ACF WATER MANAGEMENT GAP ANALYSIS

April 2014

THE UNIVERSITY COLLABORATIVE (TUC) OF THE APALACHICOLA CHATTahoochee FLINT STAKEHOLDERS
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EXECUTIVE SUMMARY

In June 2013, the Apalachicola–Chattahoochee–Flint Stakeholders (ACFS) asked The University Collaborative (TUC) to perform a gap analysis of water management functions in the ACF Basin. The goal of this project is to take a first step in identifying and assessing water management functions that are currently underway in the ACF in order to (a) disclose gaps where activities essential for effective multi-state planning and sustainable management of the ACF Basin are missing and (b) illuminate initial opportunities for a transboundary water management institution (TWMI) to fill in those gaps. A team of masters, PhD, and law students, assisted by staff and faculty, developed and implemented a research and analysis program which stretched over three semesters. Students started with book and web-based research of laws, policies and programs; moved on to limited interviews with and surveys of specific basin stakeholders; and received substantial input from members of the ACFS, who reviewed earlier drafts of the report.

This document, the ACF Water Management Gap Analysis – Draft 3.0, represents the most recent compilation of our work. We note that the Ohio River Valley Water Sanitation Commission (ORSANCO), a TWMI we studied in drafting our Institutional Options report for the ACFS, is currently undertaking a Gap Analysis to examine the opportunities for expanding their scope from water quality issues to water quantity. Their analysis will take three years and cost $400,000. Though not nearly as comprehensive in scope, our document discloses specific opportunities for transboundary management intended to motivate discussions among the ACFS itself as well as other stakeholders such as federal and state resource agency staff and the governors’ offices.

Our team has identified four overarching water management functions essential for sustainable management of the ACF Basin: Data Acquisition, Coordination and Dissemination; Education and Outreach; Coordination, Facilitating Collaboration, and Resolving Conflict; and Regulatory Coordination and Review. We find that all are being performed to some extent by entities in the basin; the ACFS has in recent years played a significant role in the first three areas. Noteworthy gaps in all of these areas exist, however, and opportunities for closing these gaps abound. In summary, these opportunities are:

- Data Clearinghouse and Facilitation
  - Provide easily accessible, accurate and relevant data to decision-makers, researchers and the general public
  - Facilitate new studies to close current gaps in data to better inform decisions
• Investigate potential for the use of dashboards to display both data and data needs
• Investigate the need for and assemblage of real-time data
• Education and Outreach
  • Create a web presence for information about the ACF as an entire system and the need to manage it thusly
  • Develop and distribute to the basin’s recreational water users information about the ACFS and transboundary management issues
  • Create a speakers’ bureau for the same purpose
• Coordination and Collaboration
  • Promote communication and build consensus
  • Develop basin-wide plans
  • Resolve conflicts
• Regulatory Coordination and Review
  • Develop and promote uniform standards
  • Review permits
  • Control floods
  • Manage droughts
I. INTRODUCTION

Before delving into the gaps and opportunities for transboundary management, it is worthwhile to provide a general description of activities impacting flows in the ACF Basin and current efforts to mitigate the impacts of these activities and/or respond to low flow conditions. Although other basin characteristics, such as water quality, are also important, we focus on flows here because they have and will likely continue to be at the center of disputes in the ACF unless addressed collaboratively across jurisdictional lines. The natural flow regime of the basin has been impacted by human activity for hundreds of years, and particularly in the past several decades as the region has grown. In recent years, low flow conditions have impacted many water users in the basin, prompting an inquiry on how we can adapt and adopt new strategies and structures to share the resource more equitably and manage more sustainably. As described in the function summaries that follow this introduction, a TWMI could help respond to these needs.

I.A. Activities Impacting Flows

I.A.1. Withdrawals

Water is withdrawn from surface water and groundwater in the ACF for many purposes. These withdrawals can impact system flows. Cities, counties and individual homes and industries withdraw water for potable, waste treatment, and industrial purposes. Some of this water is returned to the system after treatment in centralized plants or onsite systems, and some is lost through evaporation, manufacturing, residential irrigation, and other processes. Agricultural water withdrawals from both groundwater and surface water also impact system flows. Much of the water withdrawn for agricultural irrigation is lost through evapotranspiration.

I.A.2. Dams

Dams are another activity that impact flows in the ACF Basin. They impede the flow of water downstream and result in water losses through surface evaporation. Dams are prevalent in the Georgia portion of the basin. As of 2010, there were 1,129 reservoirs in the ACF Basin tracked in the USACE’s National Inventory of Dams and over 24,500 small reservoirs and ponds that, although not tracked, may have a substantial aggregate effect on basin flows. The dams with the most significant impacts on flows in the ACF are the five major USACE-operated dams and reservoirs in the basin. USACE-regulated releases from these dams control the timing and amount of water traveling downstream, and are a source of controversy in the basin.
I.A.3. Power Generation

There are thirteen hydroelectric, seven thermoelectric, and one nuclear power facility in the ACF Basin. Aside from the impacts caused by dam development, discussed above, hydroelectric impacts on flows mostly stem from hydropeaking, which augments power supplies during peak demand periods. Releases for hydropeaking can result in rapid flow increases downstream. On the Chattahoochee, for example, hydropeaking operations can cause daily stage fluctuations of four feet or more. Thermoelectric and nuclear facilities impact flows through their use of water for cooling purposes. There are two types of cooling technologies used in the basin – once-through and recirculating. Once-through cooling systems withdraw more water but end up consuming less (they do, however, cause other impacts because wildlife may be harmed in the withdrawal process and the used cooling water is returned to the system at higher temperatures). Recirculating cooling systems withdraw far less water but consume a greater percentage of it. Cooling needs for power plants can also impact flows by requiring releases from upstream reservoirs that ensure levels will be high enough to cover downstream cooling system intakes.

I.A.4. Interbasin Transfers

Interbasin transfers take place when water is taken from one basin (the donor basin) and deposited for use in another basin (the receiver basin); the water is not returned to the donor basin and as such results in a net loss of “native” water resources in the donor basin. In 2012, 24 interbasin transfers occurred in the Chattahoochee and Flint basins in Georgia, totaling net losses of 36.9 million gallons per day in the Chattahoochee and 21.6 million gallons per day in the Flint.

I.A.5. Land Use Changes

Land use changes can have a major effect on natural flow regimes, and land use has – particularly in the metro Atlanta region – changed dramatically in the ACF Basin in the last several decades. One impact from land use change is the increase in water use that can result with a shift from low to higher intensity land uses. More water will be taken from a system, for example, if land is converted from natural open space to suburban development. Land use changes can also impact flows through landscape alterations. Streams can be piped, destroying their groundwater connections and increasing flow velocity. Wetlands are often filled during development, removing their flood storage and groundwater recharge functions. When these and other natural areas are developed, they are often replaced with impervious surfaces such as pavement, rooftops, and lawns (which, although covered in vegetation, are generally quite poor at water infiltration). Impervious surfaces can have a marked impact on flows because they reduce natural infiltration of stormwater into the ground; precipitation instead directly enters surface
waters faster and in greater quantities. This can cause “flashy” stream systems that experience significant erosion, and prevents recharging of groundwater systems that maintain base flows in streams during drought.

I.B. Mitigation Efforts and Responses to Low Flows

I.B. 1. Conservation

Water conservation can occur in municipal, agricultural, and industrial uses. It can be voluntary, incentivized, or regulated. There are a wide variety of conservation programs taking place in the ACF, including water utility conservation rate structures, conservation requirements attached to withdrawal permits, residential irrigation restrictions, leak detection initiatives, public education programs, agricultural irrigation technical assistance, and other programs.

I.B. 2. Reuse

Water reuse (reclamation) involves treating wastewater for reuse for nonpotable uses such as irrigation; it is becoming more common in the basin. Florida is the national leader, reusing over 660 million gallons of water per day. Georgia reuse is becoming more common; the state frequently encourages utilities to incorporate reuse technology into new or expanded facilities. Where reuse is feasible, it may lessen pressure on surface and groundwater systems.

I.B. 3. Desalination

Desalination plants treat brackish or salt water for uses such as drinking water. They are most heavily used in Florida, though there are currently no desalination plants in the ACF Basin in that state. One desalination plant is being considered for use in Dothan, Alabama; it would treat brackish groundwater for municipal uses. Georgia currently has no desalination facilities. Desalination is expensive, energy intensive, and produces a salty waste which must be disposed of, but as freshwater demand increases they may be utilized in the ACF Basin.

I.B. 4. Augmentation Projects

Augmentation refers to supplementing stream flow with another water source during periods of low flow. There are currently two kinds of augmentation projects occurring in the ACF Basin. The first, utilized in the Spring Creek watershed in southwest Georgia, pumps groundwater from two wells into Spring Creek during low flows to support the survival of endangered mussels in the creek.5 It is intended as a temporary solution until a more permanent response to low flows can be developed. The second project is an
aquifer storage and recovery (ASR) project in Chickasawhatchee Creek, also in southwest Georgia. ASR projects store water in wells constructed within aquifers; the water can be withdrawn for use at a later date when needed. In the Chickasawhatchee project, water will be taken from the shallow Floridan Aquifer during wet periods and placed in deeper aquifers; in dry periods the water will be placed into the creek to supplement flows. The project’s intended purpose is to determine the effectiveness and safety of this technology. Permitting and design work is underway in 2014; construction is slated for 2015 and the project operation date is 2016.7

I.B. 5. Restoration

Restoration activities can help restore flow regimes by returning some natural function/s to a system. Many organizations are involved in restoration work in the ACF. Wetland and riparian restoration – often a permit requirement pursuant to the federal Clean Water Act – can reestablish groundwater recharge and flood attenuation functions lost to development activities. Restoration of river cutbacks – removed by USACE in the Apalachicola to improve navigation – can also improve flows by reducing water velocity and increasing water elevation. Dam removal is another form of restoration that is becoming more popular in the basin and across the country; a 2013 project in Columbus, Georgia, and Phenix City, Alabama removed two dams on the Chattahoochee to create a whitewater course and restore aquatic habitat.

I.B. 6. Low Impact Development

Low impact development (LID) refers to practices that cluster development to preserve natural open space and use “green infrastructure” techniques to more naturally infiltrate stormwater, reducing runoff and maintaining the hydrologic integrity of the site. LID can reduce or eliminate flow impacts from land use changes, and although it is becoming more common in the ACF, has not experienced the kind of widespread use many commentators advocate. In 2013 the Flint Riverkeeper in partnership with American Rivers launched a green infrastructure project to restore flows in the upper portion of that watershed.
II. TRANSBOUNDARY WATER MANAGEMENT FUNCTIONS

The first phase of our research focused on documenting all of the activities that fall under the mitigation categories described above; for purposes of analysis we compiled much of this information in table form, which we will make available to the ACFS. Next, we identified gaps in those activities, gaps which contribute to ongoing disputes on allocation and equity and inefficiencies in use of agency funds. Then we identified opportunities for a TWMI to fill these gaps to promote sustainability. We often provided examples on how TWMIs in other river basins have fulfilled these functions. We incorporated our findings under the headings of the four transboundary management functions that we feel are most appropriate to address gaps.

II.A. DATA ACQUISITION, COORDINATION, AND DISSEMINATION

II.A. 1. Current Situation

Data is acquired and disseminated in the ACF Basin by federal, state, regional, and local agencies; private entities; non-profit organizations; and universities. Coordination between these organizations on data issues occurs at a variety of scales. Federal agencies charged with collecting and disseminating data include the US Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service (USFWS), Environmental Protection Agency (EPA) and US Army Corps of Engineers (USACE). These organizations generally do not focus on collecting data specifically in the ACF Basin but are charged with collecting data nationally. Each agency collects water quality and quantity data as is required for carrying out mandates and program goals. Universities collect and disseminate data through research and extension programs. There are many examples of universities partnering with federal and state agencies in these efforts. Non-profit organizations and private entities (e.g. farmers, industrial water users) collect data to facilitate operations, comply with federal and state regulations and contribute to public-private partnerships and cooperative research programs. The ongoing effort by ACFS to develop a Sustainable Water Management Plan acknowledging the trade-offs associated with various water allocations represents a major data collection and coordination effort.

