

04.05.07

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Water Forum: Dr. Gene Eidson



Historic
Preservation

Healthy
Communities

Advanced
Materials

Restoration
Ecology

restoring our future

04.05.07

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Clemson University Water Forum

Public Private Partnerships

Gene W. Eidson, Ph.D.

Director, Restoration Ecology Focus Area

President, Southeastern Natural Sciences Academy



Environmental Research and Education PPPs

Public-private partnerships in the environmental research and education arena provide a first-hand means for both the public and private sectors to work together on programs and projects that support community needs and create opportunities for an enhanced environment

- Core concept involves business/industry/not for profit agencies (private sector) working with governmental agencies (public sector)
- Multi-stakeholder collaboration working together
 - local, state, and federal governments
 - community based nonprofits
 - private donors, foundations, & corporations
- With a shift in research funding from universities to CBOs capable of conducting their own research, university collaborations are needed for peer review and technical support



Water is the key issue for a sustainable economy

- Across the ages, cities have thrived where the supply is abundant, and collapsed in the face of drought (Science, V. 313, p. 1067)
- **Water quantity and quality** will determine economic vitality and future patterns of economic growth.
- Cities with **abundant and affordable** water will be the economic winners.

Collaborative research is needed to support watershed-scale studies





South Carolina River Issues

Sanford echoes report on water conservation

By Josh Gelinis

South Carolina Bureau Chief

AIKEN — Parts of Georgia and South Carolina need to reduce the amount of water they pull from the Savannah River to prevent saltwater from penetrating drinking water near the coast.

Helping communities such as Hilton Head Island, S.C., and Savannah, Ga., could mean conservation as far inland as Augusta.

South Carolina Gov. Mark Sanford made that recommendation this week in response to the Coastal Georgia Water and Wastewater Permitting Plan for Managing Saltwater Intrusion, which was developed by the Georgia Environmental Protection Division.

The Georgia report, which was released in June, calls on cities, industries and farmers to cut back when possible on water use from the Savannah River. It also cites plans to reduce usage by counties closer to the coast and stricter criteria for counties that apply to pull water out of the river in the future.

"While the current plan is a good start, we believe more needs to be done," Mr. Sanford wrote in a letter sent to Georgia Gov. Sonny Perdue on Wednesday.

South Carolina and its coastal water users have spent about \$90 million since 1990 to protect the Upper Floridian aquifer from saltwater contamination, and "Georgia should be prepared to make an equally proportional investment to protect this valuable shared resource," Mr. Sanford wrote.

The governor's spokesman, Joel Sawyer, said Mr. Sanford was referring more to restrictive measures than dollar figures.

"There has been a substantial effort on the South Carolina side to reduce water usage," Mr. Sawyer said. "We believe that Georgia should make an equally proportional investment. ... It should be proportionally equal in terms of stewardship of the water resources."

The Savannah River forms a border between the two states that is more than 300 miles long. As more and more water is pulled from the waterway, saltwater creeps into fresh water supplies near the coast.

The problem is so bad near Hilton Head Island, Mr. Sanford warned, that "we insist that a firm schedule for further reductions in pumping be developed."

Mr. Perdue's office didn't have time to fully review Mr. Sanford's proposals Thursday and couldn't comment on specific recommendations, said Shane Hix, Mr. Perdue's deputy press secretary.

"Georgia and South Carolina share a common goal of maintaining the river basin and aquifer," Mr. Hix said in an e-mailed statement. "Gov. Perdue appreciates the recommitment and continued support of our interstate discussions."

In recent years, committees appointed by the two governors have been discussing how to best share the Savannah River.

Reach Josh Gelinis at (803) 648-1395, ext. 110, or josh.gelinis@sugustachronicle.com.

Charlotte Observer

11/13/05.. Will the Catawba meet our water needs

Island Packet Online

7/5/06..Atlanta eyes Savannah River as water source

Augusta Chronicle

8/6/06..Tapping into the Savannah

Charlotte Observer

9/19/06..Who has right to Catawba River's water?

Coastal Conservation League
Spring/07..Water withdrawals could leave SC rivers high and dry

The Coming Crunch

Source: Wall St. Journal, 10/13/06

As U.S. Population Continues To Swell, Researchers Foresee Megacities, **Crowded Coasts**

By JUNE KRONHOLZ

THE U.S. POPULATION will hit 300 million at 7:46 on Tuesday morning, says the Census Bureau. But it's the 400 million milestone, which the U.S. will reach in about 35 years, that has demographers and economists really talking.

Those additional 100 million people, many of them immigrants, will replace aging baby boomers in the work force, fill the Social Security coffers and, in all likelihood, keep the economy vital and life interesting. But they also will further crowd cities and highways, put new strains on natural resources, end the majority status of whites, and probably widen the gulf between society's haves and have-nots.

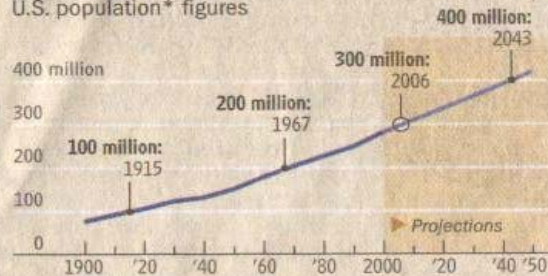
"It's not that we're going to be running out of this and that," says Princeton University professor Charles Westoff, who headed a 1972 presidential commission that called for stabilizing the population. "But how many more people do we want?"

With about 86 people per square mile nation-



Steady Climb

U.S. population* figures



wide now, the U.S. would seem to have plenty of room for more. Even after the next 100 million people are added, the U.S. still will have one-sixth the density of Germany, whose population is expected to stop growing within a few years.

