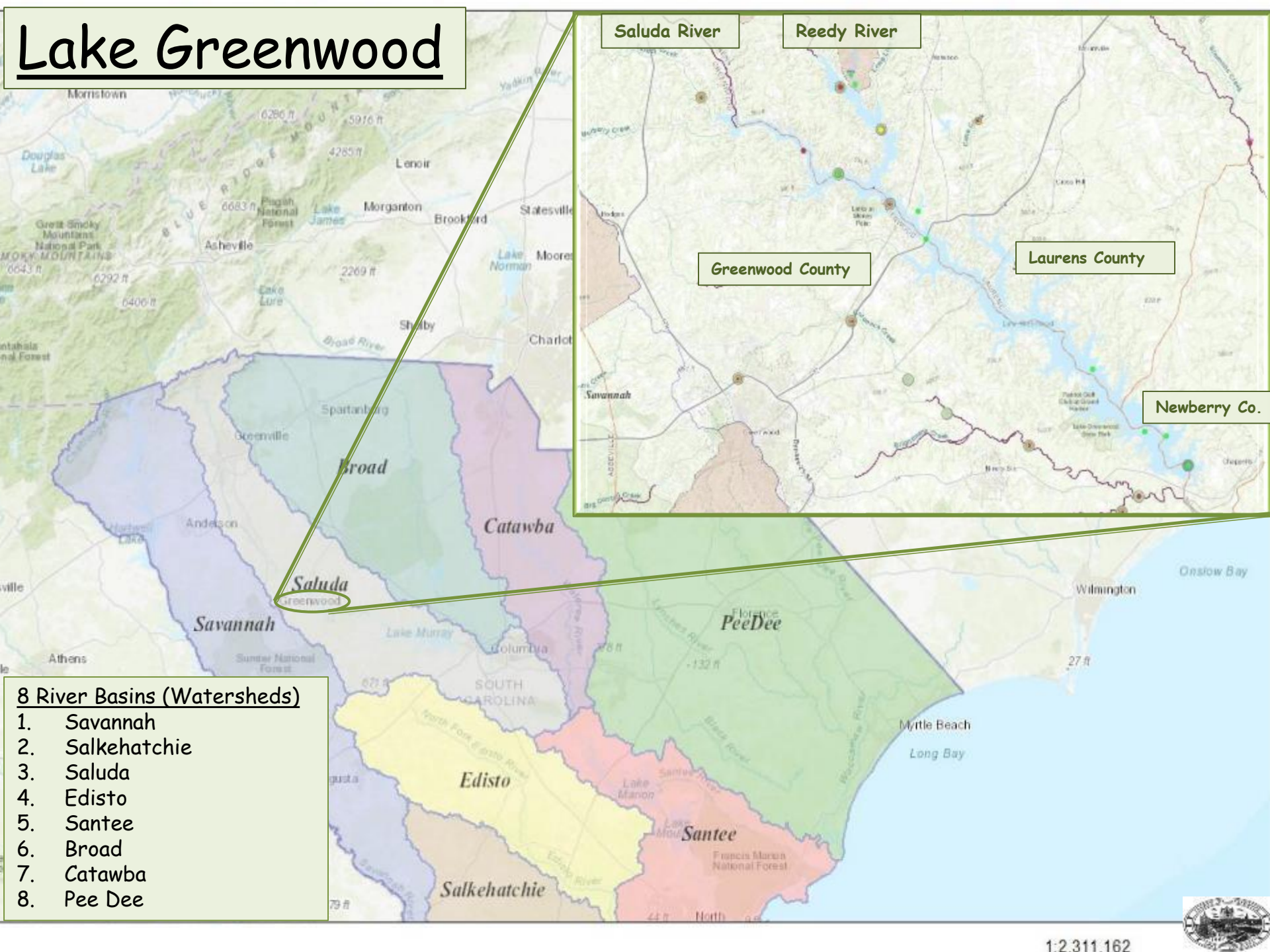
FERC Project #P-1267

SC DHEC Navigable Waterway of SC

Section 404 Waters of the US


04/22/2015

Lake Greenwood

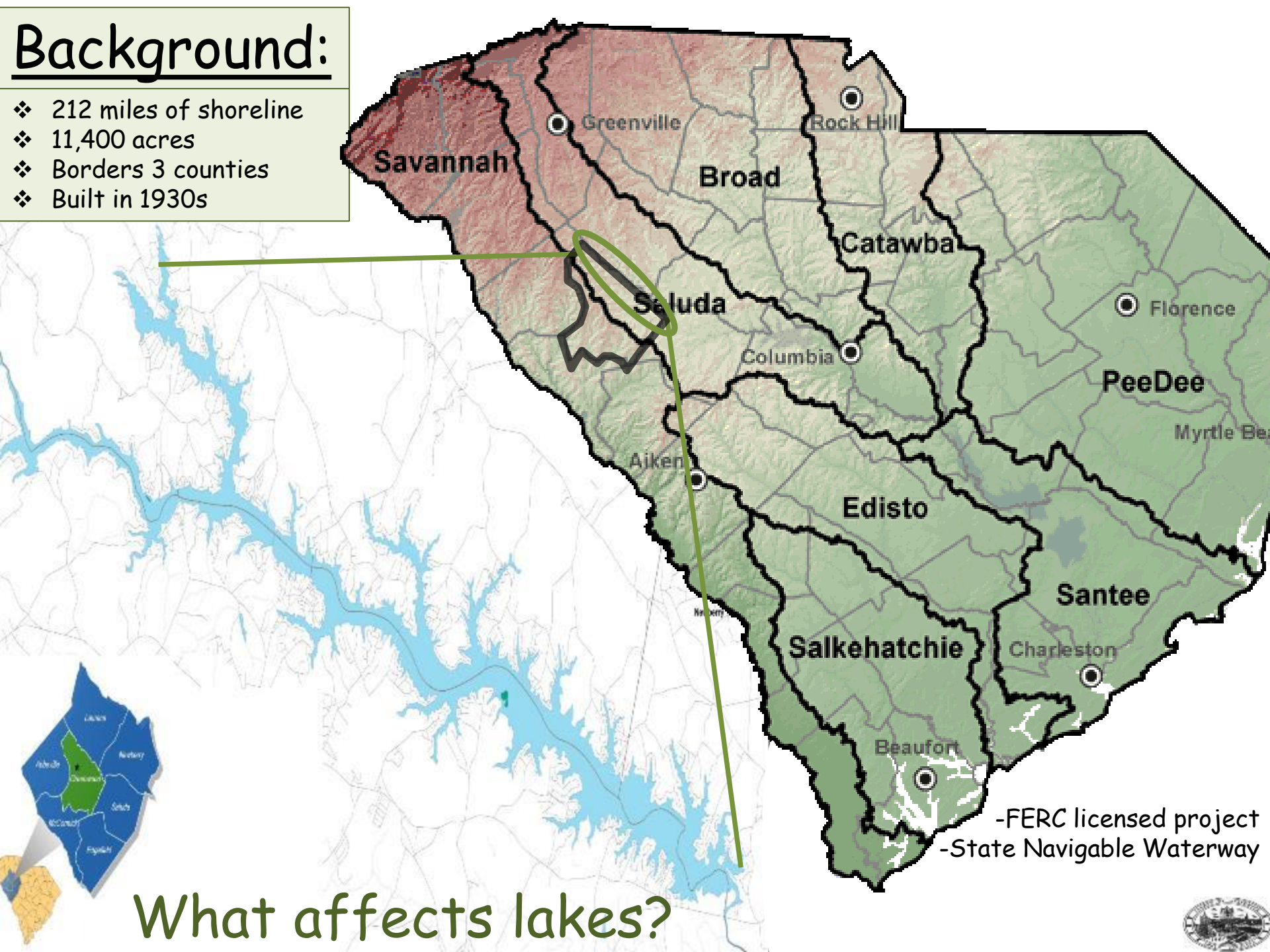


8 River Basins (Watersheds)

1. Savannah
2. Salkehatchie
3. Saluda
4. Edisto
5. Santee
6. Broad
7. Catawba
8. Pee Dee

Background:

- 212 miles of shoreline
- 11,400 acres
- Borders 3 counties
- Built in 1930s



-FERC licensed project
-State Navigable Waterway

What affects lakes?

Pollution in Lakes

Point Source Pollution

- Include MS4, Wastewater treatment plants, companies
- Federal and state agencies regulate point source dischargers and monitor state waterways.

NonPoint Source Pollution

Common pollutants are:

- Excessive fertilizers, herbicides;
- Oil, grease, and toxic chemicals,
- Sediments from erosion,
- Salt and acids,
- Bacteria and nutrients from livestock, pets, and faulty septic tanks.

*Nonpoint source pollution occurs as water moves across land or through the ground and picks up pollutants.

Therein lies the quandary…

The nonpoint source pollution is such that, in general, it can not be monitored at the point of origin and the source of the nonpoint source pollution is not easy to discover.