II.A.1.a. Water Quantity, Quality, and Use Data

The USGS is a science driven agency that “provides impartial information on the health of our ecosystems and environment, the natural hazards that threaten us, the natural resources we rely on, the impacts of climate and land-use change, and the core science systems that help us provide timely, relevant, and useable information”; additionally they “carry out large-scale, multi-disciplinary investigations and provide impartial scientific information to resource managers, planners, and other customers.” A number of
statutory authorizations lead the USGS to acquire and disseminate quantity, quality, and use data for surface and ground water resources. Some of their authorizations also specify the USGS to coordinate data collection and dissemination efforts with other federal agencies, such as the EPA. A wealth of data on water resources is acquired and disseminated by the USGS pursuant to their water science strategy and other mission areas such as climate and land use change, core science systems, ecosystems, environmental health, and natural hazards.

The National Water Information System (NWIS) is the main repository for water resources data collected by the USGS. It can be accessed online at: [http://waterdata.usgs.gov/nwis](http://waterdata.usgs.gov/nwis). Historic and current data for the ACF Basin can be accessed through an interactive web-based mapper or acquired in tabular form. The USGS also publishes reports synthesizing these ground water, surface water, water quality, and water use data. While voluminous data for the ACF Basin has been acquired and disseminated by the USGS, there is no central data repository for the Basin; the user must queue sites separately which can be cumbersome and confusing. There are USGS websites that compile water resources data for each state in the ACF Basin.

Several USGS programs have targeted the ACF Basin. From 1991-2001, as part of the National Water Quality Assessment Program (NAWQA), interdisciplinary assessments were conducted to establish a baseline for water quality conditions in the ACF Basin. During the second cycle of the NAWQA, 2001-2012, these data were furthered analyzed to determine trends in water quality. The National Water Census, part of the WaterSmart Initiative, is a massive effort towards creating a water budget for several regions, including the ACF Basin. The budget will account for surface and ground water availability, evapotranspiration, water quality, water use, and ecological water. The specific goals for the ACF Basin are to model surface and ground water flows, accurately calculate water use, and understand the ecological impacts of hydrologic alterations. Each state within the ACF Basin has a Water Resources Institute (WRI) that provides grants funded by the USGS, to universities for research on water supply and quality issues.

The USGS partners with federal agencies such as NOAA, USACE, and EPA, as well as universities in compiling data for the Water Census.

The USACE collects and compiles data relating to its dam operations. This includes the current reservoir and river levels and a forecast of those levels in the future. Also, included is a wide range of current and past data relevant to navigation.

The USFWS is the federal agency charged with acquiring and disseminating wetlands data. It accomplishes this through the National Wetlands Inventory. This data is accessible through an online mapping interface on the USFWS website and Google Earth. Users may also download tabular data directly or create personalized wetlands.
maps. Wetland data, including mitigation data, is housed within the FDEP Environmental Resource Permitting and Submerged Lands Program.

The EPA maintains STORET, which is a data storage and retrieval system for chemical, biological and physical data relevant to water quality. STORET provides a one-stop location for water quality data in the United States. This includes EPA’s biennial National Water Quality Inventory Report and lists of each state’s impaired and threatened waters and water quality reports. The EPA compiles information summaries for most National Pollutant Discharge Elimination System (NPDES) permits, including Municipal Separate Storm Sewer Systems (MS4) permits, issued to major effluent-discharging facilities. This information can be accessed via the EPA’s Envirofacts online database.

State agencies are often delegated the responsibility by the EPA to develop standards and issue permits to comply with the federal Clean Water Act and Safe Water Drinking Act. The agencies in the ACF Basin are the Alabama Department of Environmental Management (ADEM), the Florida Department of Environmental Protection (FDEP) and the Georgia Environmental Protection Division (GEPD). These state agencies collect a wide range of data, either firsthand or through issuing permits with monitoring requirements. Every two years the agencies must submit to the EPA an integrated 305(b)/303(d) report that includes chemical, biological, and physical water quality data parameters.

The Integrated Water Resource Monitoring Network, maintained by the FDEP Watershed Monitoring Program, includes three tiers of water data: I) statewide, II) basin-scale, and III) site specific. Impaired waters are identified and confirmed at tier II, while regulatory compliance is determined at tier III. The Florida Water Resources Monitoring Council is a statutorily authorized cooperative effort between FDEP and many water monitoring and management organizations. It aims to reduce data duplication by coordinating local, state, and federal monitoring programs. The scope of the Council includes freshwater, both surface and groundwater, and marine resources. The GEPR Watershed Planning and Monitoring Program is the main collector, compiler, and modeler of water data used for all enforcement and water resource assessment programs in Georgia. Various units in the agency are responsible for monitoring, analysis, data assessment and management, and modeling.

Municipalities, industry, and other facilities discharging wastewater must complete a discharge monitoring report (DMR) to submit monthly to state resource agencies charged with issuing NPDES and Land Surface Application permits. MS4s must submit to EPA and/or their state natural resource agencies an annual report that includes data on implementation of stormwater management plans; flood management projects; municipal waste facilities; pesticide, herbicide and fertilizer applications; illicit discharges; industrial facility stormwater discharges; construction site management; and highly visible pollutant
sources. The DMRs and MS4 Annual Reports constitute a major monitoring effort and source for water quality data. These data are available in report form on state natural resource agency websites and/or generally through EPA’s STORET database.

Regional water agencies are also sources of data. The Northwest Florida Water Management District compiles links to hydrologic and GIS data. Extensive data on existing hydrologic conditions is provided on the NWFWMD website, including summaries of hydrologic conditions in northwest Florida, water conservation information, real-time and monthly river stage and rainfall data, estimated monthly district-wide rainfall, and links to USGS streamflow and aquifer data. The Metropolitan North Georgia Water Planning District (MNGWPD) provides links to water conservation information and a water use calculator for residential water users and educators as part of the ‘My Drop Counts’ program. The MNGWPD also collects annual reports from municipalities that describe implementation of their three management plans (wastewater, water supply and conservation, and watershed management). These annual reports include a wide array of data, such as water conservation measures, wastewater collection system maintenance and repair, and implementation of stream buffer ordinances. The Georgia Regional Water Councils of the Chattahoochee and Flint Basins compiled and disseminated data on water use, availability, and quality as part of the statewide water planning process. The Regional Water Plans created by these councils synthesized existing base data and models to project future demands and availability of water supply and assimilative capacity in order to predict and mitigate potential shortfalls. These plans and all supplementary materials are available to the public online.

Regional water planning councils are not yet active in the Alabama portion of the ACF Basin.

University research and outreach units are also a source for information on water quantity, quality, and use, as well as for aquatic biological and agricultural data. Each state has a land grant university in or near the basin with agricultural experiment stations and cooperative extension staff, a source for agricultural water use and quality data. The University of Georgia’s National Environmental Sound Production Agriculture Laboratory (NESPAL), acquires and disseminates data on precision agriculture, and water use and quality. NESPAL houses a dataset for agricultural water use efficiency, variable rate irrigation, and an irrigation survey. Similar datasets are found at the University of Florida (UF) Institute of Food and Agricultural Sciences (IFAS) Extension. The Georgia Water Planning and Policy Center (GWPPC) at Albany State University hosts the ACF-related research and outreach generated by that university. The GWPPC has completed research and policy projects related to most water use sectors but their primary focus recently has been on agricultural water use, efficiency and management strategies with funding from the Georgia Soil and Water Commission and the United States Department of Agriculture. The Alabama Cooperative Extension System provides outreach for the
land-grant functions of AL Agriculture and Mechanical (AL A&M), Auburn, and Tuskegee Universities. This includes collecting and disseminating data on agriculture and natural resources.

II.A.1.b. Climate, Droughts, and Flood Data

NOAA collects climate and weather data, particularly regarding flooding and drought. The data acquired and disseminated by NOAA for the ACF Basin includes observed and forecasted river stages, flood outlooks, and observed and forecasted weather. Additionally, NOAA issues warnings for droughts and floods on their website. The NOAA Climate Program Office, in collaboration with the EPA and a number of non-profit organizations and corporations, conducted a case study on extreme climatic events in the upper ACF Basin. The objectives of this case study are two-fold: to "better understand how water utilities had planned for, and responded to, these events, and to learn how they are preparing for future events" and to "gather information on how they [water utilities] use forecasts and what kind of information they would like to have for planning." A major effort of NOAA, in collaboration with many federal agencies, universities, and stakeholders, was to create the National Integrated Drought Information System (NIDIS) in 2006. The purpose of this program is to create a framework for better predicting and preparing for future drought periods. Components of the NIDIS include an interactive web portal for quality-controlled data on droughts, an early warning system for droughts, as well as periodic webinars to update stakeholders on existing drought conditions and future drought outlooks for the ACF Basin. The NOAA NIDIS and the University of Georgia’s Department of Biological and Agricultural Engineering collaboratively developed a drought outlook and agricultural decision support system for farmers in the Southeast.

II.A.1.c. Coastal and Bay Data

The Florida Sea Grant Program housed at the University of Florida (UF) is a partnership between NOAA and 16 universities which “supports research, education and extension to conserve coastal resources and enhance economic opportunities for the people of Florida.” With funding from UF’s Institute of Food and Agricultural Science, Florida Sea Grant has convened an Oyster Recovery Team to address oyster collapse in the Apalachicola Bay.

The Apalachicola National Estuarine Research Reserve is a 246,000-acre reserve, designated in 1979, that is run by the FDEP. The FDEP, in conjunction with numerous universities, federal agencies, and municipalities, conducts research and monitors the health of the Apalachicola River and Bay. Elements monitored include water quality, fish and benthic macroinvertebrates, listed species (sea turtles, shorebirds), shoreline, oyster growth and spatfall, and seagrass. Staff have maintained four data-loggers in the bay on a continuous basis since 1995, measuring temperature, specific conductivity,
salinity, dissolved oxygen, pH, water level and turbidity every 15 minutes. Weather conditions are monitored from a station in the upper East Bay marshes. Nutrient and chlorophyll a samples are collected monthly at each data-logger location, plus nine additional sites.

The Apalachicola Gulf Ecological Management Site (GEMS) is a cooperative effort between the EPA’s Gulf of Mexico Program and the state of Florida. “Information about each site, such as size, boundaries, ecological characteristics and current management status, will be included in a Gulf-wide database. This information network will be used by participants in the GEMS Program to coordinate and to share information about ecologically important sites and appropriate management techniques on a regional basis.”

II.A.1.d. Endangered Species and Biological Data

The USFWS maintains a searchable online database, the Environmental Conservation System Online, for threatened and endangered species. The database includes conservation plans; critical habitat data; the Geospatial Fisheries Information Network; species reports; the Information, Planning, and Conservation System; and the National Wild Fish Health Survey Database. The Critical Habitat Portal allows users to access critical habitat spatial data and metadata as well as federal register documents and species profiles. The Geospatial Fisheries Information Network is an interactive online database and mapper with biological information including fish passage and barriers, species data, fisheries projects, fisheries facilities, hydrography and wetlands, environmental quality, and land use data. The agency’s Information, Planning, and Conservation System (IPaC) is a decision support system and planning tool that helps to streamline the environmental review process. The USFWS expects to release a IPaC Project Manager Tool that will further streamline the environmental review process by allowing users to “enter the details of...proposed development projects, such as actions, locations, and timelines” with the IPaC Project Manager responding with a list of suggested conservation measures for Biological Assessments and other environmental review requirements.

The NOAA National Marine Fisheries Service (NMFS) shares the responsibility of implementing the Endangered Species Act with the USFWS. The NMFS manages marine and anadromous species while the USFWS manages land and freshwater species. In comparison to the USFWS, the NMFS lacks user-friendly online access to endangered species data. Species information, recovery plans, biological opinions, and other protected resources data can be accessed online at: http://www.nmfs.noaa.gov/pr/]. A NMFS Southeast Fisheries Science Center located in Panama City, Florida that “conducts multi-disciplinary research programs to provide management information to support national and regional [NMFS] programs.”
The Southeast Instream Flow Network (SIFN), part of the Southeast Aquatic Research Partnership, is composed of fish and wildlife agencies from 14 states. It provides research resources, holds conferences, and facilitates regional and local communication among water management professionals to build support and expand awareness of the value of protective instream flow policy in the southeast. Select projects from the ACF Basin include restoration of fish passage in a tributary of the Chattahoochee River and restoration of the Chipola River Watershed for listed mussels and black bass.