But those averages hide disparities that could prove worrying. Even as it grows, the population is increasingly concentrating in just a dozen or so states. North Dakota is losing population, Ohio is adding a mere 20,000 people a year and heartland states like Kansas and Nebraska average fewer

The Center for Environment and Population, a nonpartisan research group in New Canaan, Conn., calculates that more than half the population lives within 50 miles of the coasts. In the next decade, an additional 25 million people—half the total population increase—will join them there.

That concentration of population is likely to result in megacities of 25 million or more as people



North Carolina

Water Policy and the Economic Future of South Carolina

Watershed-scale river experiments are needed to define ecosystem needs for informed policy development: an opportunity for a public-private partnership. Example: Savannah River at Risk™

Georgia



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Historically, in the southeast we have viewed energy, agriculture, industry, and public consumption as the best uses of water, with less regard for the ecology of rivers, streams, lakes, and reservoirs. Source: Dr. David Feldman, Southeast Water Resources, 1998

What is changing this view?

Population Growth

Droughts

Economic Future

Ecosystem Impacts

Sustainability

72% of Americans are looking to major universities for solutions

Yale Center for Environmental Law & Policy, March 5, 2007

The Research Driver: Savannah River Drought

Economy



Ecology



Research Driver: Water Quality Concerns

Challenge of Micro-pollutants

Table 2. Examples of ubiquitous water pollutants.

Source: Science, Vol. 313, p. 1073, August 25, 2006

Origin/usage	Class	Selected examples	Related problems
Industrial chemicals	Solvents	Tetrachloromethane	Drinking-water contamination
	Intermediates	Methyl- <i>t</i> -butylether	
	Petrochemicals	BTEX (benzene, toluene, xylene)	
Industrial products	Additives	Phthalates	Biomagnification, long-range transport
	Lubricants	PCBs (polychlorinated biphenyls)	
	Flame retardants	Polybrominated diphenylethers	
Consumer products	Detergents	Nonylphenol ethoxylates	Endocrine active transformation product (nonylphenol)
	Pharmaceuticals	Antibiotics	Bacterial resistance, nontarget effects
	Hormones	Ethinyl estradiol	Feminization of fish
	Personal-care products	Ultraviolet filters	Multitude of (partially unknown) effects
Biocides	Pesticides	DDT	Toxic effects and persistent metabolites
		Atrazine	Effects on primary producers
	Nonagricultural biocides	Tributyltin	Endocrine effects
		Triclosan	Nontarget effects, persistent degradation product (methyl-triclosan)
Geogenic/ natural chemicals	Heavy metals	Lead, cadmium, mercury	Risks for human health
	Inorganics	Arsenic, selenium, fluoride, uranium	
	Taste and odor	Geosmin, methylisoborneol	
	Cyanotoxines	Microcystins	Drinking-water-quality problems
	Human hormones	Estradiol	Feminization of fish
Disinfection/oxidation	Disinfection by-products	Trihalomethanes, haloacetic acids, bromate	Drinking-water-quality, human health problems
Transformation products	Metabolites from all above	Metabolites of perfluorinated compounds Chloroacetanilide	Bioaccumulation despite low hydrophobicity Drinking-water-quality problems

The political climate today follows a national trend to rely more on public-private partnerships to achieve community objectives (White House Conference on Cooperative Conservation)

- Due to limitations in funding sources, innovative public-private partnerships must be developed that coordinate research efforts among many public and private entities to insure the maximum return for the research and monitoring investment.
- A demonstration and commitment of collaboration is often required for federal funding (seed funding).
- A genuine, regional collaboration which transcends institutional and political boundaries to share funding and technical resources toward a common goal
- Cross-jurisdictional public and private cooperation to support a common objective
- Cost-share programs to supplement government cost-share funds
- Multiple agencies and organizations working across boundaries on a watershed level to support a common objective



'An alternative model of collaboration between scientists, managers, and other stakeholders to perform large-scale river experiments is emerging around the world. Innovative funding partnerships between government agencies, not-for-profit foundations, and the private sector are required to advance the scientific basis of water management.' River flows and water wars: emerging science for environmental decision making. Poff et al, Front Ecol Environ 2003: 1(6):298-306.

Clemson University has the opportunity to participate in public-private partnerships to produce, disseminate, and apply experimentally-based science to solve complex environmental issues. Through collaboration, scientists become partners at the table to insure sound science is integrated in management strategies. Example: Savannah River Ecological Flow Prescription