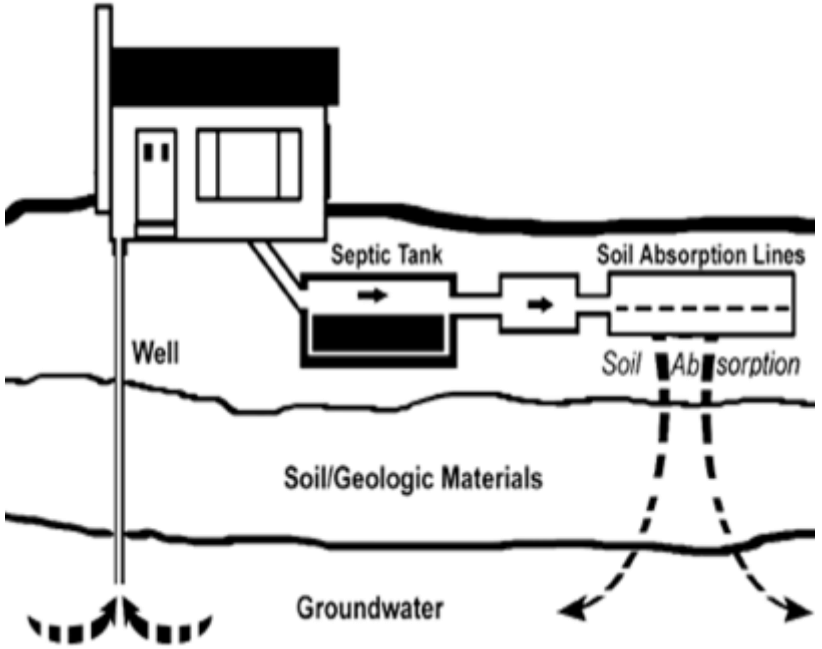
Pollutant	Potential Sources		Impacts on Waterbody Uses
	Point Sources	Nonpoint Sources	
Pathogens	• WWTPs • CSOs/SSOs • Permitted CAFOs • Discharges from meat-processing facilities • Landfills	• Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout facilities • Land application of manure • Land application of wastewater	• Primarily human health risks • Risk of illness from ingestion or from contact with contaminated water through recreation • Increased cost of treatment of drinking water supplies • Shellfish bed closures
Metals	• Urban runoff • WWTPs • CSO/SSOs • Landfills • Industrial facilities • Mine discharges	• Abandoned mine drainage • Hazardous waste sites (unknown or partially treated sources) • Marinas • Atmospheric deposition	• Aquatic life impairments (e.g., reduced fish populations due to acute/chronic concentrations or contaminated sediment) • Drinking water supplies (elevated concentrations in source water) • Fish contamination (e.g., mercury)
Nutrients ★	• WWTPs • CSOs/SSOs • CAFOs • Discharge from food-processing facilities • Landfills	• Cropland (fertilizer application) • Landscaped spaces in developed areas (e.g., lawns, golf courses) • Animals (domestic, wildlife, livestock) • Malfunctioning septic systems • Pastures • Boat pumpout • Land application of manure or wastewater • Atmospheric deposition	• Aquatic life impairments (e.g., effects from excess plant growth, low DO) • Direct drinking water supply impacts (e.g., dangers to human health from high levels of nitrates) • Indirect drinking water supply impacts (e.g., effects from excess plant growth clogging drinking water facility filters) • Recreational impacts (indirect impacts from excess plant growth on fisheries, boat/swimming access, appearance, and odors) • Human health impacts
Sediment ★	• WWTPs • Urban stormwater systems	• Agriculture (cropland and pastureland erosion) • Silviculture and timber harvesting • Rangeland erosion • Excessive streambank erosion • Construction • Roads • Urban runoff • Landslides • Abandoned mine drainage • Stream channel modification	• Fills pools used for refuge and rearing • Fills interstitial spaces between gravel (reduces spawning habitat by trapping emerging fish and reducing oxygen exchange) • When suspended, prevents fish from seeing food and can clog gills; high levels of suspended sediment can cause fish to avoid the stream • Taste/odor problems in drinking water • Impairs swimming/boating because of physical alteration of the channel • Indirect impacts on recreational fishing
Temperature	• WWTPs • Cooling water discharges (power plants and other industrial sources) • Urban stormwater systems	• Lack of riparian shading • Shallow or wide channels (due to hydrologic modification) • Hydroelectric dams • Urban runoff (warmer runoff from impervious surfaces) • Sediment (cloudy water absorbs more heat than clear water) • Abandoned mine drainage	• Causes lethal effects when temperature exceeds tolerance limit • Increases metabolism (results in higher oxygen demand for aquatic organisms) • Increases food requirements • Decreases growth rates and DO • Influences timing of migration • Increases sensitivity to disease • Increases rates of photosynthesis (increases algal growth, depletes oxygen through plant decomposition) • Causes excess plant growth

Note: WWTP = wastewater treatment plant; CSO = combined sewer overflow; SSO = sanitary sewer overflow; CAFO = concentrated animal feeding operation; DO = dissolved oxygen.

Excessive nutrients

Malfunctioning Septic Tanks

- Design and installation should be based on specific site characteristics.
- Problems can arise from inadequate size, location, and poor construction.
- Drainfield should be analyzed before construction.
- Drainfield should be level with non-compacted soils.