II.A.1.e. Restoration and Land Conservation Data

The Florida Ecological Restoration Inventory, a project of FDEP, catalogs current and proposed restoration projects, including: “wetland restoration...upland natural community restoration, exotic species removal, cultural and historic resource management, and ecological protection projects.” USACE maintains a database of many mitigation and conservation banking sites called RIBITS (Regulatory In lieu fee and Bank Information Tracking System). The Florida Natural Areas Inventory contains data for species and communities, invasive species, planning and analysis, and conservation lands. Public entities, including universities and non-profit organizations, can submit data to the inventory. This inventory includes an interactive map of conservation lands. Georgia maintains an online map of natural areas and the Alabama Natural Heritage Program of the Auburn University Environmental Institute hosts an online natural heritage database.

A number of nonprofit organizations and governmental entities hold perpetual conservation easements to protect natural resources, including water resources, in the ACF Basin. Pursuant to this gap analysis, the UGA RBC compiled a table that lists many of these entities and information as to the easements they hold, using information obtained from the National Conservation Easement Database (NCED). Achieving an accurate measure of the number of easements and the number of acres of land protected in the ACF Basin is not a simple matter. NCED maintains the most accurate list of easements, state by state rather than by watershed, but it is by no means comprehensive. Often landowners do not want their land to be listed on easily accessible databases and the easement holder consequently does not publish information about the easement. To obtain a more accurate picture of the number and location of conservation easements intended to benefit water resources in the ACF Basin, one would have to seek out the information from the individual county or city governments where the easements are recorded.
II.A.1.f. Historic and Cultural Data

The Alabama Historical Commission maintains a basic map of historic sites. The Florida Ecological Restoration Inventory includes information on historic and cultural sites. The Georgia Department of Natural Resources Historic Preservation Division maintains an inventory and online database of archeological and historic resources.

II.A.1.g. ACFS Sustainable Water Management Plan

The ACFS Sustainable Water Management Plan will provide a consensus-driven vision for the future of water resources in the ACF Basin. The plan aims to provide detailed metrics of the quantity and quality of water needed by various basin stakeholders and portray the tradeoffs associated with different management scenarios. A goal of this planning process is to provide state and federal agencies with one or more alternative management scenarios that would be considered viable to all stakeholders. Work on the plan commenced in 2011 and is expected to be completed in Summer 2014. The Technical Oversight and Coordination Work Group, an ad-hoc ACFS committee, oversees the development of the plan and acts as an intermediary between consultants and the ACFS governing board. Two consulting firms have taken part in plan development. Atkins conducted the instream flow assessment and Black and Veatch are conducting the remaining components of the plan. The Georgia Water Resources Institute at Georgia Tech is performing the modeling needed for the plan using the ACF-DSS model created for the Georgia statewide water planning process. Alternative scenarios will also be modeled with ResSim, the modeling platform utilized by the Army Corp of Engineers. The planning process includes problem definition, development of performance indicators, tailoring models to indicators, development of water management alternatives, conducting iterative basin assessments, development of consensus on iterative basin assessments, and report creation and dissemination.

II.A.2. Gaps

There is no central clearinghouse for data related to water resources in the ACF Basin. Data is collected by numerous organizations and is stored in various databases. In many cases this information is difficult to access and use. For example, in order to study flow effects on endangered Gulf Sturgeon populations, a researcher from a state natural resource agency needs to query USGS databases for hydrologic data separately for each stream gauge site, and USFWS databases and recovery plans for biological data. There might also be relevant research undertaken by university personnel yet most of the universities in the basin do not maintain a centralized database that includes all of their respective colleges’ and units’ work in the ACF. Understanding which databases to query can be a daunting and time-consuming task.

Sometimes databases on particular resources and activities in the ACF that would inform
management decisions or other activities do not exist though the individual data does exist. For example, there are no comprehensive basin-wide datasets on (a) major water conservation activities, including conservation pricing and water loss audits; this dataset may be useful for an evaluation of the need to adopt more uniform policies across jurisdictions to promote equity; (b) flow alteration and augmentation activities currently underway and those being considered; (c) water withdrawals, consumption, and discharges for all power production plants in the ACF Basin to determine whether efficiencies are being maximized; or, (d) water-based recreation and tourism sites and outfitters, which could be used to promote regional economic development opportunities.

In some cases, data, much less databases, do not exist. Some management decisions are being made in the absence of fundamental scientific and ecological understanding of natural systems. Though there are major efforts underway in trying to understand needs of imperiled species and oysters by state agencies, as outlined in section II.A.1.d ‘Endangered Species and Biological Data’, gaps still exist. Moreover, there is a need to reach tri-state consensus on data regarding contentious issues such as these; vetting of data at a basin wide scale may make it more usable and increase overall trust in its accuracy. The cumulative impact of the multitude of small farm ponds and amenity lakes on flow in the ACF is poorly understood as are the returns from such uses as onsite wastewater treatment, land application and residential irrigation. Further study is needed to evaluate the potential for economically sustainable commercial navigation within navigation windows; the incremental benefits to downstream ecosystems provided by seasonal navigation releases; and the opportunity cost (including recreational use losses) of releasing water for navigation and downstream uses versus that of storing water in upstream reservoirs for future use.

II.A.3. Opportunities for a TWMI

Better data allows for better-informed water management decisions. Providing easily accessible, accurate and relevant data should be a focus of any transboundary institution in the ACF Basin. While the organizations that currently collect and compile data are largely effective, they are generally not ACF-focused in their work and their missions are not focused on promoting collaborative basin-wide management and decision-making. A TWMI can leverage considerable resources in generating funds for research that all its constituents have identified as critical to inform management. Compiling, synthesizing, and disseminating data in a coordinated way may reduce redundancies, increase relevance for decision-making, and increase mutual trust in its validity. Collecting biological and hydroelectric power production data at a basin-wide scale by the Northwest Power and Planning Conservation Council, for example, has facilitated planning efforts and highlighted areas of biological uncertainty in need of further research.
II.A.3.a. Data Clearinghouse and Facilitator

The most apparent opportunity for a transboundary institution is to create a clearinghouse for ACF Basin data and to adopt uniform data collection and information management standards and protocols to facilitate data sharing and trust between various agencies and user groups. The institution could also assemble data sets of existing data relevant to specific needs.

A TWMI could facilitate (through consensus-building on the need for, and procuring funding for) new studies to close current gaps in data that stymie informed decisions. This might include, as previously mentioned, data on the impact of small amenity lakes and farm ponds in the ACF; power facility withdrawals, consumption, and discharges; the flow needs of imperiled species; and the potential for using navigation windows.

II.A.3.b. Displaying Data via Dashboards

The Northwest Power and Conservation Council (NWPCC) has developed an excellent framework for organizing research efforts and displaying uncertainties. A comprehensive list of biological research needs are listed by research theme, including effects of climate change, estuary, harvest, hatcheries/artificial production, human development, hydrosystem, invasive species, monitoring and evaluation, ocean, population structure and diversity, toxins, and tributary and mainstem habitat. The framework uses “dashboards” to compile, synthesize and display data for sub-basins and species in a user-friendly and compelling manner. The framework uses “dashboards” to compile, synthesize and display data for sub-basins and species in a user-friendly and compelling manner. Figure 1 (below) illustrates a sample subbasin dashboard. For targeted species and sub-basins, data is provided regarding objectives, limiting factors, actions, and external resources. The dashboard allows users to track regional progress towards fish and wildlife goals in a number of different ways: by high-level indicators, species, or location. A screen shot of the webpage for high-level indicators is provided below (figure 2).
Figure 1. NWPCC Subbasin Dashboard

Figure 2. NWPCC High-level Indicators
II.A.3.c. Real-time Data and Its Potential Use in the ACF Basin

One opportunity for a TWMI that has been suggested by members of the ACFS Governing Board, is identifying whether there is a need for a real-time data monitoring system in the ACF or parts of the ACF and procuring the necessary resources for developing such a system in the event the need is identified.

According to Bruce Beck, professor and eminent scholar of environmental systems analysis at UGA’s Warnell School of Forestry and Natural Resources, real time data is useful where the manager has the capacity to make operational decisions in real time or where system features are sensitive to high frequency disturbances; otherwise real time data may not be worth the time and expense. For example, real-time data might be useful to monitor water quality during times of drought; because there is less water to dilute pollutants, non-compliance with water quality standards and harm to aquatic species may occur at rapid time scales. Likewise, real-time data is useful for planning for and responding to floods. With a real-time data system in place, it is possible that USACE could anticipate incoming flood flows and engage in anticipatory releases downstream. This practice could support utilization of smaller flood pools. From a systems perspective, one may see particular nodes where real-time data would be useful and focus efforts there, rather than installing a real-time data system for the entire basin. There are risks/liabilities associated with real-time data technology. The equipment used is expensive and sophisticated and may become obsolete quickly; it also requires well-trained staff. The use of real-time data for operational purposes in the ACF would require buy-in by USACE.

II.A.4. Real-time Data Case Study: The Intelligent River Project

The Intelligent River Project, initiated in 2007, is an interdisciplinary research initiative of Clemson University. Funded by the National Science Foundation’s Major Research Implementation Program, the project consists of a basin-wide network of computerized sensors to monitor water quality along the entire length of the Savannah River. This network will provide real-time data on water quality and flow rate, which will improve water resources management as demand increases for drinking water, hydroelectric power, recreation and industrial production. The Project collects data through the MoteStack, a tiny battery-operated computer that has the ability to sense environmental data. Placed into buoy systems anchored to the river floor, the MoteStacks collect data on water temperature, flow rate, turbidity, oxygen levels and the presence of pollutants and transmit it to Clemson’s high-performance computer system for public display on the Intelligent River web site.

MoteStacks have already been installed in Aiken, South Carolina, where they monitor the effectiveness of green infrastructure stormwater management projects and the movement
of runoff in the stormwater infrastructure. They have also been installed in some sections of the Savannah River. The Project anticipates installing more headwater stations in the mountains of South Carolina, platform profiling in the three major reservoirs of the Savannah River, tailrace monitoring related to hydropower on major reservoirs as well as a small hydropower facility located on Lake Russell. The installation of eight additional buoys in the Savannah River has been delayed for several months due to high flows exceeding 30,000-cfs within the river. The Project anticipates that all stations will be monitoring and reporting data by June 2014.

II. EDUCATION AND OUTREACH

II.B. Current Situation

Significant educational materials and educational and outreach programs focused on water resources and water management are offered across the basin. Many local government and utility websites host information about their respective rivers and promote activities for children and adults ranging from trash pickups to Adopt-a-Stream and Project Wet activities to paddling excursions with an educational focus. The nongovernmental organizations throughout the watershed, including lake associations and riverkeepers, offer these as well. Florida State University teaches on ongoing course about the entire ACF Basin and at times the University of Florida, Auburn, and the University of Georgia have taught parallel courses but in most cases the educational and outreach offerings in the basin focus on particular systems or management actions rather than on the basin as a whole.

In the arena of water conservation, outreach programs include those offered by state agencies, water management districts, water utilities, schools, and local governments. Conserve Florida Water operates through a clearinghouse at the University of Florida and provides a free statewide service for utilities in planning and monitoring water conservation programs. Georgia’s WaterSmart program gives residents conservation information, particularly with regards to landscape irrigation.