Funding of Large \$\$ River Projects

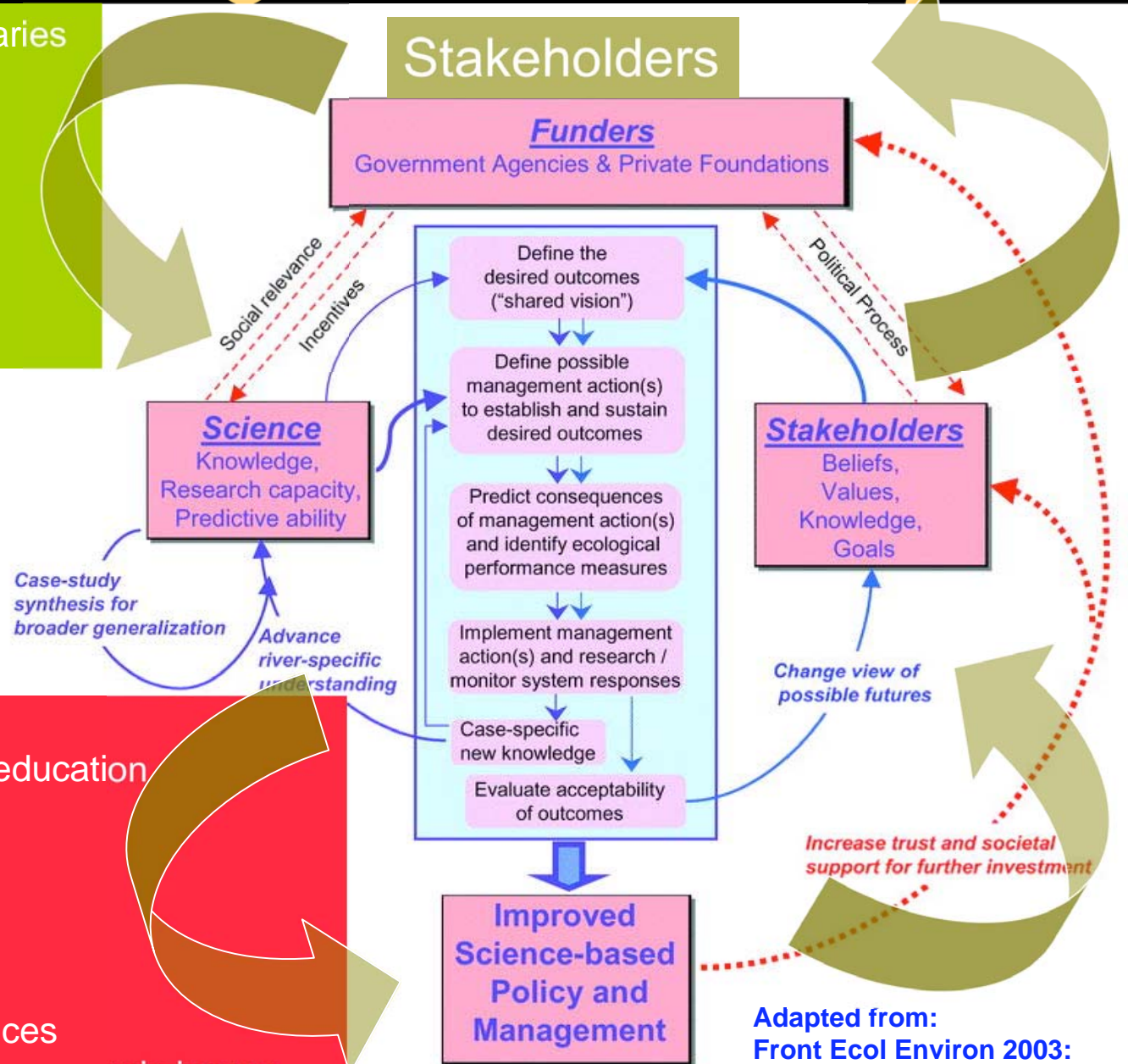
Collaboration across boundaries

Academic
Nonprofit
Government
Industry
Commerce
Public at Large

combine talent, create synergy, and economies of scale

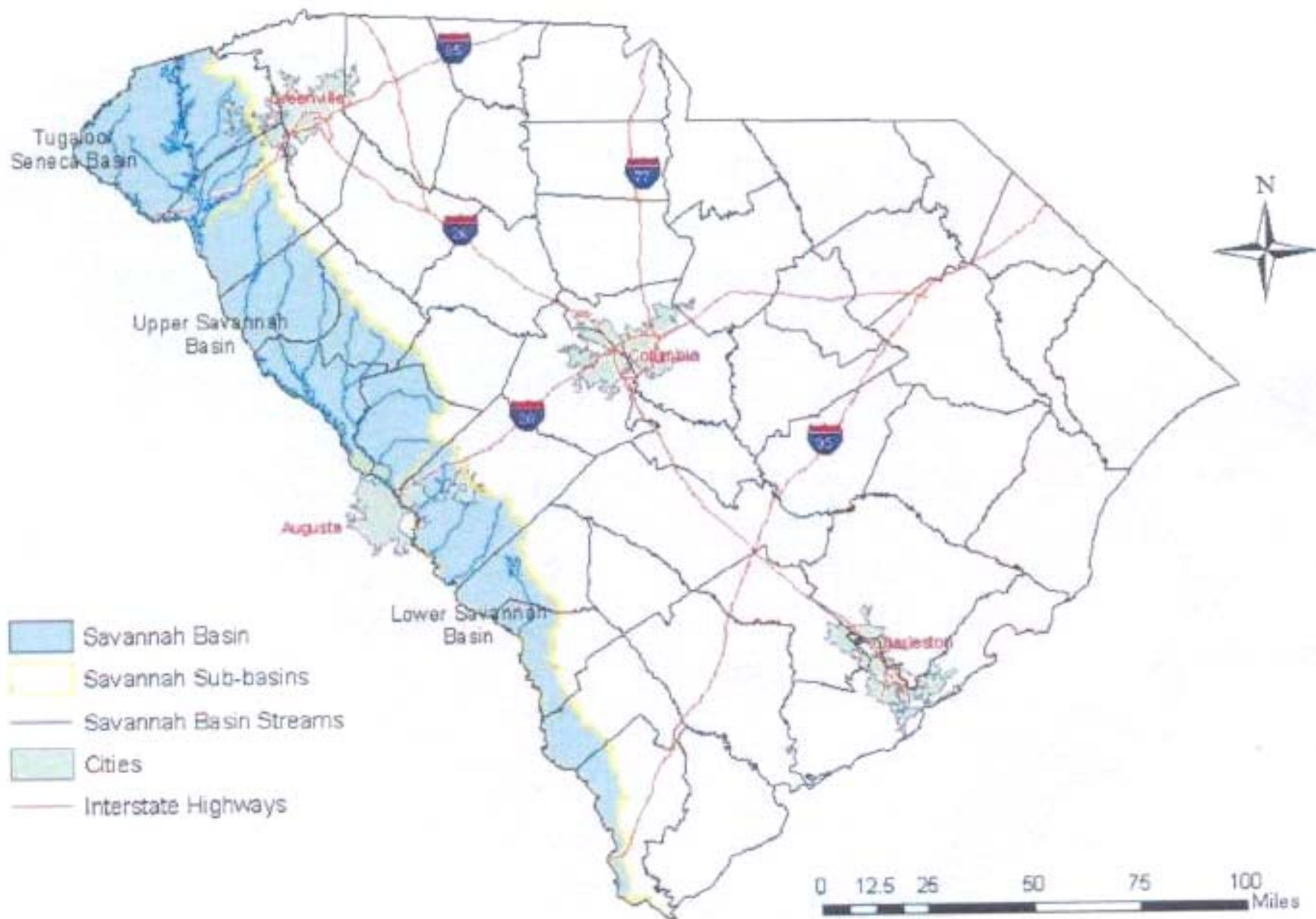
step off in bold new directions of inquiry