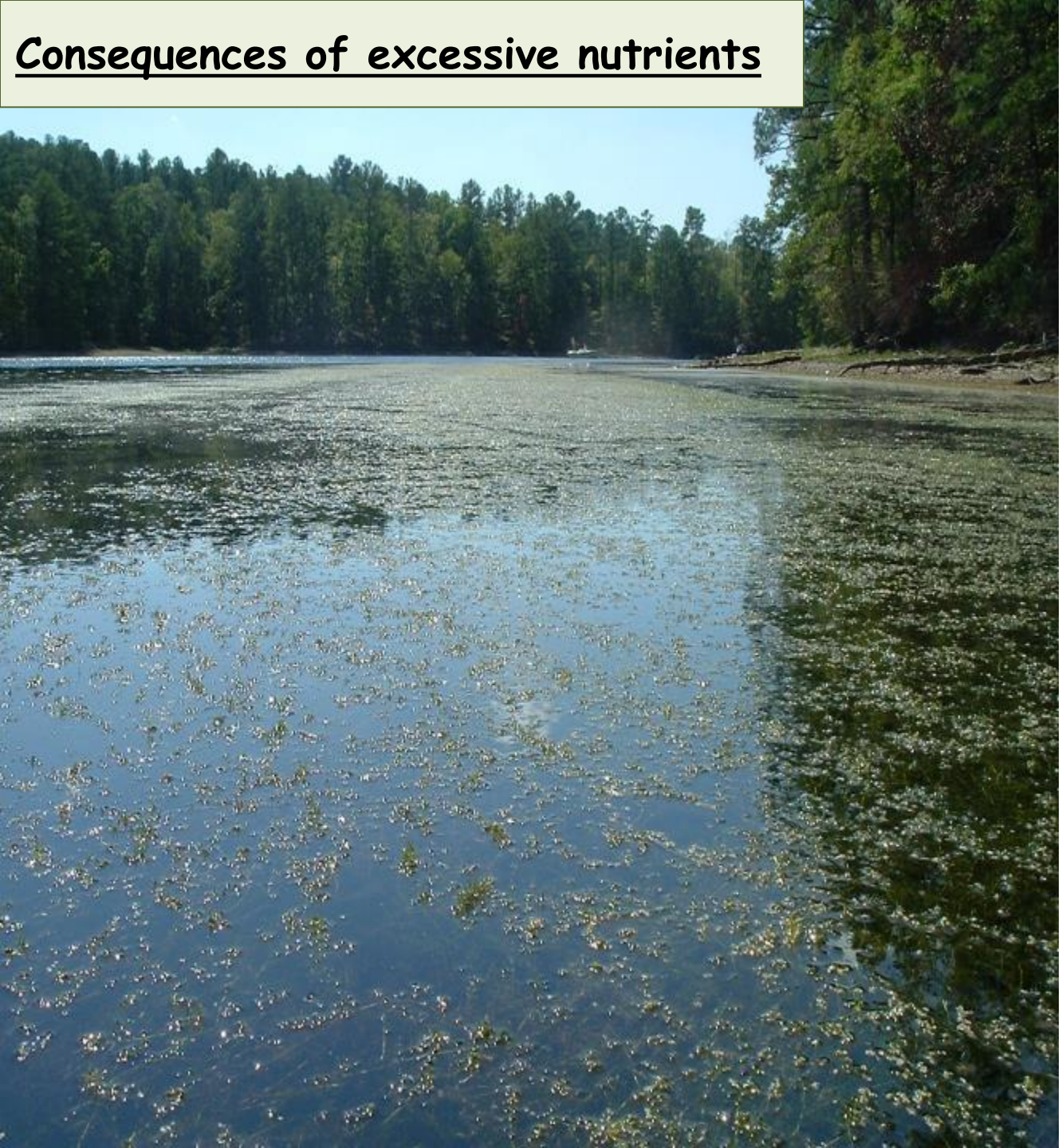


- U.S. EPA recommends system inspections every three years and pumping every three to five years.
- Water conservation and efficient use will prolong the life of the system.

Excessive nutrients

- Excessive fertilization runs off into Lake Greenwood.
- Folks manicure lawns all the way down to the water's edge.
- Dispose of old and extra fertilizers properly.
- Do not bathe, shampoo or wash boats, pets, or cars around the lake where detergent can run into the lake.
- Have soil tested to determine proper fertilizer needed.
  - Study of 236 N.E. lawns, available phosphorus in soils was 4 times amount needed to maintain a healthy lawn.

Consequences of excessive nutrients



Excessive nutrients from nonpoint source pollution can lead to EXCESSIVE AQUATIC PLANT GROWTH and ALGAL BLOOMS

South Carolina's Regulations

- 1980 - Governor Riley created the SC Aquatic Plant Management Council
  - Statewide coordination of aquatic plant management
- 1990 - Governor Campbell established SC Aquatic Plant Management Program
  - Required mgmt of invasive, noxious aquatic species

Lake Greenwood's Aquatic invasives

Hydrilla

Najas

Primrose

Alligator weed

Integrated Aquatic Plant Management

- All management techniques have environmental, social, and physical impacts.
- Management should be site specific; residential areas should have a higher priority than critical habitat areas.
- Techniques include Physical, Chemical, and Biological.

- Not all exotic species cause problems, but those that disrupt natural ecosystem functions, impair use of areas, and adversely affect native populations need to be curtailed.

- Some impacts from invasive exotics include:
  - Limited recreational uses - Public perception
  - Blocked water flow - Reduced property values
  - Degraded water quality - Reduce biodiversity
  - Ecological impacts - Economic costs

Physical Techniques

- Most common form is hand raking/ pulling aquatic nuisance weeds from the lake.
- Physical techniques usually require more man-power than chemical and biological.

Management Method	Advantages	Disadvantages	Areas	Plant response
Hand Cutting/ Pulling	Low technology, affordable, selective	Labor intensive,	Volunteers	Effective in very localized areas.
Harvesting (Cut & Remove)	Removes plant biomass	Slower and more expensive, Sediment problems	Chronic plant areas	Cosmetic, non-selective, short-term
Dredging/ Sediment removal	Creates deeper water, Long-term results	Very expensive, Deal with dredge sediment	Shallow lakes	Not selective
Drawdown	Inexpensive, Moderate-term results	User and environmental impacts	Manmade lakes	Less effective on herbaceous perennials
Benthic Barriers	Direct and effective, Moderate-term results	Not aesthetically pleasing	Small areas	Not selective

Chemical Techniques

- Chemical treatment options have changed drastically over the last 20 years.
- Only a limited number of herbicides that are available for use in water due to strict standards.
- Two groups of herbicides:
  - Contact – act immediately
  - Systemic – are translocated throughout plant

- South Carolina Law requires individuals to possess a Pesticide Applicators License in Category 5, Aquatic Pest Control, before they apply aquatic herbicides on private or public property.
  - A license is also required, regardless of ownership, if the application is made to an area where public access to the treated site is expected.
  - Private swimming lakes, where the public would be exposed to the treated waters, are the most obvious example of the latter requirement.