Incentive programs include Water Sense, an EPA program that labels household and irrigation products that meet EPA water efficiency criteria; federal, state, and local tax and other rebates may be available for purchase of these products. In Florida, water management districts are required to establish incentive programs for local governments to require Florida-Friendly Landscaping (water-efficient landscaping designed specifically for Florida’s climate). Georgia’s WaterFirst communities, certified by the Department of Community Affairs upon the adoption of water conservation criteria, are offered incentives such as lower interest rates on some loans.
Much outreach is being provided in the arena of agricultural water efficiency. Both the University of Florida and the University of Georgia have developed field sites in the ACF for research and demonstration of agricultural practices and their impact on water. UF IFAS’ North Florida Research & Education Center (NFREC) provides research and extension programs to help agricultural and natural resource clientele adapt and manage resources and agricultural operations effectively and profitably in a changing socioeconomic and environmentally aware setting. Their 1000-acre Quincy and 1300-acre Marianna campuses include programs in irrigation management and sod-based rotation. The 130-acre UGA Stripling Irrigation Research Park in Camilla GA focuses on defining crop water needs and improving food, feed and fiber production through the development and demonstration of more efficient irrigation methods. Both of these universities’ programs feature partnerships between governmental agencies, non-governmental agencies and the agricultural industry. The Alabama Cooperative Extension System provides education and outreach on agriculture and natural resources.

The Georgia Water Planning and Policy Center (GWPPC) at Albany State University provides extensive outreach services in the ACF. It has been the primary provider of technical and facilitation support for the Lower Flint, Upper Flint and Middle Chattahoochee Regional Water Planning Councils and is currently facilitating the investigation of the viability of an aquatic Habitat Conservation Plan for the imperiled species in the Flint Basin. Its director serves as staff to the ACFS. In addition, faculty, staff and students at the GWPPC, the University of Florida, the University of Georgia River Basin Center, Georgia Tech, Auburn University and Troy University provide research and outreach services through their participation in The University Collaborative of the ACFS.

The Flint River Basin Partnership was formed by the Flint River Soil and Water Conservation District, the Natural Resources Conservation Service of the U.S. Department of Agriculture and the Nature Conservancy to promote agricultural water conservation in the Lower Flint. The goal is to “move innovative agricultural water conservation practices from the research laboratory to the working farm so as to determine economic feasibility, field functionality and conservation impact”. Projects using five key water conservation measures – low pressure drop nozzle retrofits with end gun shut-off, variable rate irrigation, advanced irrigation scheduling, conservation tillage and sod based rotation – are funded through contributions from farmers and cost-share programs.

II.B. 2. Gaps

There is little information provided online about the ACF as a system other than descriptions of the history of the legal disputes. Descriptions of collaborative projects, particularly those that cross state boundaries, and opportunities for the general public to participate in these are hard to find unless someone specifically knows about the project.
Yet the interstate partnerships formed to promote recreational opportunities, such as the dam removal/whitewater course on the Chattahoochee at Columbus and Phenix City and the Chattahoochee Blueway, as well as interstate efforts to share information about agricultural water efficiencies, are compelling and make clear that interstate cooperation is a key to economic prosperity. Similarly missing is outreach in terms of a speakers’ bureau focused on the works of the ACFS and other examples of collaboration.

II.B. 3. Opportunities

With a minimal investment in time, the ACFS or another organization could incorporate website components that promote the concept of sustainable transboundary management among a wide public audience including children and adults and feature examples of successful collaboration. An information sheet about the ACFS and/or the ACF or a catchy bumper sticker or refrigerator magnet could be distributed to the millions of annual visitors to the Corps lakes at marinas, parks and paddling outfitters, provoking wide-spread awareness and interest. The number of annual visitors to the larger lakes within the watershed alone exceed 12 million. A speakers and press bureau including staff and volunteers available to speak about basin issues, including the Sustainable Water Management Plan, and the need to work together proactively across jurisdictional and interest boundaries, would likely be used by civic, social, school and church groups across the watershed and again, reach millions of stakeholders. The demand for speakers and statements for the press from the ACFS is likely to increase dramatically upon the completion of the Sustainable Water Management Plan.

II.C. COORDINATION, FACILITATING COLLABORATION, AND RESOLVING CONFLICT

II.C. 1. Current Situation

Sustainable water management in the ACF Basin will require significant coordination and collaboration on a wide range of topics among varying sectors (e.g., public, private, academic) and governmental levels (e.g., local, regional, state, federal). Coordination of policies and regulatory regimes can create a more basin-centric system for managing water resources, and collaboration on individual projects or broader initiatives can focus efforts on specific issues or promote shared objectives. Coordination functions may also include conflict resolution and facilitation. Currently, most coordination and collaboration occurs across jurisdictional boundaries within individual states. These intrastate efforts show that states recognize that encouraging program and policy synchronization and project teamwork can help communities share water resources equitably and agencies manage effectively. Past and current ACF interstate coordination
and collaboration activities – including those that have failed – can provide insights into crafting successful approaches here.

II.C.1.a. Interstate Activities

The most notable attempts at interstate coordination and cooperation for ACF Basin management are the past ACF River Compact of 1997 and existing initiatives of the ACFS. Although it failed to produce a water allocation agreement, some of the relationships that facilitated the development of the current ACFS were borne from this negotiation process. The compact is worth examining to identify key characteristics that prevented it from becoming a model for coordination and collaboration. The first notable characteristic is that the ACF Basin Commissioners (charged with developing the allocation agreement) were the governors of the three states, which from the outset politicized the process. Some commentators maintain that the exclusion of important interest groups was a significant issue. Another major issue was the lack of jointly-developed tools, data, and approaches to interpreting data to inform the process. These issues contributed to the lack of trust that was prevalent throughout the compact negotiations. Indeed, many assert that it was a failure of process, not a failure of modeling or allocation formulas, which resulted in the eventual demise of the ACF River Basin Compact.

The ACFS is attempting to develop a Sustainable Water Management Plan through a process that avoids the pitfalls experienced in the compact. Membership includes representation of all interest groups and water users from the three basin states; highly politicized interests such as state agencies, lawyers, and politicians are excluded at this stage of the organization’s development. One of its key activities is developing metrics on water quality and quantity needs of user groups and the models necessary to evaluate data and allocation options. The goal for all projects and processes of the ACFS is to maintain impartiality, inclusiveness, and transparency to develop trust and achieve consensus on management options. The organization has so far received varying levels of buy-in and encouragement from a wide array of state and federal organizations.

There are several outstanding examples of interstate coordination to develop water-based recreational and tourism opportunities in the ACF Basin. The cities of Columbus GA and Phenix City AL with partners including the Corps, the USFWS and the Trust for Public Land, created the nation’s longest urban whitewater course by removing two dams on the Chattahoochee. The cities of West Point GA and Valley and Lanett AL are collaborating with the National Park Service and The Trust for Public Land to create a paddling blueway from West Point Dam to Lake Harding. Tri-Rivers Waterway Development Association is a basin-wide organization that pursues the development and maintenance of equitable uses of the waterways of the ACF including navigation and recreation.
II.C.1.b. Intrastate Activities

II.C.1.b.i. Coordinated Planning

Within ACF states, there is generally a recognition that coordinated planning can support equitable sharing of water and collaboration across sectors and governments. Through existing efforts, states have gained experience in developing the kind of planning structures that could facilitate these goals at a basin-wide scale. Georgia and Florida have established statewide and regional water plans; Alabama has taken first steps that might ultimately lead to a statewide water plan; in 2011 Governor Robert Bentley created the Alabama Water Agencies Working Group (AWAWG) to assess the state’s current water resource policies and generate recommendations on how to improve water management. That group submitted its report to the Governor in late 2013.

Florida and Georgia have embarked, in varying degrees, in water planning programs that are generally resource-based and emphasize coordination among water users and other actors. As part of Georgia’s statewide water planning process, regional water plans are created by regional water councils and submitted to GAEPD. The Water Planning Regions defined by the state water plan are not, however, entirely consistent with hydrologically defined watershed boundaries. There are four regional councils charged with creating plans for Georgia’s portions of the Chattahoochee and Flint Basins: the Middle Chattahoochee Council, Lower Flint-Ochlockonee Council, Upper Flint Council, and Metropolitan North Georgia Water Planning District. The headwaters of the Chattahoochee River are in the Coosa-North Georgia region and small parts of the Flint River Basin are located in the Middle Ocmulgee region. Regional council membership includes representatives of municipalities, agriculture, industry, and other pertinent stakeholders. Regional water councils coordinate with adjacent councils on regional issues of interest. For example, the Middle Chattahoochee Council coordinates with the Upper Flint and Lower Flint-Ochlockonee Councils to address USACE’s Revised Interim Operating Plan. The Georgia Water Council is a committee charged with coordinating state agency efforts during the creation of the comprehensive statewide water management plan. This tiered approach to water planning has allowed for communication and coordination among state, regional, and local entities.

The DEP shares the responsibility for management of Florida’s water resources with five regional water management districts. The Northwest Florida Water Management District (NWFWMMD) creates and implements comprehensive water management plans for a 16-county region, which includes the Apalachicola River and Bay systems. The NWFWMMD is subdivided into seven water supply planning regions. These planning regions do not directly parallel watersheds and consequently, water supply planning for the Apalachicola River and Bay is divided between three regions. A Strategic Water Management Plan was developed for the NWFWMMD region in 2011; it addresses water
supply, water quality, flood protection, and protection of natural systems. These plans require coordinated regulatory review, via environmental resource permitting. While there is extensive coordination of land and water use planning efforts within the NWFWMD, there is little emphasis on coordinated planning with adjacent districts.

Land use has a significant effect on water use and allocation, and ACF states have in some instances coordinated land use and water planning. In Georgia, there are several statutes requiring interagency coordination in the development of water and land use plans. Additionally, the Georgia Comprehensive State-wide Water Management Plan requires “closer coordination between state and local government agencies with respect to land use decisions and the protection of water resources.” Florida requires local authorities to promulgate and adopt appropriate land and water use regulations in order to comply with local and regional Comprehensive Plans. Alabama does not have any coordinated land and water planning statutes. The coordinated planning requirements of both Florida and Georgia are primarily met through interagency communication and data sharing during plan development and implementation. These kinds of coordination activities could be replicated or modified for use among states, agencies, and other actors on a basin-wide scale.

II.C.1.b.ii. Coordinated Data Gathering and Dissemination
Disagreements over data and its interpretation have been at the center of the ACF water dispute and were a major factor in the failure of the tri-state compact. Coordination and cooperation here is critical for establishing a water allocation scheme for the basin, and existing state and federal systems in ACF states can offer guidance for how this task can be approached at a basin-wide scale. Technical support is being provided by NWFWMD to state officials and agencies in their “efforts to engage federal agencies and adjoining states to address interstate water resource management needs within the Apalachicola-Chattahoochee-Flint (ACF) rivers basin.” Georgia has similar systems in place to coordinate data gathering and dissemination efforts between regional water councils and state natural resource agencies. For a more detailed discussion of existing and potential coordinated data gathering and dissemination activities in the ACF Basin see the preceding section on “Data Acquisition, Coordination and Dissemination”.

II.C.1.b.iii. Coordinated Policy-making and Regulatory Review
Policies and regulations will, to some extent, require coordination for true basin-wide planning. Florida and Georgia have both worked towards coordinating their regulatory activities at different geographic and development scales which is encouraging for the prospect of expanding this activity to a basin-approach. In Florida, permits required for all activities that modify surface water flows, including upland land-disturbance and wetland infilling, have recently been consolidated into one Environmental Resource
Permit (ERP) Program. This coordinated regulatory review process allows one general ERP to be issued in lieu of many individual environmental use permits. The NWFWMD submits all statutorily mandated reports\(^9\) to the FL DEP and state legislature as one Consolidated Annual Report\(^9\). Florida WMDs and DEP are collaborating on an “intensive effort to improve the statewide consistency of consumptive water use permitting”, with the aim of “making programs more predictable, ensuring equitable treatment statewide, providing consistent environmental protection, promoting streamlining and efficiency, and incentivizing behavior that protects water resources”\(^9\). Another effort towards policy and regulatory coordination is found in Georgia’s regional water plans. The plans do not establish regulatory requirements per se, but GAEPD permitting decisions on water withdrawals and discharges must be guided by recommended management practices in the plans; if an entity seeking a permit has not implemented management practices GAEPD could, in theory, deny or place conditions on the permit.

II.C.2. Gaps

Some coordination of water management and planning are occurring in the ACF Basin, but most of these occur either across county and city boundaries in individual states or among federal agencies or other actors. Coordination among the three ACF states is mostly encompassed through the activities of ACFS.