Relevant science
Integration of research and education
Interdisciplinary
Innovative
Entrepreneurial
Mix of applied and basic
Creative partnerships
Provide technological advances
Address social, cultural, and economic issues



Adapted from:
Front Ecol Environ 2003:
1(6):300, Figure 3

Savannah River Basin South Carolina



Characterizing the water quality of large rivers throughout the United States remains a challenge to river ecologists (Hirsch, 2001)



Key research topics include:

- Estimating the **annual loading rates** of numerous inorganic and organic constituents from multiple sources within a watershed (Hooper et al., 2001; Horowitz et al. 2001[a])
- Predicting the **transport characteristics and fate** of those constituents
- Determining the **appropriate sampling frequency** necessary to collect sufficient water quality data to support integrated water quality and quantity models (Haggard et al. 2003; Horowitz et al., 2001[b])
- Defining **natural and anthropogenic sources of water quality constituents** (Broshears et al. 2001) and
- Predicting **long-term watershed-level responses of river ecosystems to land-use changes** (Power et al., 1995).

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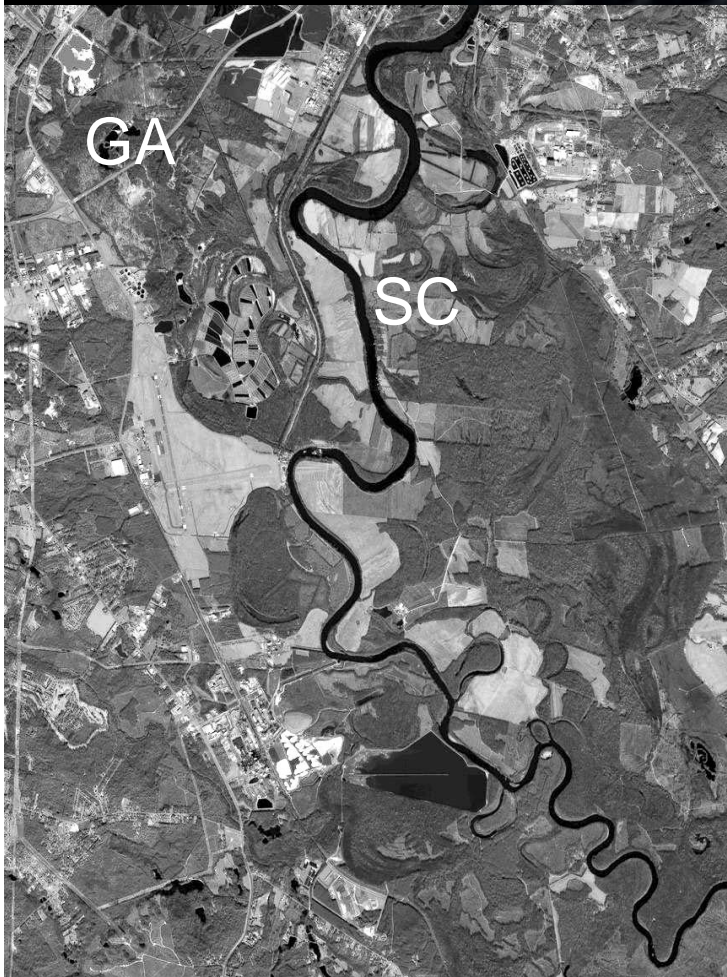
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Center for Urban River Research

Southeastern Natural Sciences Academy

Savannah River at Risk™

An initiative in leadership, research, and



Water withdrawal for the future?
Wasteload allocations for the future?
Shrinking water resources due to growth.



Drinking water
Industrial supply
Municipal discharge
Industrial discharge

Economic impact ?
Ecosystem impact?





Economic Need for Research

- The severe impact of prolonged droughts
- Potential water-war between South Carolina & Georgia
- Total Maximum Daily Load limits for DO and concerns about the assimilative capacity of Savannah River.

Ecological Issues

- Saltwater intrusion into groundwater & tidal freshwater marsh
- Water and wastewater allocation impacting water quality & water quantity
- Fish passage above dams
- Drought within basin
- Loss of riparian corridor to development

River issues nationwide

- Current management practices in most large rivers are based on insufficient knowledge
- Ecological studies on major rivers are complicated and require interdisciplinary research
- Lack sharing of monitoring and research studies among academic, regulatory, and environmental groups



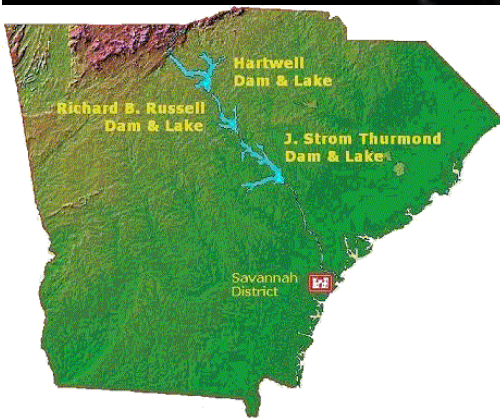


Utilize the **adaptive management process** for future operations of Savannah River dams so as to balance the needs of recreation, the environment, cultural resources, water delivery, wasteload allocation, and hydropower generation.