Compound	Exposure Time	Advantages	Disadvantages	Areas	Plant Response
Copper	Intermediate (18-72 hours)	Inexpensive, Rapid, Approved for drinking water (Nautique – No water restrictions)	Doesn't biodegrade, But is biologically inactive in sediments	Lakes for an algicide	Broad spectrum
Diquat	Short (12-36 hours)	Rapid, Limited drift	Doesn't affect underwater sections of plant	Shoreline, Localized areas	Broad spectrum
Endothall	Short (12-36 hours)	Rapid, Limited drift	Doesn't affect underwater sections of plant, (Aquathol K – Water Restrictions)	Shoreline, Localized areas	Broad spectrum
Fluridone	Very long (30-60 days)	Systemic, Very low dosage, Few label restrictions	Very long contact period, (Sonar Water Restrictions)	Small lakes, Slow flow areas	Broad spectrum
Glyphosate	Not applicable	Widely used, Few label restrictions, Systemic	Very slow action, No submersed control	Nature preserves, Emergent plants only	Broad spectrum

Biological Techniques

- Biological techniques involve using other biological agents to combat aquatic weeds.
- Many biological techniques are still in the research and development phase.
- In combination with other types of techniques, some of these have been proven useful for lakes in SC.
- Greenwood County took a proactive step in 2009 with the release of Grass Carp

Management Method	Advantages	Disadvantages	Areas	Plant response
Grass Carp	Long-term control, Relatively inexpensive	Cannot control feeding sites, "All or None" response, Persistent	Areas with hydrilla and preferred species	Hydrilla preferred
Hydrilla Fly, Stem Weevil	Species selective	Has not been Established yet	Released in FL, AL, TX	(Research)
Native Weevil and Insects	Already established	Has not been Established yet	Released in VT, MN	(Research)
Fungal Pathogen	Acts as a contact bioherb, low dispersion, Broad spectrum	Expensive, cross-contamination	Research for watermilfoil and hydrilla	Plants fall apart, but regrow from roots

Education is the key to fighting nonpoint source pollution!

It is always good to have partners to spread the word.

Partnerships
5R Watershed Based Plan

PARTNERS

Community & Conservation Groups

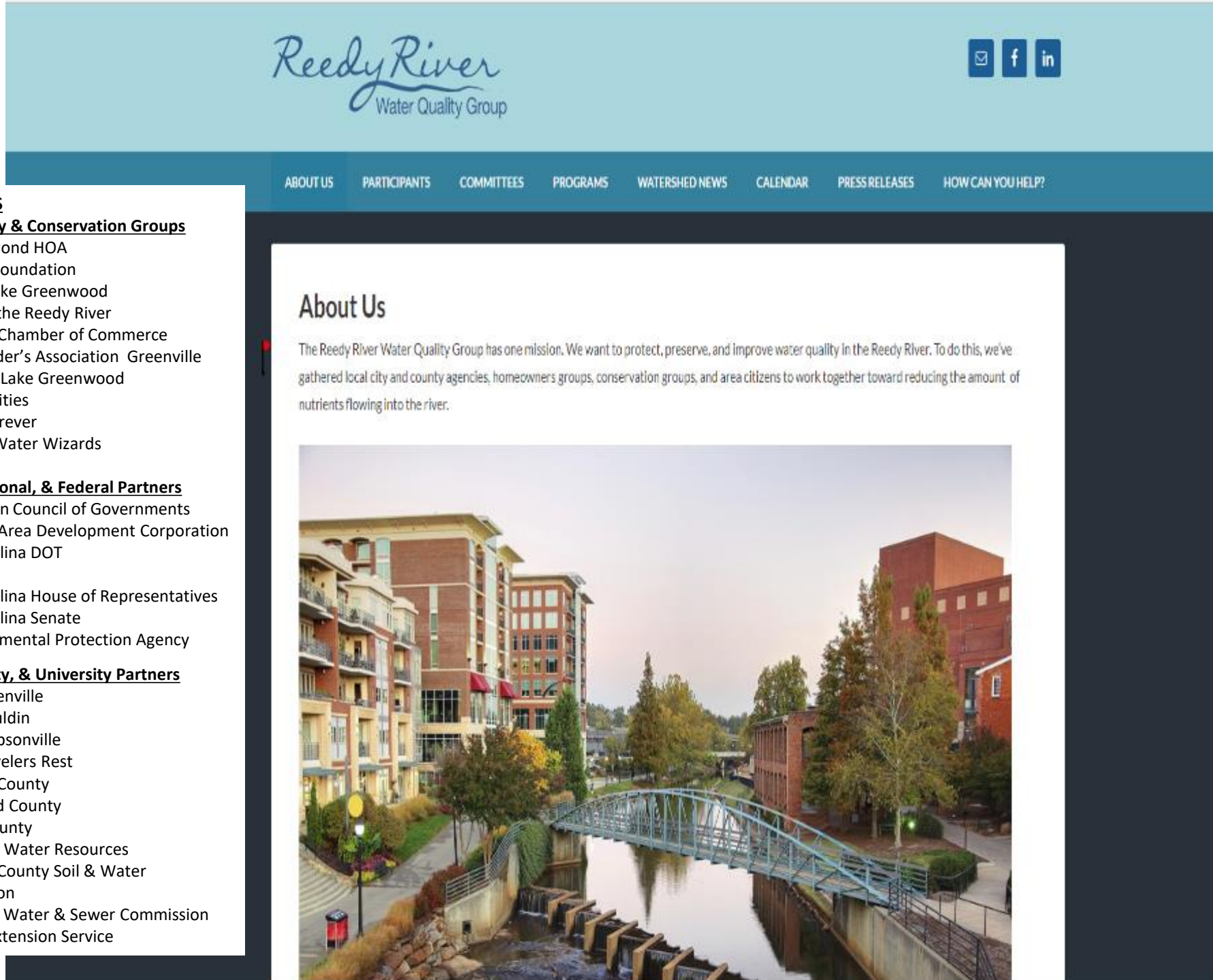
Boyd Mill Pond HOA
Conestee Foundation
Connect Lake Greenwood
Friends of the Reedy River
Greenville Chamber of Commerce
Home Builder's Association Greenville
Preserving Lake Greenwood
United Utilities
Upstate Forever
Waterloo Water Wizards