In 2011 the GAEPD adopted all ten regional water plans submitted by the Regional Water Councils; these plans are currently in varying stages of implementation. A variety of challenges have faced actors responsible for implementation of the plans. In 2011 and 2012, GA legislators did not appropriate any states funds to continue Regional Water Council planning and implementation activities. Without adequate funding for the councils, activities to promote local implementation of regional water plans are left to Regional Commissions, RC&D Councils, and other existing natural resource organizations. Slowed economic growth combined with decreased pressure from droughts, may be correlated with setbacks to local implementation of the plans.

Minimum Flows and Levels (MFLs) have not yet been developed and implemented for the Apalachicola and Chipola portions of the NWFWMD’s jurisdiction. There is a plan to assess and adopt MFLs on a strategic basis, beginning with high priority watersheds, with the timeline for adoption starting in 2018 and extending beyond 2026. In the meantime a general regulation reserving instream flows for aquatic health governs; it is set to expire in 2016. Funding to develop and implement Regional Water Supply Plans has been budgeted only for coastal regions of the Apalachicola Basin,\(^9\) thereby excluding much of the upper basin from the water supply planning process.
Water use by power generating facilities has become a much-discussed topic in recent years, and many researchers and policy experts have advocated for expanded utilization of alternative energy sources and equipping new and existing plants with water-efficient technologies. Currently in the ACF, there is no formal collaboration mechanism for addressing these suggestions on a basin-wide scale.

II.C.3. Opportunities for a TWMI

There are numerous opportunities for a TWMI to promote coordination and collaboration and build consensus at a basin-wide scale. A TWMI could facilitate the communication and sharing of information, which may serve as the basis for developing a unified vision for the ACF Basin. With a unified voice, state and local interests may more effectively and proactively participate in federal decisions.

For example, a TWMI could coordinate input from and potentially promote consensus among major water users regarding federal actions such as updates to USACE water control manuals. A TWMI could play some official or unofficial consulting role in the development of these updates.

In the event research shows that commercial navigation within certain windows could once again be a viable use in the ACF, a TWMI could work with existing organizations to bring together relevant stakeholders, including recreation, conservation and commercial navigation interests, to determine what actions are needed to promote this use and develop a coordinated strategy to accomplish these activities.

A TWMI could provide a forum for the landowners and agencies involved in restoration in the ACF Basin to share information. This would allow the various groups working in the basin to apprise themselves of the larger restoration picture in order to seek more collaboration. The TWMI could exercise even more authority by bringing together the appropriate federal and state agencies and nongovernmental groups to develop a comprehensive restoration plan for the Basin that would inform the decision making process for the Corps, FWS, and EPA.

Another area where a TWMI could augment coordination and collaboration is water-efficient power generation. It could provide a platform for diverse water users in the basin, by engaging and informing these groups, the TWMI could promote the use of more water-efficient power technologies. There are several research programs already in existence which could spur dialogue and action here (examples include the U.S. Department of Energy’s Water Power Program which focuses on hydropower technology development) and initiatives of the Electric Power Research Institute (which include RD&D projects for nearly every area of electricity generation, delivery, and use)).
Indeed, some facilities in the basin have already retrofitted with water-efficient technologies (Plant Yate’s addition of cooling towers in 2007 cut its water withdrawals by 93%), so a collaborative effort across the basin may prompt similar endeavors.

As noted, entities within the ACF states have collaborated on several water-based recreation projects. A TWMI could help facilitate more of these collaborations or it could play a more limited role in publicizing and promoting these efforts via its website, a mention in presentations, and through written literature.

A TWMI could be granted authority to develop, implement, and enforce a basin management plan; this would require either parallel legislation passed at the state level or an interstate compact. The possibilities for improved interstate coordination and collaboration are extensive.

The SRBC and DRBC have the authority, gained via a federal-interstate compact, to develop, implement, and enforce basin management plans. An interstate compact provides the ICPRB with authority to create basin management plans, but parallel legislation passed at state level is required for implementation. Similarly, the Great Lakes Commission is provided with the authority to promulgate basin management plans and legislative priorities, but specific implementation requires state actions. While the Gulf of Mexico Alliance does not have formal planning authority, the Governor’s Action Plans, created by extensive collaboration among basin stakeholders, are currently being implemented at state and local levels.

And very importantly, a TWMI could encourage and participate in the identification, discussion, and resolution of conflicts within the basin. The Susquehanna River Basin Commission and the Delaware River Basin Commission serve as administrative forums to resolve interstate disputes over water allocation and infrastructure projects, in lieu of costly court cases. The DRBC has successfully resolved interstate water conflicts since its creation in 1961, preventing the need for Supreme Court amendments to the 1954 equitable apportionment. For example, the DRBC facilitated good faith negotiations between basin states in 1984 that lead to an agreement for reducing water diversions and downstream releases during droughts.

Coordination, promoting collaboration and consensus, and resolving conflicts can be performed by a TWMI with or without a formal grant of authority. Many successful transboundary river basin organizations found nationally and globally have an impartial technical staff, which gather, analyze, and disseminate data in a coordinated fashion and bring together diverse interests to reach consensus on specific goals and issues. The ACFS are filling this role now unofficially as they develop a sustainable water management plan and investigate opportunities for transboundary operations. This role could be
institutionalized through a formal grant of authority (perhaps from Congress, ACF states, and/or USACE) and budget appropriations. Alternatively, such an organization could be granted a formal role to advise federal decisions through the Federal Advisory Committee Act.

The Great Lakes Commission and Interstate Commission on the Potomac River Basin are examples of TWMI organizations lacking regulatory authority, which instead focus on coordination and building collaboration. For example, The ICPRB, in collaboration with The Nature Conservancy and the US Army Corps of Engineers, is developing a consensus-based set of environmental flow recommendations. These flow recommendations are to be implemented by state and local jurisdictions. In addition to facilitating a consensus-driven process, ICPRB has developed guidance for jurisdictions implementing environmental flow recommendations.

II. D. REGULATORY COORDINATION AND REVIEW

II.D.1. Current Situation

Regulatory standards related to water are developed and enforced by a wide range of governmental entities in the ACF Basin. Regulations exist for many water uses; these are developed and applied within political instead of natural borders and vary significantly throughout the basin. This wide variation can, at times, promote feelings of inequity when similar water users are held to different standards or feel as though standards in other jurisdictions do not adequately protect their interests. Regulatory programs are discussed below according to common themes: water quality, species and habitat, federal environmental review, water allocation, water conservation, navigation, flood control, land use, and flow augmentation and aquifer storage and recovery.

II.D.1.a. Water Quality

The federal Clean Water Act (CWA) is the primary water quality law in the U.S.; it regulates most pollution sources, with some key exemptions. The CWA requires states to establish water pollution control programs to enforce many minimum standards in the Act and accompanying regulations. Region 4 of the Environmental Protection Agency (EPA) provides oversight for ACF states for these programs.

The CWA requires states to develop water quality standards (WQS) and total maximum daily loads (TMDL). WQS are comprised of designated uses that classify water bodies, narrative or numeric water quality criteria that must be met for each use, and an anti-degradation policy that protects existing uses. TMDL are established when a water body cannot support its designated use because it does not meet water quality criteria.
The CWA requires states to develop a list of these water bodies and must calculate for each the maximum amount of the problematic pollutant the water body can receive and meet WQS.\textsuperscript{100} The TMDL is used as a road map for identifying and mitigating pollutant sources so the water body can support its designated use.

The CWA National Pollutant Discharge Elimination System (NPDES) program\textsuperscript{101} requires permits for point source discharges into waters of the United States.\textsuperscript{102} Point sources are discrete conveyances such as pipes or man-made ditches; facilities that need permits include industrial and municipal wastewater dischargers and concentrated animal feeding operations (CAFO). Power facilities that discharge used cooling water must also obtain NPDES permits as temperature is regulated as a pollutant under the CWA. Permits must be designed to comply with WQS and may be impacted by TMDL. The NPDES program also requires permits for stormwater discharges from large and medium communities through the Municipal Separate Storm Sewer System (MS4) program; it requires communities to develop a stormwater management plan with a number of required elements.\textsuperscript{103} States may not issue NPDES permits that would result in violation of a downstream state’s WQS.\textsuperscript{104}

The CWA primarily regulates point source pollution, but the biggest threat to U.S. water quality is nonpoint source (NPS) pollution. NPS pollution stems from many discrete sources and generally enters waters via stormwater runoff. Sources of NPS pollution include urban areas, construction sites, agriculture and forestry operations, septic systems, and other sources. Many activities that contribute to NPS pollution, including agriculture (except for CAFO) and silviculture, are exempt from the CWA. States generally maintain these exemptions in their laws.

In the ACF, the Alabama Department of Environmental Management (ADEM), Georgia Environmental Protection Division (GAEPD), and Northwest Florida Water Management District (NWFWMOD) issue NPDES permits for facility discharges. ADEM and GAEPD also issue MS4 permits; in Florida this duty resides with the Florida Department of Environmental Protection (FDEP). As part of the NPDES permitting process, Georgia requires watershed monitoring plans, assessments, and protection plans from some facilities. Florida requires a Basin Management Action Plan (BMAP) for implementing some TMDLs; development of the BMAP involves collaboration among local stakeholders, FDEP staff, and others.\textsuperscript{105} When a BMAP includes agricultural sources of pollution, FDEP requires agricultural producers to either implement state-defined Best Management Practices (BMPs) or to monitor to prove they are meeting WQS.\textsuperscript{106} In Alabama and Georgia, general agricultural BMPs are voluntary, though the states encourage their use by providing technical assistance and cost-share or other funding through grants and loans.\textsuperscript{107}
The CWA also regulates water pollution through Section 404; it requires a permit for the discharge of dredge or fill material into waters of the U.S.,\(^\text{108}\) which includes piping streams and filling wetlands. This program is administered by the Mobile and Savannah Districts of the USACE in the ACF; they require permits for impacts to streams and wetlands and mitigation for unavoidable impacts.\(^\text{109}\) Section 404 includes several key exemptions, mostly for agriculture and forestry activities such as development of farm ponds and logging roads.\(^\text{110}\) EPA has the power to veto or restrict 404 permits resulting in unacceptable adverse effects and authority to prohibit or restrict use of sites for discharges even if no permit is pending.\(^\text{111}\) States also have some oversight; under CWA § 401 they can veto or impose conditions on permits or licenses to protect water quality or habitat.\(^\text{112}\) The U.S. Supreme Court has held that states can require maintenance of minimum flows under § 401.\(^\text{113}\)

Florida and Georgia have additional water quality controls in place. FDEM and the state’s five water management districts oversee the Environmental Resource Permit Program, which regulates activities involving the alteration of surface flows.\(^\text{114}\) Activities covered include upland construction that generates stormwater runoff and dredging and filling of wetlands and other surface waters. Water management districts also implement permit programs that cover many agriculture and forestry activities exempt under the CWA, including construction of many farm ponds.\(^\text{115}\) In Georgia, communities must adopt and enforce some protection requirements for water supply watersheds, groundwater, wetlands, and protected rivers (see Land Use, below). Georgia also has special requirements in place in the North Metro Georgia Water Planning District (NMGWPD). Created by the state legislature in 2001, the NMGWPD is charged with establishing policy, creating plans, and promoting intergovernmental coordination for water issues in the 15 counties and 92 cities in the metro Atlanta region.\(^\text{116}\) To this end, the NMGWPD creates plans for stormwater, wastewater, water supply, and conservation.\(^\text{117}\) Local governments are responsible for implementing regulations and other measures identified in the plans; those that fail to do so are ineligible for state grants and loans and risk GAEPD denial of permit requests.\(^\text{118}\)

II.D.1.b. Imperiled Species and Habitat

The Endangered Species Act (ESA) is the primary federal mechanism for protecting endangered and threatened species and their habitat.\(^\text{119}\) It prohibits “taking” (i.e., killing or harming) listed species without a permit,\(^\text{120}\) and requires a consultation with federal wildlife agencies for all actions carried out, funded, or authorized by a federal agency that might jeopardize listed species or adversely modify critical habitat.\(^\text{121}\) In the ACF, there are four ESA-listed species (three mussels and the Gulf sturgeon), and federal actions that require consultation include the operation of the five major dams in the basin, which have thus far been approved with conditions. The ESA also requires Recovery Plans for listed species. The Recovery Plans for mussels and Gulf sturgeon recommend, respectively,
incorporation of conservation approaches into ACF water allocation and development of a regulatory and/or incentive framework to ensure protection of habitat, streamflow, and groundwater in-flows.