COE Photo

Upper Savannah Impoundments



Middle Savannah

Public Forums



COE Photo

Lower Savannah

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Savannah River at Risk™

An initiative in leadership, research, and

A public-private partnership approach

\$2.0 Million Research Program

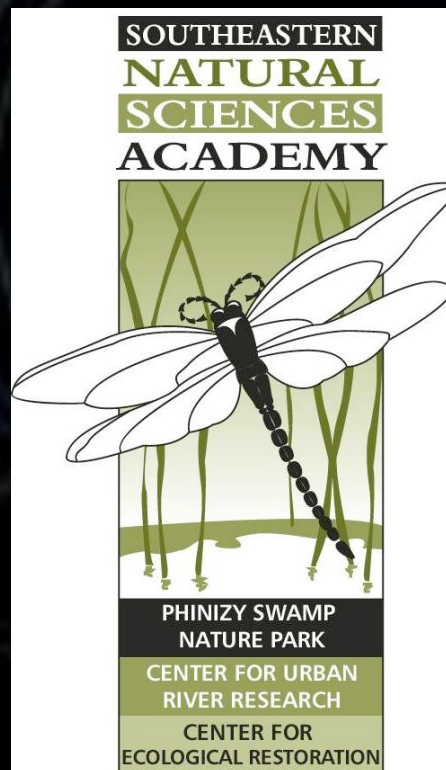
Public \$700,000

Augusta Richmond County
\$300,000

Columbia County
\$100,000

North Augusta
\$75,000

U.S. EPA
\$242,000 through
Water Quality Cooperative
Agreement



Private \$1.3 Million
Individuals, Granting Agencies,
Banks, Industries, Corporations





Biological Studies

- Periphyton
 - periphyton productivity
 - diatometer deployment
- Phytoplankton
- Macroinvertebrates
- Stable isotope analysis