State, Regional, & Federal Partners

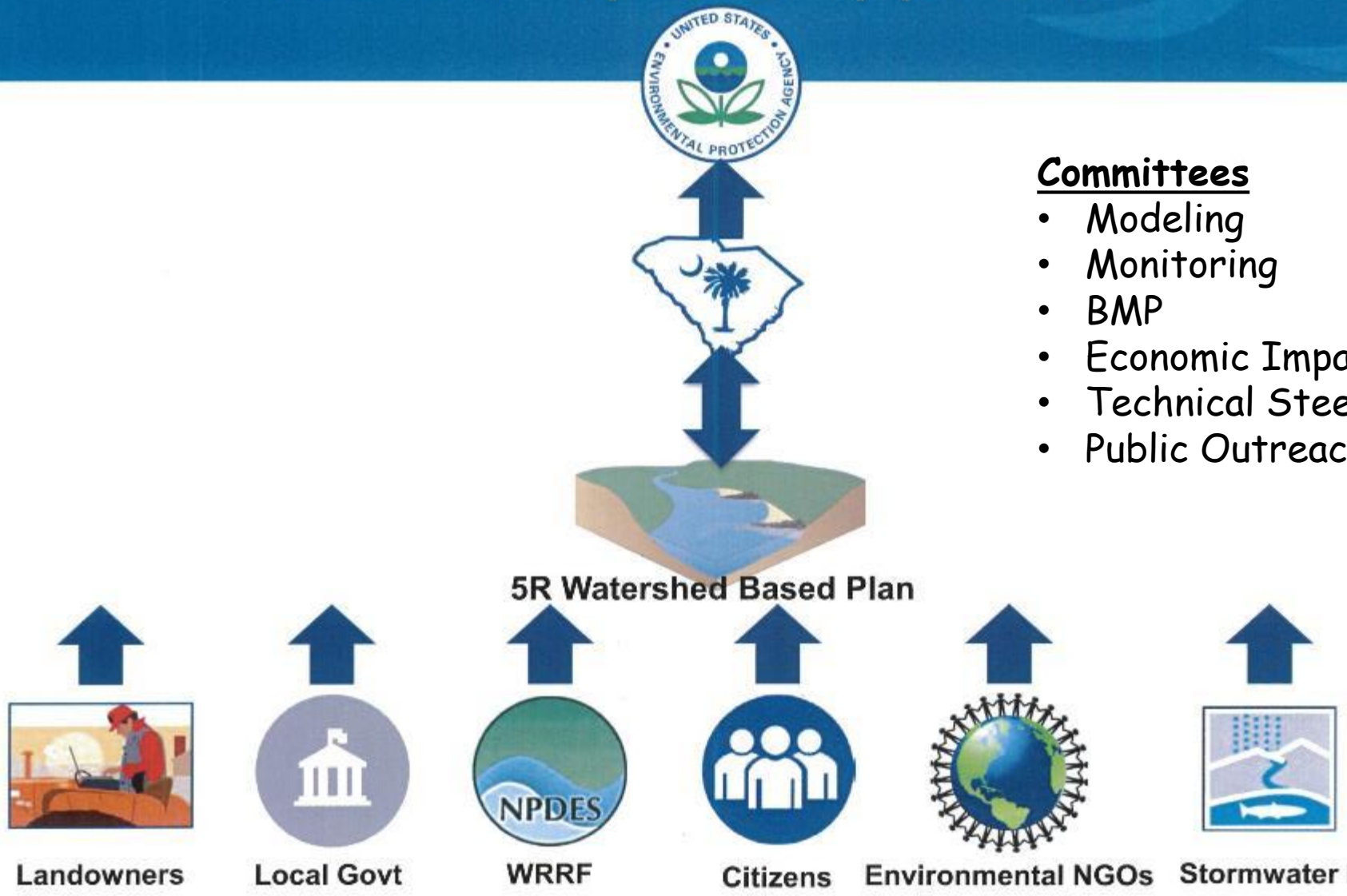
Appalachian Council of Governments
Greenville Area Development Corporation
South Carolina DOT
SC DHEC
South Carolina House of Representatives
South Carolina Senate
US Environmental Protection Agency

City, County, & University Partners

City of Greenville
City of Mauldin
City of Simpsonville
City of Travelers Rest
Greenville County
Greenwood County
Laurens County
Renewable Water Resources
Greenville County Soil & Water Conservation
Laurens Co Water & Sewer Commission
Clemson Extension Service



Bottom-up 5R Approach



Committees

- Modeling
- Monitoring
- BMP
- Economic Impact
- Technical Steering
- Public Outreach

Keep it Clean Campaign

August 2018-March 2019

- Car Washing
- Buffers
- Fertilizers

To find out more information about the Reedy River Water Quality Group, contact:

Sandra K. Ralston, WEF Fellow
Facilitation Team
Reedy River Water Quality Group
843-697-7840
sandraralston@wqr-inc.com