The ESA provides for Incidental Take Permits (ITP), issued for otherwise lawful activities that could incidentally take listed species. USACE had to obtain an ITP for listed ACF mussels in 2012 in order to reduce its releases from Woodruff Dam from 5,000cfs to 4,500cfs. A Habitat Conservation Plan (HCP), which minimizes and mitigates harm to the species caused by a specific activity, is required for an ITP. Mitigation measures identified in an HCP are enforceable under federal law. Individual ITP can be expensive and time-consuming to obtain, so in some places multiple jurisdictions and/or user groups whose activities might require an ITP cooperate to develop an HCP that establishes requirements for a wide variety of impacts. One commentator has noted that an HCP could provide the framework for a basin-centric water allocation plan for the ACF, as it is “one of the few legal instruments available to establish and enforce, as a matter of federal law, a basin-wide water management plan that could potentially ensure adequate water supplies for upstream interests, while also providing sufficient water for the recovery of listed species.” The USFWS is currently funding an investigation into the feasibility of an aquatic HCP in the basin.

II.D.1.c. Federal Environmental Review

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of and reasonable alternatives to their proposed actions. The NEPA process consists of three levels of review. The first determines whether an agency action meets criteria showing that it has no significant environmental impact. If so, the action receives a Categorical Exclusion and the NEPA analysis stops. If an action does not receive a Categorical Exclusion, the agency prepares an Environmental Assessment (EA) to determine whether the action would significantly affect the environment. If the EA shows that the action may have a significant environmental impact, an Environmental Impact Statement (EIS) is prepared. The EIS is a detailed evaluation of the proposed action and alternatives, and is supposed to guide the agency’s decision making process. NEPA compliance was at the center of one of the early ACF lawsuits, and will continue to be a factor in updates to the USACE Water Control Manual and other federal plans and activities.

II.D.1.d. Water Allocation

Water allocation within the ACF Basin is at the center of the tri-state water dispute. Much of the controversy revolves around USACE allocation of Lake Lanier storage for municipal water supply and releases from other dams for protection of listed species, but state water allocation regulations are also highly relevant.
USACE authorization to manage federal dams and reservoirs stems from individual reservoir authorization acts and the Water Supply Act of 1958. USACE water supply allocation and releases are managed via a basin-wide Water Control Manual (WCM) and individual reservoir water control plans. Pursuant to a court order from the last decision in the tri-state water dispute litigation, USACE is currently updating both the WCM and water control plans for the ACF. The manual and plans will, among other things, respond to Atlanta’s requests for additional water supply and establish flow release schedules for dams in the basin, both during “normal” periods and during drought. USACE released the Scoping Report for the WCM in March of 2013 and the updated WCM should be released in 2015 or 2016. Until the WCM is released, reservoir operations are conducted according to the USACE Revised Interim Operating Plan (RIOP). Pursuant to the RIOP, reservoir releases occur according to “Action Zones,” which basically describe different reservoir levels, from normal to drought, and which kinds of releases are allowed in each. The RIOP also specifies maximum “ramp down rates” (the vertical drop in river height, expressed in feet per day), which are designed to protect mussels and other species from stranding and encourage tree colonization of river banks by keeping them from drying out too fast. Different ramp down rates apply for flows in different ranges. In order to accomplish these ramp down rates, USACE augments reservoir storage; this prevents the rapid rise and subsequent rapid fall of river levels.

Despite the major presence of USACE in the basin, federal policy maintains that developing water supply is primarily a state and local function. At the state level, water allocation frameworks are generally comprised of minimum instream flows, withdrawal regulations, and plans for future water use.

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Alabama currently has no regulatory framework for instream flows, water withdrawals, or future water use. Minimum flows exist for some river segments through negotiated requirements for large scale utility projects, but no statewide policy exists. Withdrawals are managed (not regulated, per se) through the Alabama Water Use Reporting System. Entities with capacity to withdraw more than 100,000 gallons per day (gpd) and all public water systems must obtain a Certificate of Use (COU) from ADEM, which requires that the applicant certify that the proposed use will not interfere with an existing legal use and is reasonable and beneficial. Cumulative impacts of multiple withdrawals are not considered, but annual reporting is required. Alabama does not currently have a plan for
future water use, but Governor Bailey formed the Alabama Water Agencies Working Group in 2012 to address this need. The group recently submitted a report to the governor that recommends “a statewide water management action plan and timeline that takes into account and equitably manages the various demands of the State’s water.” The Alabama Drought Planning and Response Act, introduced in the 2014 legislative session, would, among other things, create the Alabama Drought Assessment and Planning Team and provide for development of a state drought plan. It is expected to pass during the 2014 session. Florida’s instream flow policy, water withdrawal permits, and Regional Water Supply Plans are all developed or issued by water management districts. Minimum instream flows are developed for individual water bodies, must prevent withdrawals that would significantly harm water resources or the ecology of the area, and, when appropriate, reflect seasonal variations. Withdrawal permits are divided into two categories: No Notice General Permits and Individual Permits. No Notice General Permits are generally issued for withdrawals with an average daily rate less than 100,000gpd that do not exceed specific thresholds of defined resource limited areas. Individual Permits are required for all other withdrawals. The NWFWMD prohibits withdrawals (except for those for cooling purposes and for alternative water supply for the City of Port St. Joe) from the Apalachicola and Chipola Rivers in order to protect fish and wildlife, floodplains, and Apalachicola Bay. Florida Regional Water Supply Plans are based on Water Supply Assessments conducted every five years; if the assessments show that a water supply planning region’s water supply needs will likely exceed available sources in the next twenty years the district must prepare a Regional Water Supply Plan that identifies alternatives for meeting supply needs.

The Georgia instream flow policy offers water withdrawal permit applicants three options: monthly 7Q10 minimum flows, a site-specific study, or seasonal minimum flows of 30-60-40% mean annual flow (regulated) or 30% mean annual flow (free-flowing). This interim policy, which will be updated when study results are available, is meant to maintain assimilative capacity necessary to protect aquatic biota. Georgia surface and groundwater withdrawals are regulated by GAEPD. Permits are required for surface water withdrawals and diversions of more than 100,000gpd and impoundments that reduce downstream water flow by more than 100,000gpd (all monthly averages). Farm ponds are exempted. Amendments to the Flint River Drought Protection Act, passed by the Georgia Legislature in March of 2014, provide that the EPD Director may require agricultural withdrawal permittees in the basin to achieve irrigation efficiencies of 60 or 80% as conditions of their permits.

A couple of major planning initiatives in Georgia deserve mention here because of their potential to impact water allocation. First is the Governor’s Water Supply Program, established by executive order in 2011 to “assist local governments with developing new sources of water supply adequate to meet future water demand forecasts.” The
program will provide $300 million over four years for supply projects such as reservoirs. The second major initiative is the Statewide Water Plan. Developed pursuant to the 2004 Comprehensive State-wide Water Management Planning Act, the plan established 10 water planning regions and their corresponding water planning councils. Each of the councils developed a regional water plan based on resource assessments and water demand forecasts that contained recommendations for water management practices to meet future needs. The regional plans are intended to guide GAEPD decisions concerning NPDES, consumptive use, and other permits.

II.D.1.e. Water Conservation

Alabama requires no water conservation measures beyond requiring applicants for a COU to report conservation practices or programs in their Declaration of Beneficial Use. ADEM does allow water reuse through the NPDES permitting program, and is in the process of developing its own reuse regulations and drought protection measures.144

Florida’s water management districts designate areas with critical water supply problems as Water Resource Caution Areas (WRCA). In a WRCA, all non-exempt withdrawals are subject to increased scrutiny during permitting, and permittees are subject to increased reporting requirements and must engage in conservation measures (including reuse of reclaimed wastewater) and improve efficiencies.145 The NWFWMD currently has two WRCAs. In certain situations, reuse can also be required outside of WRCA.146 Water management districts may also adopt mandatory lawn watering restrictions that can apply to all water sources, including wells. Local governments are encouraged to adopt ordinances enforcing these restrictions.

GAEPD has, in recent years, encouraged water reuse at wastewater treatment facilities, and set a 10% reuse goal for facilities in the MNGWP.147 The Flint River Basin Regional Water Development and Conservation Plan places limits on irrigation in areas of the basin where groundwater withdrawals have caused unsustainable impacts on the Floridan Aquifer. Irrigation conservation measures are a condition of farm permits issued after March 1, 2006.148 As noted above, a recent bill passed by the Georgia Legislature may also result in greater irrigation efficiencies in the Flint basin. Outdoor water use is governed by the Georgia Water Stewardship Act. During periods of non-drought, it restricts lawn irrigation to between the hours of 4pm and 10am and restricts other outdoor water use, such as washing cars, to a three day a week schedule. During drought, outdoor water use can be further restricted. Local governments may impose more stringent outdoor water use restrictions if they can demonstrate “good cause” through an approval process with GAEPD.149 The MNGWP has 19 water conservation measures in its Water Supply and Water Conservation Plan that local governments and utilities are required to implement, including implementing conservation pricing, requiring rain sensor shut-off switches in new irrigation systems, requiring sub-unit
meters in multi-family buildings, require car washes to recycle water, and establishing a water waste policy.\textsuperscript{150}

II.D.1.f. Navigation

Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. and requires approval from USACE for such activities.\textsuperscript{151} The CWA also plays a role in navigability, as some reaches require continued dredging to maintain navigability. In the Apalachicola River, FDEP § 401 certification of dredging activities has placed numerous conditions and prohibitions on the practice that make it largely impractical. To maintain navigability, USACE has employed “Navigation Windows,” which are scheduled dam releases that provide flows needed for commercial navigation.\textsuperscript{152} These releases are governed by the ACF WCM and water control plans.

II.D.1.g. Flood Control

Two major entities are involved in flood control in the ACF Basin; they address both stormwater storage and community planning. USACE is the primary agent responsible for stormwater storage. USACE manages Lake Sidney Lanier, West Point Lake, Walter F. George Lake, and Lake Seminole for flood control by permanently reserving a portion of the lakes’ capacity for stormwater capture. This portion is allowed to fill only in the instance of large storms. After storm events, the stored stormwater is released slowly over time in order to prevent downstream flooding. The release, in turn, makes the reserved capacity available as storage for future storms.\textsuperscript{153} USACE’s maintenance of a large flood pool results in lower insurance premiums for the agency.

Floodplain management is an additional form of flood control. The Federal Emergency Management Administration (FEMA) oversees creating floodplain management regulations. Although each community is individually responsible for developing floodplain management measures, these regulations must meet or exceed certain minimum requirements before a community can be insured by FEMA. The National Flood Insurance Program (NFIP) designates various zones and creates a Flood Insurance Rate Map (FIRM) which allows a community to determine base flood elevations, flood zones, and floodplain boundaries for planning and zoning purposes.\textsuperscript{154} The NFIP requires permits for all new developments and redevelopments in flood-prone areas in order to be insured.\textsuperscript{155} Communities which adopt more stringent flood protection requirements may be eligible for reduced flood insurance rates.

II.D.1.h. Land Use

Land use decisions in the ACF are primarily a local function, though communities in Georgia and Florida have more authority and guidance than in Alabama. In Alabama, the
only non-Home Rule state in the southeast, only land use is largely unregulated. There, only municipalities are authorized, but not required, to create a planning commission and comprehensive zoning ordinances; an Act of the Alabama legislature is required for creation of county planning commissions and zoning ordinances (zoning ordinances are, however, authorized by state law for county flood prone areas). Counties and municipalities may also apply to the governor to create a regional planning commission for two or more communities.