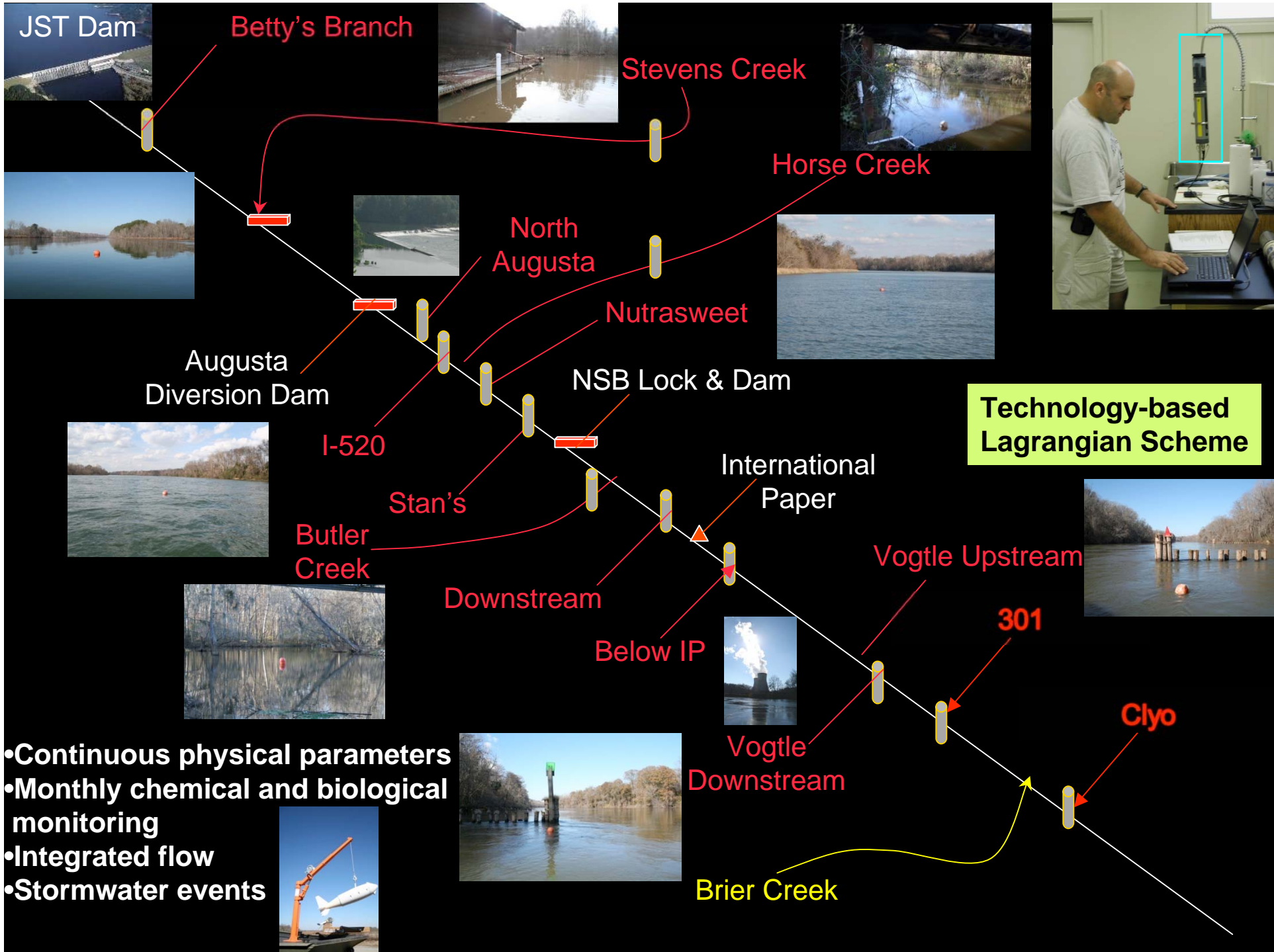
Chemical Studies

- Water Column
 - Trace metals (Cd, Cr, Cu, Fe, Mn, Ni, Pb, Se, Zn, Hg, As) total and dissolved
 - Major ions: sulfate, chloride, sodium, calcium, magnesium, silica
 - Nutrients
 - Nitrogen: TKN, $\text{NH}_3\text{-N}$, $\text{NO}_2\text{-N}$, $\text{NO}_3\text{-N}$
 - Phosphates: total-P, ortho-P
 - TSS, DO, pH, hardness, alkalinity, DOC, conductivity, temperature, turbidity, Redox, BOD, COD
 - Polycyclic aromatic hydrocarbons, other organics
 - chlorophyll a / SCUFA technology

River Channel and Sediment Analyses

- River channel profiles
- Sediment characterization



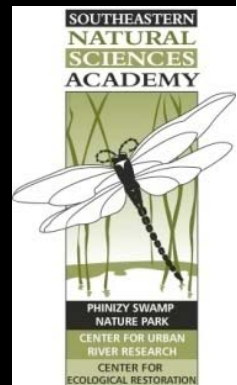
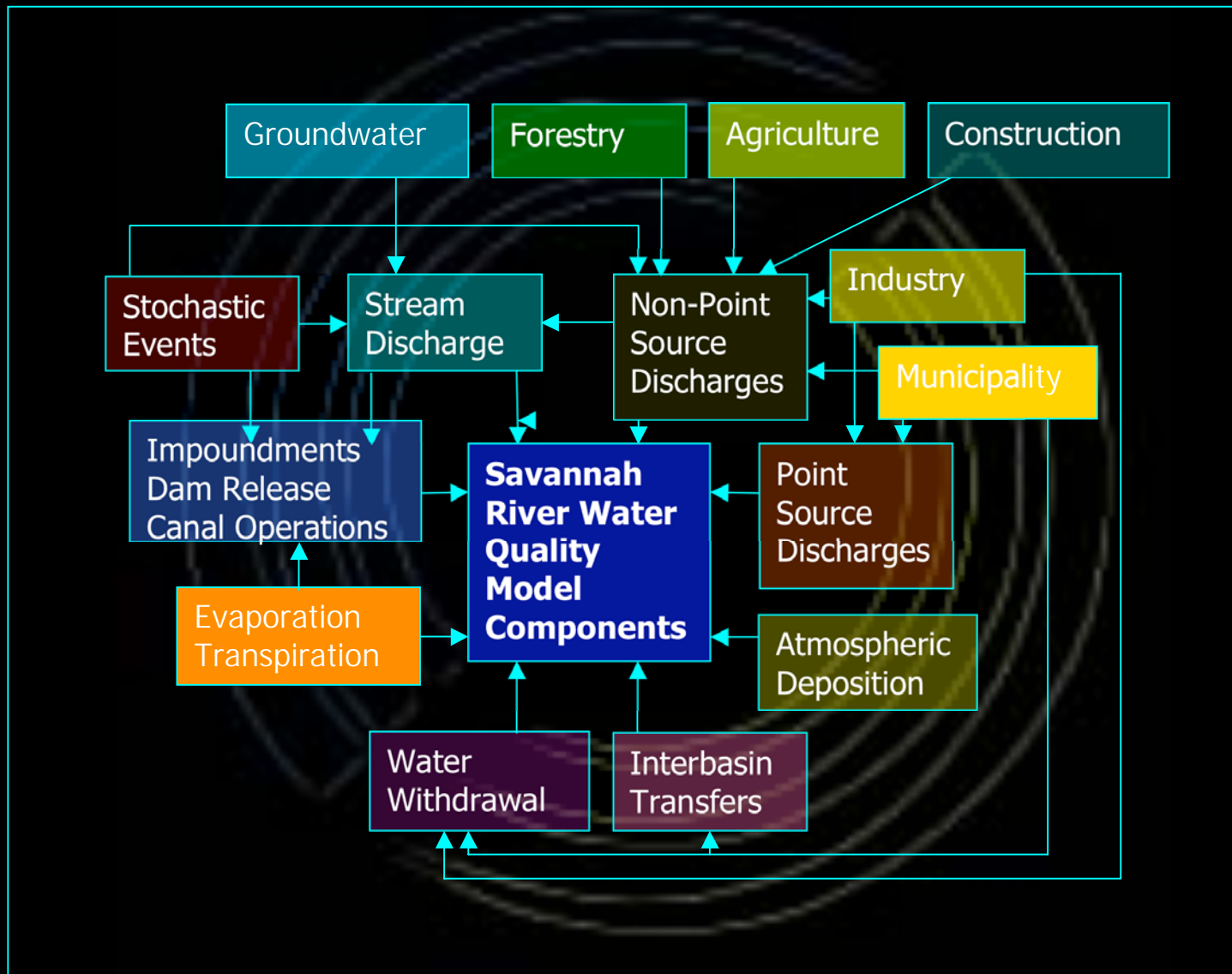


- Continuous physical parameters
- Monthly chemical and biological monitoring
- Integrated flow
- Stormwater events





Savannah River at Risk™ Integrated Water Quality/Water Quantity Model



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Hammond's Ferry is a 200-acre mixed-use neighborhood on the banks of the Savannah River in North Augusta, South Carolina. The project is designed as a collection of walkable, mixed-use neighborhoods which extend the historic town of North Augusta, reconnecting the town with its riverfront.