Lake Mgmt's Efforts Educational Information

Table 4-28. Watershed Chemical Control Standards

Nutrient and Pesticide Control Standard	Estimated Savings and Impacts
Decrease fertilizer use.	The average DIY[a] applies 2 to 4 times the desirable amount of fertilizer. By reducing fertilizer amounts, costs can be reduced accordingly.
Use phosphorus-free or low-phophorus-content fertilizers.	Cost increases $1.00 to $1.50 per household where phosphate-free fertilizer are used. In the Lake Barcroft, Virginia, Water Management District, Natural Lawn estimated a 7,000-pound reduction in fall phosphorus loadings and an 80-85% decrease in spring loadings due to the use of phosphate-free fertilizers (Natural Lawn, personal communication, 1991).
Use slow-release fertilizers.	Organic fertilizers tend to be slow acting and less soluble than chemical fertilizers (Shultz, 1989). Depending on the fertilizer source, conversion to organic fertilizers would reduce costs to $0.00 where compost from a municipal or county facility is used; costs would increase $1.00 per 100 ft² for the purchase of commercial organic fertilizer (Cook, 1991)
Test soils to determine appropriate application rates.	Soil tests and fertilizer recommendations range in cost from $0.00 to $5.00 if done by a Cooperative Extension Service. Private soil test labs may charge $30.00 to $45.00 for the service (Carr et al., 1991).
Stagger fertilizer applications instead of using one large application.	Excess fertilizer may leach into ground water if not utilized by plants. Plants have a limited capacity to utilize fertilizer in any one application; fertilizer costs can be reduced by staggered applications so that the bulk of available nutrients are utilized and excess fertilizers are not applied.
Spot-apply pesticides to control broad-leafed weeds.	Natural Lawn Company reports that by switching from blanket applications to spot applications of herbicides, herbicide use can be reduced 85% to 90% (Bonifant, personal communication, 1991). Volume reductions will result in a comparable cost savings.
Mow lawn at the recommended height.	Shultz (1989) and Carr (1991) suggest that proper mowing techniques result in healthier lawns and can reduce pesticide and fertilizer use.
Retain grass clippings on lawns and other areas planted with turf grass.	Research conducted by Starr and DeRoo (1981) on grass grown in low-nitrogen sandy loam soils showed that grass clippings are beneficial as fertilizer for continued grass growth. Use of clippings as fertilizer can enhance grass growth, reduce the need for additional fertilizer, and decrease total fertilizer costs. *(This recommendation is promoted by the Professional Lawn Care Association of America.)*

Source: EPA
Retrieved: March 2015

[a] DIY - Do-it-yourself lawn caretaker.

Buffer zones

- In general, 100ft buffer will remove 70% of pollutants.
- Best Management Practices will prevent harmful pollutants from entering rivers and lakes.

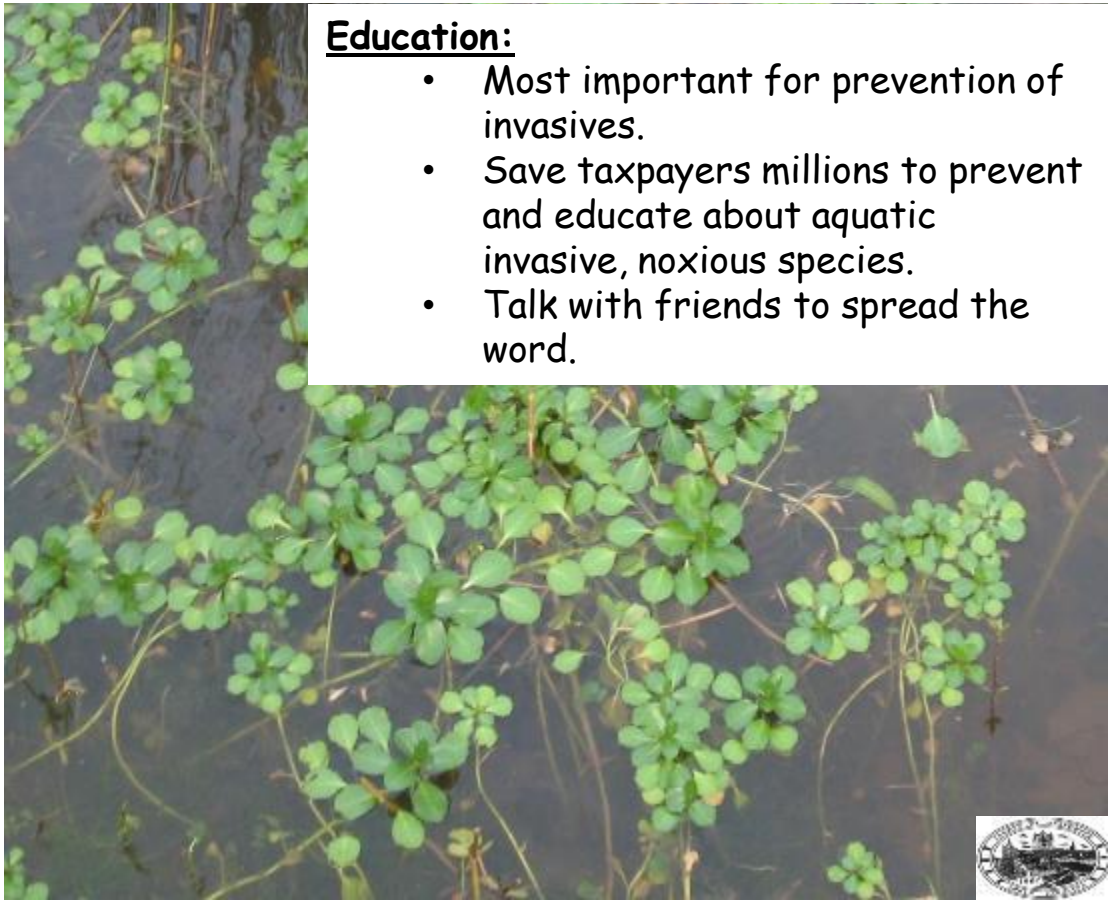
Educational Efforts:
Brochures/Flyers, presentations, homeowner meetings, school demostrations, and informal sharing.