Florida land use decisions are made by local governments under the Community Planning Act (CPA). The CPA requires local governments to adopt comprehensive plans, and prohibits permitting of public or private development except in conformance with such plans. These plans are intended to implement policy directives of the State Comprehensive Plan, which includes goals for water use and natural resource protection. They must also be coordinated with water management district regional water supply plans. Regional Planning Councils such as the Apalachicola Regional Planning Council in the ACF develop Strategic Regional Policy Plans and assess local plans for compatibility with water management district water supply plans.

Georgia land use plans and regulations are developed at the local level under the auspices of the Georgia Planning Act of 1989. It requires counties and municipalities to adopt comprehensive plans, including “Environmental Planning Criteria,” minimum planning measures to protect wetlands, water supply watersheds, groundwater recharge areas, protected rivers, and protected mountains. One notable requirement here is the limitation on impervious surfaces in small water supply watersheds. Regional Commissions also prepare a Regional Resource Plan which identifies natural and historic “Regionally Important Resources” and recommends best practices for their protection, most of which involve land use strategies. There are six Regional Commissions located in the ACF, all of which identify water resources as regionally important.

II.D.1.i. Flow Augmentations and Aquifer Storage and Recovery

Flow augmentation is used to supplement the flow of a stream with other surface or groundwater resources during low flows, either for the benefit of water users or aquatic species. Aquifer storage and recovery (ASR) is the recharging of an aquifer through injection of treated water into an underground injection well. Regulatory standards specific to flow augmentation do not exist in any ACF state, though Georgia is currently engaging in an experimental augmentation project in Spring Creek in the basin to supplement flows to protect mussel populations.

ASR is regulated at the federal level via the Safe Drinking Water Act as a Class V injection well, which are used to inject non-hazardous fluids underground. States with certified programs can hold responsibility for Class V wells; in the ACF, Georgia and
Alabama have full responsibility and in Florida shares responsibility with EPA. ASR is common in Florida, but is used primarily in the southern portion of the state; the NWFWMD has greater water supplies than other water management districts and has not relied on ASR. Georgia’s only experience with ASR is a demonstration project in the development stages in Baker County in the ACF. Amendments to the Flint River Drought Protection Act, mentioned above, provide regulatory authority for Georgia EPD to engage in ASR projects in specific areas of the Flint Basin “for the sole purpose of maintaining the minimum stream flows sufficient to protect habitat critical for vulnerable aquatic life within the affected areas.”

II.D.2. Gaps

With some exceptions, regulatory functions performed by governmental entities in the ACF Basin cover most water-related activities. Coverage does not, however, guarantee that this function is sustainably supporting the various interests in the basin. For example, a major gap is in research and data needed to inform regulatory regimes. Many regulatory standards, such as instream flow requirements, are based on available information rather than comprehensive data and modeling. This gap is analyzed in detail in another section of this analysis.

Another significant gap is standards based on data and models that, while extensive and well-researched, are geographically or politically limited. Some standards, such as consumptive use permits and conservation requirements, often seek to ensure supply for local needs rather than considering impacts from and to other parts of the basin. Regulations may need to be crafted and/or administered from a basin-wide approach to support all interests in the ACF. This gap has many connections to the research and data gap noted above, as new data gathering, models, and other investigations will be needed to ensure regulations address basin-wide impacts. In other instances, ensuring that regulations reflect a basin-approach may have less to do with data and research and more with providing a voice to basin-wide interests when standards are being crafted or permitting or other decisions are being made. Many ACF stakeholders are impacted by this gap. First, interest groups can be negatively impacted by the effects of regulations that do not take extraterritorial impacts into consideration. This is particularly true for downstream interest groups. Second, the lack of a basin-centric regulatory regime means that all interest groups are operating under a level of uncertainty that can impede long-term planning and appropriate resource management, and may result in speculative water supply projects.

In many cases, there are specific regulatory gaps in federal, state, and local regulatory programs. These will be discussed according to the regulatory areas detailed above. New
or amended regulations may not necessarily be required to address all of these gaps, but they should be considered as a possible approach.

II.D.2.a. Water Quality

There are several potential gaps in water quality regulation in the ACF. First, nonpoint source pollution is largely unregulated. When the CWA was enacted, point source discharges represented the largest impact to water quality, but today the vast majority of water pollution comes from nonpoint sources such as urban runoff, sediment runoff from construction, and agricultural fertilizers and pesticides. Some nonpoint sources, such as construction sites, are regulated, but their diffuse nature makes enforcement of standards difficult, especially with current constrained state and local budgets. Others, such as urban runoff, are also covered by regulation, but standards are somewhat general and provide communities with a lot of leeway in how they craft and implement their programs. Some nonpoint sources are generally unregulated. Agriculture and forestry activities are the most notable, and are granted many exemptions in the CWA and state laws. Incentive and educational programs have made some headway in addressing these activities, but regulatory standards – such as those in use in Florida and some other states – should be considered if enhanced non-regulatory programs do not result in pollutant reductions, particularly because agriculture and forestry are the predominant land uses in the ACF Basin. Gaps in nonpoint source pollution regulation should be of importance to many ACFS interest groups. Nonpoint source pollution can degrade drinking and recreational waters, making treatment more expensive and/or limiting the use of waterbodies for fishing or swimming. If nonpoint source pollution degrades waters that entities such as wastewater treatment plants or industrial facilities use for discharge, NPDES permit standards may be tightened; this can be expensive and is currently somewhat unpredictable. Agricultural interests are a source of many nonpoint source pollutants, and though they may currently enjoy exemption from many requirements, increasing problems and calls for regulation suggest that it will behoove these interest groups to engage in future regulatory planning processes. The seafood industry is also impacted by this gap, as sediment and other nonpoint source pollutants can greatly impact commercial seafood species in the Apalachicola River and Bay. Finally, local governments should be interested in this gap because they may be responsible for developing nonpoint source programs under the NPDES MS4 program.

A second potential gap involves state TMDL programs. States are required to develop impaired waters lists for both streams/rivers and lakes/ponds/reservoirs, but do not assess all waters. In the ACF, states do a better job of assessing lakes/ponds/reservoirs (Alabama: ~88%; Florida: ~54%; Georgia: ~82%) than they do for streams/rivers (Alabama: ~14%; Florida: ~20%; Georgia: ~20%). In order to measure the impact of the TMDL program, assessments of streams and rivers should increase. If regulatory gaps for nonpoint sources were addressed in the ACF, assessments such as those conducted for the
TMDL program would almost certainly increase, as determining which waters are
degraded and the sources of pollution are integral components of a regulatory regime
here.

A third gap involves protection of headwater streams and isolated wetlands. A series of
U.S. Supreme Court cases between 2001 and 2006 have limited federal protection for some
streams and wetlands because they lack an obvious connection to navigable waters. This
is important in the ACF, where the headwaters are the smallest drainage area providing
water supply for any metropolitan area in the nation and wetland systems – particularly
in the lower reaches of the basin – provide critical services such as groundwater recharge,
habitat, and filtration of pollutants. Because of the services these natural resources
provide, this gap could have significant impacts to water supply and water quality
throughout the ACF Basin. This could impact all interest groups, but these effects are
likely unappreciated. In early 2014 EPA announced release of a new rule clarifying
federal protection of some wetlands and streams, but it has yet to go through a public
comment period and as such its final language and impact, if adopted, are unpredictable.

II.D.2.b. Imperiled Species and Habitat

Some interest groups (particularly environmental/conservation and seafood industry)
argue that the water supply management framework in the ACF does not currently
provide sufficient flows for species in the Apalachicola River and Bay. Research and
modeling is likely needed to determine a suitable management plan, and a potential
method for both gathering the necessary information and forming a legally enforceable
plan is development of an HCP. Feasibility of an aquatic HCP is currently being
investigated by stakeholders in the ACF, facilitated by the Georgia Water Planning and
Policy Center at Albany State University with funding from the USFWS and Georgia
Department of Natural Resources.

II.D.2.c. Federal Environmental Review

A primary gap in the NEPA process is – as is the case in many other regulatory regimes –
the absence of a voice that represents the cooperative input of all ACF interest groups.
Having a representative body of interests in the ACF to help inform the NEPA process
could make this balancing act required by the law easier for federal officials and result in
a more satisfactory outcome for water users. This gap echoes the overarching gap of no
basin-centric regulatory regime, and can impact all interests in a similar fashion: the
current NEPA approach may not take extraterritorial interests or impacts into
consideration and may cause a level of uncertainty regarding the outcome of NEPA
decision making.
II.D.2.d. Water Allocation

Water allocation is at the heart of the tri-state water dispute, and absence of a regulatory regime that equitably apportions the water resources of the ACF is the largest regulatory gap in the basin. The regulatory structure for water allocation consists of a wide variety of laws covering many activities, from USACE dam releases to instream flow requirements to consumptive use permits, and coordinating programs to support basin-centric management will require much planning, research, and compromise. A pivotal regulatory coordination need here is the harmonization of minimum flow standards. Defining ecological flows was one of the issues that foiled success of the first ACF compact, so it seems unlikely that a water allocation scheme could succeed without agreement on this issue. Aside from the need for a coordinated regulatory structure for the basin, there are specific gaps that deserve mention here. In Alabama, there are a number of specific gaps, including the lack of regulatory programs or standards for instream flows and consumptive use. The state lacks a comprehensive statewide water management plan. Florida currently has the most watershed and resource-centric regulatory program for allocation in the basin; as the farthest downstream state its regulations and policies for water allocation have the least impact on the basin as a whole. Georgia and Alabama might look closely at the programs of FDEP and the NWFWMD as potential models in addressing regulatory gaps in a way that is beneficial to all interests. Over-allocation in the Flint must be addressed to assure sustainability. Georgia is in the process of conducting ecological research in order to revisit its instream flow policy; it should also consider conducting research to determine the impact of farm ponds and agricultural groundwater withdrawals on the hydrology of the basin, as this research may indicate that a regulatory response is justified.

II.D.2.e. Water Conservation

Alabama’s regulatory frameworks do not provide for aggressive water conservation. Farmers in all three states may be more amenable to adopting water conservation practices on their land (especially those that can increase yields while saving money), if provided financial and technical resources for implementation. More aggressive assistance programs will likely be required here, either coupled with regulation or via a heightened incentive program for voluntary conservation measures.

II.D.2.f. Navigation

Navigation is an area that requires more research; if these efforts show that seasonal navigational windows can be scheduled in a manner that benefits downstream ecosystems and species, USACE may consider revising its releases to maximize these benefits.
II.D.2.g. Flood Control

Some interest groups, particularly those in metro Atlanta, contest the USACE’s operation of Lake Lanier’s flood and conservation pools. The practice they point to is the release of water from the conservation pool in order to augment the reservoir’s flood storage capacity. Keeping flood storage capacity at its current level assures lower insurance prices, but interest groups maintain that the money saved is far less than the costs to businesses, municipalities, and other water users from the loss of conservation pool storage during times of drought.

The federal Watershed and Flood Prevention Operations (WFPO) Program is authorized by the Flood Control Act of 1944 and the Watershed Protection and Flood Prevention Act of 1954. This program facilitates cooperation between local and state governments and the federal government in order to manage floodwaters in addition to other water quality improvements throughout the watershed. These projects are locally led and are initiated only once a local entity requests funding and technical assistance for a watershed project through the Natural Resources Conservation Service. It appears that this program is currently not in use in the ACF Basin, however, both Alabama and Florida have previously taken advantage of it. Additionally, there is no coherent flood warning/management program for the watershed.