Hammond's Ferry



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Hammond's Ferry



Public-Private Partnership

1. Hammond's Ferry
2. City of North Augusta
3. Southeastern Natural Sciences Academy
4. National Fish & Wildlife Foundation



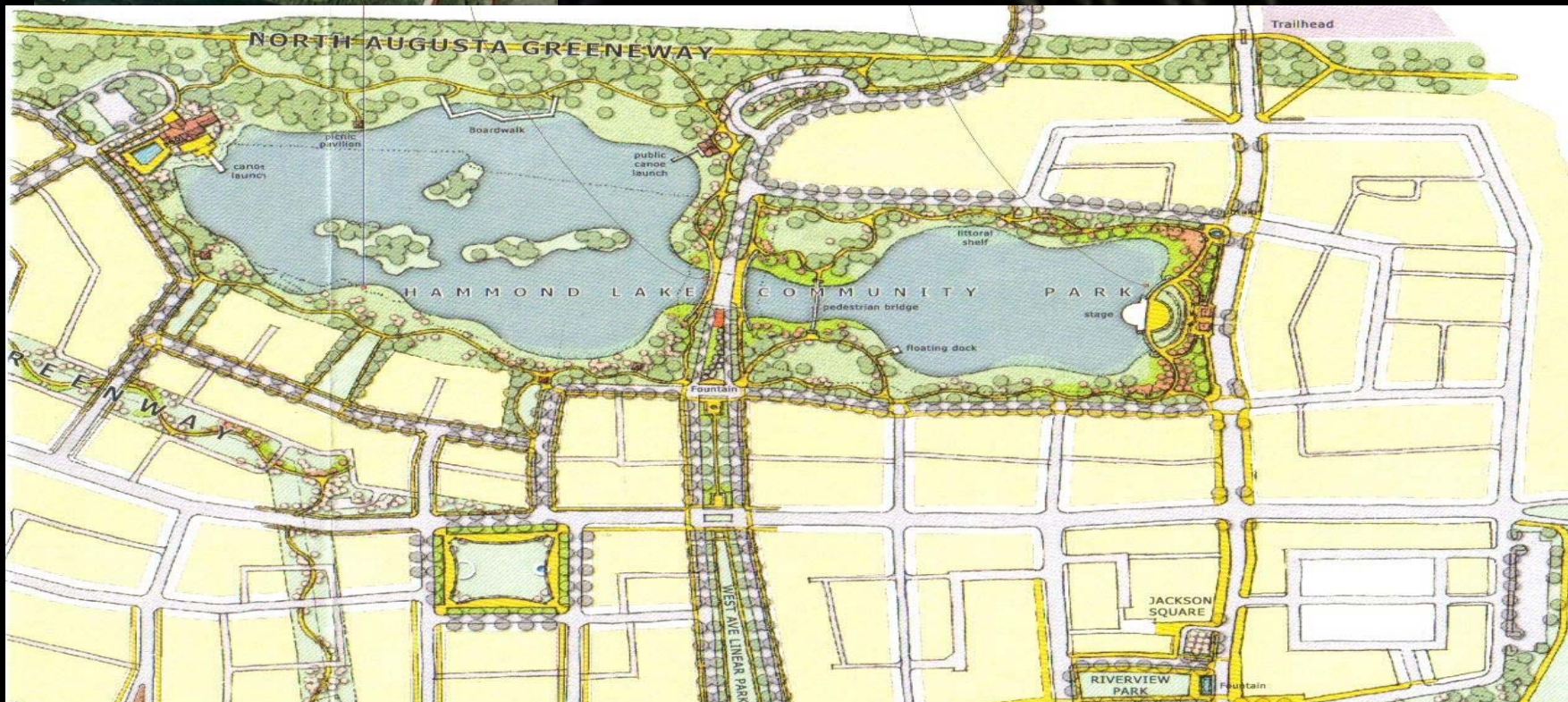
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Hammonds Ferry Clay Pit Ponds Ecological Restoration Plan Preliminary Restoration Plan



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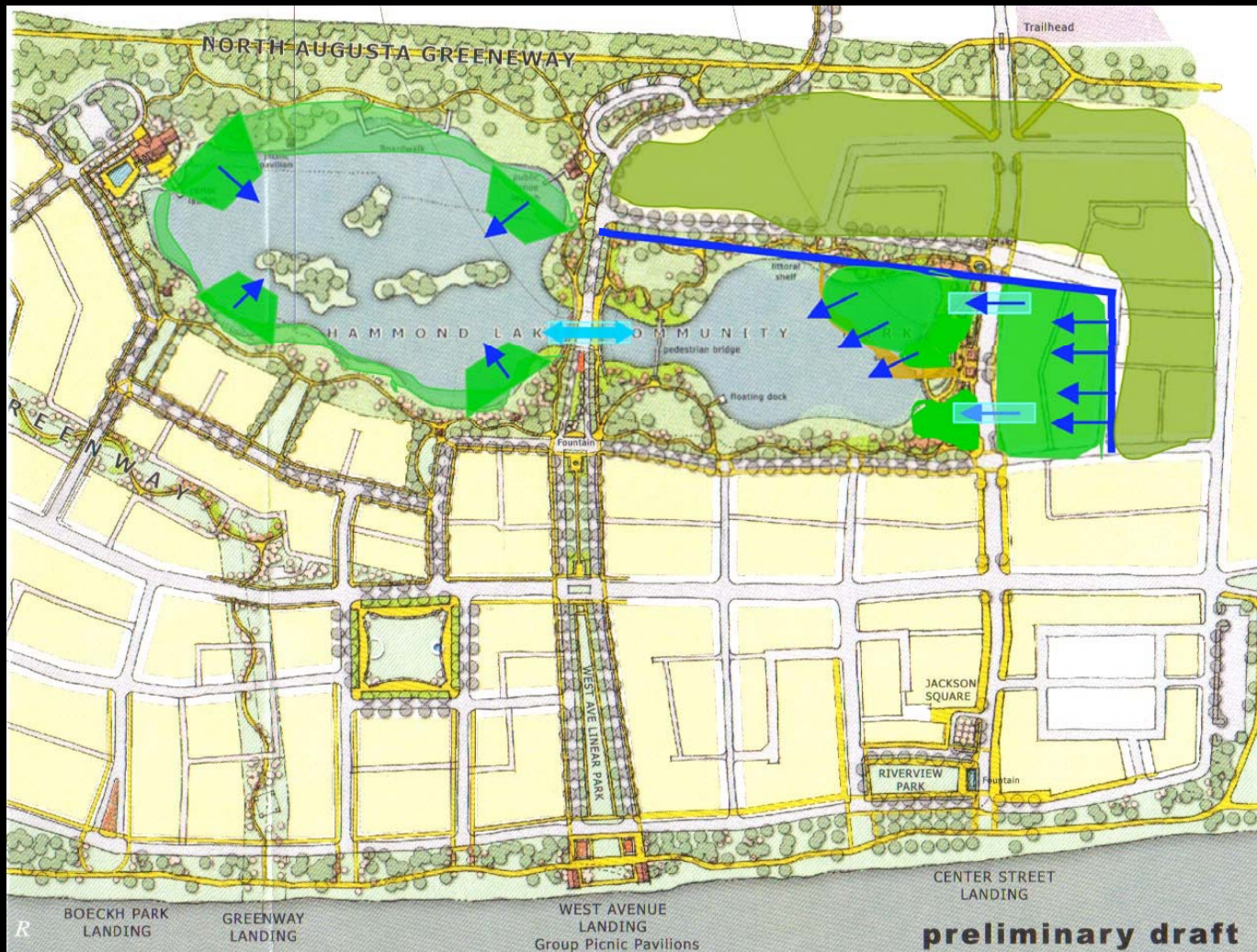
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Hammond's Ferry Pit Lakes Ecological Restoration Design