What can Homeowners Do?

- **Prevention :**
  - Don't put any nonnative plants, fish, pets or other organisms into any waterbody.
  - Clean, remove and check boat trailers, boat hulls and propellers for aquatic plants or invertebrate hitchhikers.
  - Replace invasive and other non-native plants in your yard with native species.
  - Do not put excessive fertilizers on your yard.
  - Make sure all septic tanks are working properly.

Other noxious, invasive species

- Ballast waters and carelessness are the some of the main ways that invasive, noxious species enter new ecosystems.
- Invasive, noxious species compete with native species, disturb the balance, and affect the water quality and ecosystem.



Education:

- Most important for prevention of invasives.
- Save taxpayers millions to prevent and educate about aquatic invasive, noxious species.
- Talk with friends to spread the word.

Questions?

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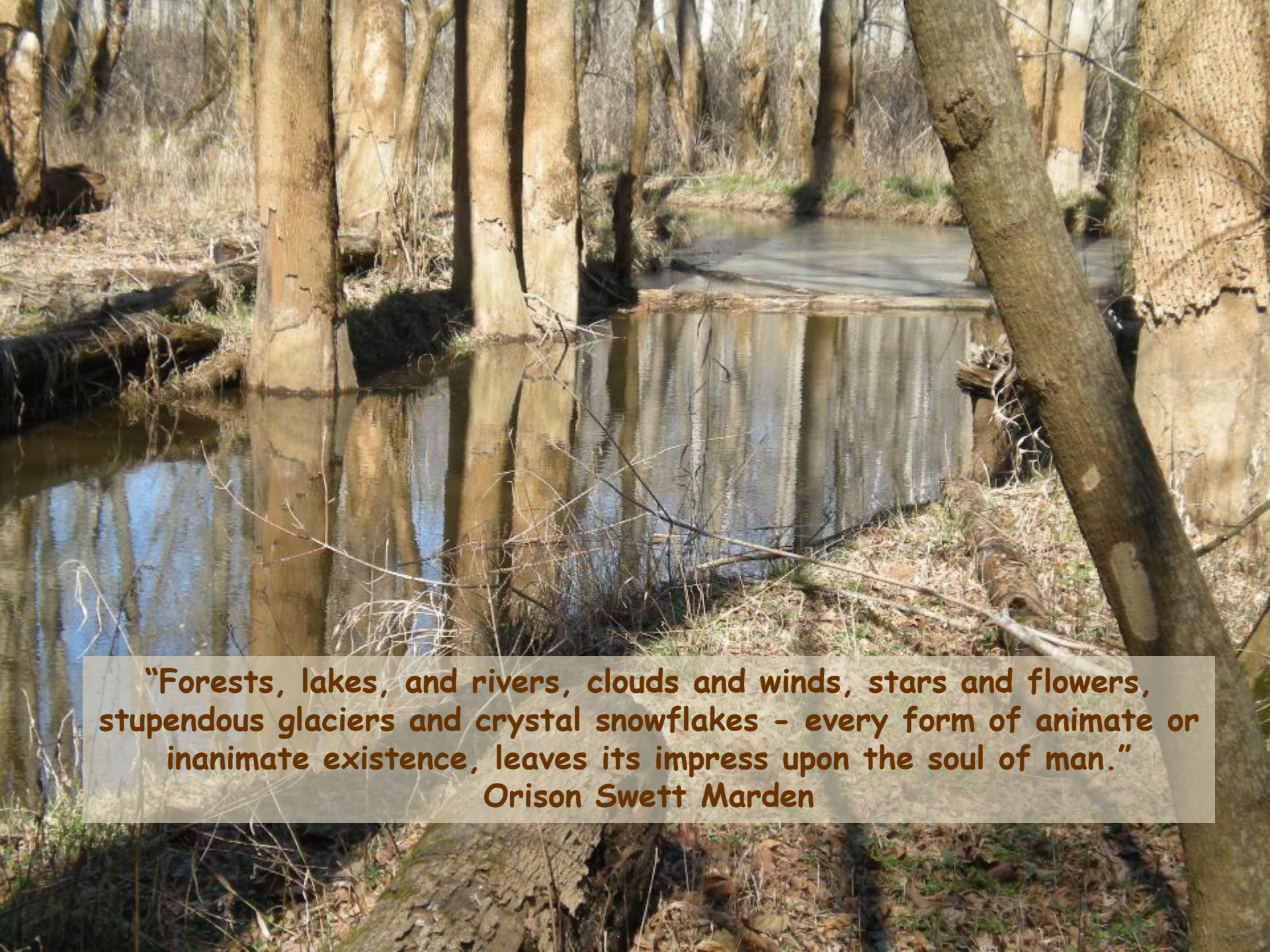
864-943-2648


"Forests, lakes, and rivers, clouds and winds, stars and flowers, stupendous glaciers and crystal snowflakes - every form of animate or inanimate existence, leaves its impress upon the soul of man."
Orison Swett Marden