Stormwater Conveyance

Hydraulic Connection

January 18, 2006

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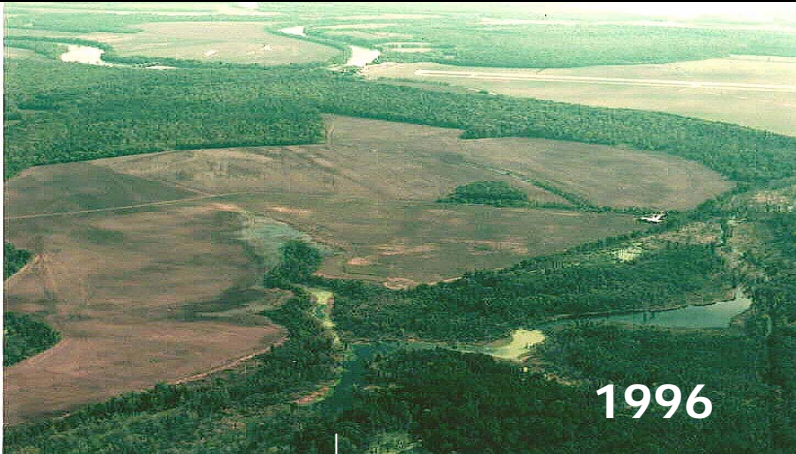
Research Opportunity

Development on all our river basins present the 'next great waterfront' – and a significant issue for our rivers



Constructed Wetlands Project, Phases 1-3 Augusta, Georgia

Innovation in technologies for cleaner water



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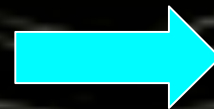
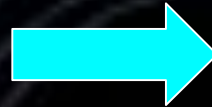
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Cooperative Conservation with TNC/COE Ecological Flow Prescription



Clemson University



Kennecott-Ridgeway Gold Mine

Long-term Pit Lake and Ecological Restoration Research Site



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Application of Mine Restoration Research at Barite Hill Mine, McCormick, SC Savannah River Basin

50 MG highly contaminated water
impacting stream and potentially
groundwater
(pH=2, heavy metals)



Seafloor hydrothermal processes,
massive sulfide deposit in Late
Proterozoic period



Will people conserve when asked?

Source: *The Salt Water intrusion Problem and Water Conservation Practices in Southeast Georgia, USA*, Drs. Gibbison and Randall, Georgia Southern University, *Water and Environmental Journal*, 20 (2006) 271-281.

Issue: attitudes of Georgia residents regarding the need to create and implement a conservation strategy to address the salt water intrusion problem in the Upper Floridian aquifer that is seriously impacting Hilton Head Island and Savannah

Findings: majority of respondents agree salt water intrusion is a serious threat to the region's water supply, however, only a small proportion of residents practice conservation on a regular basis

Solutions:

- implement conservation pricing to 'encourage' conservation, considered weak as studies show 10% \$ increase = 5% reduction
- Change household indoor and outdoor water use technology, will probably require significant financial incentives, rebates, etc.



Capturing Research Funding Opportunities

Complex ecological issues are best addressed through collaboration among agencies, stakeholders, universities, and private organizations funded by public-private partnerships

- Get to know stakeholder communities throughout South Carolina and identify their problems where Clemson expertise can drive the research program

• Extension Service/Watershed Center of Excellence/South Carolina Water Resources Conference

- Focus on complex issue research, such as watershed-based studies/large river ecosystems that require the diverse strength of our colleges/departments/institutes
- Develop collaborative relationships internally, among local, state, and federal agencies, and community-based organizations
- Be innovative in creating public-private funding strategies
- Deliver solutions



“In the 19th Century, we devoted our best minds to exploring nature. In the 20th Century, we devoted ourselves to controlling and harnessing it. In the 21st Century, the best minds are working on how to restore nature.”

Historian Steven Ambrose