II.D.2.h. Land Use

Land use changes can have a significant impact on water use and watershed hydrology. The primary regulators of land use in the ACF are local governments, but city and county planning efforts generally focus on impacts within their borders. If downstream impacts are considered, they usually only extend into neighboring communities. Because land use changes can have such extensive impacts, a more basin-centric approach to planning and developmental approvals may be warranted in the ACF. One change that has been encouraged by state and federal agencies in recent years is greater reliance on low impact development (LID) strategies, which seek to reduce the footprint of development while conserving important natural resources and using natural stormwater infiltration techniques. LID strategies have been used in the ACF, but not to the extent where they can provide measurable benefits. Regulatory or incentive based strategies may be needed to further encourage their use. Land use is a wide-ranging activity and can impact all interest groups in the basin. It is, however, an area where filling gaps to support one interest can provide ancillary benefits to others. LID strategies, for example, focus on natural infiltration techniques and land conservation, but are also used (often in combination with New Urbanist practices) to combat the ills of urban sprawl, which has been a major contributor to the deterioration of traditional city centers and the historic and cultural values they support. If land use regulation gaps were in part filled by encouraging or requiring LID, historic and cultural interests could benefit.
II.D.2.i. Flow Augmentations and Aquifer Storage and Recovery

Flow augmentations such as the Spring Creek project are currently largely unregulated and somewhat controversial. Regulatory criteria for their development may be necessary to ensure environmental protection and generate consensus on their use. ASR is covered by federal standards under underground injection control programs, but some Georgia commentators fear the potential for water quality impacts and call for stricter regulatory criteria.

II.D.3. Opportunities for a TWMI

There are many ways a TWMI could help fill the gaps through some form of regulatory role in the ACF Basin. Some of the most critical, such as collecting and disseminating data and engaging in research necessary to inform sustainable management regimes, are discussed in other sections of this analysis. Described more fully here are two general categories of regulatory opportunities: standard development and permit review. These opportunities are not mutually exclusive; it is possible – perhaps probable – that a TWMI involved in standard development would also engage in some form of permit review.

II.D.3.a. Standard Development Opportunities for a TWMI

TWMI involvement in standard development could take several forms. The first is through data and research functions discussed in the Data Acquisition, Coordination, and Dissemination and Education and Outreach sections of this analysis, respectively. A second form of standard development would be to facilitate regulatory coordination among the states. Currently, states develop their own regulatory programs and standards with little to no basin-wide coordination beyond what may be required by some federal laws. Instream flow requirements, for example, are based on different standards in Florida and Georgia and are nonexistent in Alabama. A TWMI recognized as a trusted entity representative of all basin interest groups could, through a formal role as standard coordination facilitator, bring state regulators together in a cooperative process that has so far been lacking in the ACF. A trusted TWMI could also facilitate regulatory coordination among ACF states and federal agencies. When developing or revising regulatory programs or standards, agencies such as USACE, USFWS, and EPA currently receive comments and requests from state agencies and interest groups that often conflict. Balancing these interests is a monumental task, and some inevitably feel as though they have been short-shifted. Using a TWMI to formally facilitate communication between ACF states and agencies during these regulatory processes could result in federal programs and regulations that more accurately balance basin interests. Even without a formal role, a TWMI could still comment on program and standard development; this could happen at both the state and federal agency level.
A final standard development role for a TWMI would be to actually develop regulatory standards and programs. These could be continual standards or only those that would come into play during times of drought. One method would be a basin compact or other agreement wherein the TWMI is tasked with developing standards and the states and federal agencies agree to adopt them if certain conditions are met. Another approach to TWMI standard development would be through a congressional grant of regulatory authority, which would likely occur only with state and federal agency support. A final technique would be to develop standards through an enforceable plan.

II.D.3.b. Permit Review Opportunities for a TWMI

The second regulatory role a TWMI could play is permit review. As with standard development, this function could be performed in several ways. First, a TWMI could develop standards that promote consideration of basin-wide impacts in the review of state or federal permits. This could be an informal role or a formal power granted by the states, agencies, or congress. A second approach would be for the TWMI to act as permit reviewer. The TWMI could actually approve or disapprove permit issuance, which would require an abdication of state and/or federal power, or provide a non-binding opinion concerning whether or not issuing the permit is warranted. In the latter situation, the process could operate much like DRI review by Georgia’s Regional Commissions. The TWMI could provide an opinion concerning the permit that the issuing agency would be required to consider, but actual permit issuance or denial would still be the responsibility of the agency. A third method of permit review adds the power to veto permits or other actions to TWMI authority. This power would likely be for enumerated permits, not permits generally, and could exist at all times or only during drought. Activities potentially included here could include state water withdrawals, state or federal drought management plans and/or operations, state, federal, or private water projects (including reservoirs), USACE Water Control Manual revisions and/or dam operations, and large scale land use changes such as DRI.

II.D.3.c. Flood Control Opportunities for a TWMI

As stated above, each community is responsible for developing their own flood control system, but many localities require only the minimum requirements of the NFIP in order to ensure they will qualify for flood insurance by FEMA. Community flood controls in combination with the USACE flood management of the reservoirs provide the flood protection currently found in the ACF Basin today. As the Basin moves towards higher levels of interstate cooperation, there may be a role for a transboundary institution to develop a basin-wide comprehensive flood management plan. The Watershed and Flood Preventions Program mentioned above may be a helpful resource in achieving that goal.

Other transboundary institutions have developed flood warning systems. An example of a successful transboundary flood program is the Susquehanna Flood Warning and
Forecast System. The system is run by the Susquehanna River Basin Commission (SRBC), spanning parts of New York, Pennsylvania, and Maryland. It works closely with USGS, the National Weather Service, and the Army Corps of Engineers to access and use the most current information regarding river conditions and potential flood risks. They provide flooding forecasts and administer warnings. Funding for the system is provided by the federal government through annual appropriations.\textsuperscript{176} A transboundary institution within the ACF could play a role similar to that of the SRBC.

II.D.3.d. Drought Management Opportunities for a TWMI

In addition to general drought planning and emergency preparedness functions (overviewed in previous sections), TWMI\textsc{s} may undertake regulatory measures to alleviate the severity of drought. For example, a low-flow allocation agreement mandates the ICPRB, USACE, and major water suppliers coordinate dam operations during droughts; an expansion of the ICPRB\textsc{'}s general regulatory authority. The Susquehanna River Basin Commission\textsc{'}s Low Flow Protection Policy protects instream flows during droughts through imposing passby flows and conservation release requirements. The Delaware River Basin Commission (DRBC) creates and implements drought operation plans, which include mandatory water use reductions. During extreme droughts the DRBC may declare a drought emergency, where they gain additional authority to require storage and releases from federal, state, and privately owned reservoirs.

Incentives, such as tax rebates and cost-share programs, are used to help alleviate the economic burden of transitioning to highly efficient technologies. Buyback programs temporarily or permanently purchase water rights, for demand reduction or reallocation. A variety of incentives and buyback programs have been implemented by TWMI\textsc{\textsc{s}} to reduce water demands, particularly among the agricultural sector. The Murray-Darling Basin Authority (MDBA), in Australia, has implemented some of the most extensive market-based mechanisms for re-allocating water in over-allocated basins. Approximately $3.2 billion has been committed by the Australian Government to purchase water for the environment thus far. Government funds are targeted at buying-back water entitlements from willing irrigators. Farmers submit bids electronically and are selected by the MDBA. A total of 1,141,642 average annual megalitres of water has been purchased at a prices ranging from $196-2276 per megalitre. The water recovery program has been highly successful to date, but has not yet met the lofty goal of a 2750 gigalitre reduction.
ENDNOTES


2 Ignatius, Amber. Big Water, Little Water: Identification of Small and Medium Sized Reservoirs in the Apalachicola-Chattahoochee-Flint River Basin with a Discussion of their Ecological and Hydrological Impacts. Florida State University, College of Social Sciences. https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxhY2ZyZWNlcnZvaXJzdGdOjM4NjM1NDRjMTQ2ZGNkNTA


4 GAEPD, Memo: 2012 Accounting of Interbasin Transfers in Georgia (May 2013).


8 Phone interview with Dan Tonsmeire


13 Found online at: http://water.usgs.gov/pubs/.


15 The main ACF-NAWQA website is: http://ga.water.usgs.gov/nawqa/. ACF-NAWQA publications can be found online at: http://ga.water.usgs.gov/nawqa/publications.html.


The Georgia WRI is housed at Georgia Tech: [http://www.gwri.gatech.edu](http://www.gwri.gatech.edu), the Alabama WRI is housed at Auburn University: [http://awrri.auburn.edu/index.php](http://awrri.auburn.edu/index.php), the Florida Water Resources Research Center is housed at the University of Florida: [http://awrri.auburn.edu/index.php](http://awrri.auburn.edu/index.php).


Data and online mapper found at: [http://www.fws.gov/wetlands/Data/index.html](http://www.fws.gov/wetlands/Data/index.html).

Found online at: [http://www.dep.state.fl.us/water/wetlands/index.htm](http://www.dep.state.fl.us/water/wetlands/index.htm).

Environmental Protection Agency. STORET. Available online at: [http://www.epa.gov/storet/](http://www.epa.gov/storet/).


The FL DEP further delegates permitting authority to regional water management districts; in the ACF Basin it’s the Northwest Florida Water Management District: [http://www.nwfwmd.state.fl.us](http://www.nwfwmd.state.fl.us).

These reports may be found online at: (GA) [http://www.gaepd.org/Documents/305b.html](http://www.gaepd.org/Documents/305b.html), (FL) [http://www.dep.state.fl.us/water/datacentral/data.htm](http://www.dep.state.fl.us/water/datacentral/data.htm), (AL) [http://adem.alabama.gov/programs/water/waterquality.html](http://adem.alabama.gov/programs/water/waterquality.html).

More information on DMRs and municipality compliance (GA) online at: [http://www.gaepd.org/Files_PDF/outreach/gsef/waterquality.pdf](http://www.gaepd.org/Files_PDF/outreach/gsef/waterquality.pdf) and industrial compliance (FL) online at: [http://www.dep.state.fl.us/water/stormwater/npdes/industrial6.htm](http://www.dep.state.fl.us/water/stormwater/npdes/industrial6.htm).

Hydrologic data: [http://www.nwfwmd.state.fl.us/pubdata/hydrologicdata.html](http://www.nwfwmd.state.fl.us/pubdata/hydrologicdata.html) and GIS data: [http://www.nwfwmd.state.fl.us/pubdata/GISdata.html](http://www.nwfwmd.state.fl.us/pubdata/GISdata.html).


Links to the Metropolitan North Georgia, Lower Flint-Ochlockonee, Upper Flint, and Middle Chattahoochee Regional Water Plans: [http://www.georgiawaterplanning.org](http://www.georgiawaterplanning.org)

Reports, summary statistics, and data found online at: [http://www.nespal.org/core%20research.html](http://www.nespal.org/core%20research.html).


Found online at: [http://sfyl.ifas.ufl.edu](http://sfyl.ifas.ufl.edu).


This data is available from the Tallahassee Weather Forecast Office: [http://www.srh.noaa.gov/tae/?n=hydrology](http://www.srh.noaa.gov/tae/?n=hydrology) and the Southeast River Forecast Center: [http://www.srh.noaa.gov/serc/](http://www.srh.noaa.gov/serc/).

The results of this case study are online at:

39 Id.

40 The NIDIS and drought portal for the ACF Basin ACF Basin are online at: http://www.drought.gov/drought/regional-programs/acfrb/acfrb-home.


42 From the “About us” webpage: https://www.flseagrant.org/about/.


44 Publications and data can be found online at: http://www.dep.state.fl.us/coastal/sites/apalachicola/.

45 More information online at: http://www.dep.state.fl.us/coastal/sites/apalachicola/science/.

46 More information online at: http://www.dep.state.fl.us/coastal/programs/gems.htm.

47 From Apalachicola GEMS overview, see note 38.

48 Links to databases found online at: http://ecos.fws.gov/ecos/home.action.

49 Database can be accessed online at: http://ecos.fws.gov/crithab/.

50 Database and mapper can be accessed online at: http://ecos.fws.gov/geofin/.

51 From “What is IPaC” webpage: http://ecos.fws.gov/ipac/.

52 Id.

53 From welcome page, found at: http://www.sefsc.noaa.gov.


55 http://southeastaquatics.net/sarps-programs/sifn/background-information/background-information

56 From webpage “Florida Ecological Restoration Inventory”:


58 Found online at: http://www.fna1.org.

59 Online at: http://data.labins.org/imf2/FREAC/FNAI.jsp?

60 Georgia Natural Areas: http://georgiawildlife.org/node/587.


62 Brian Easley interview with Hans Neuhauser and Chris Canalos.

63 Brian Easley interview with Hans Neuhauser and Chris Canalos. Temporary conservation covenants can also be placed on land currently being used for silviculture, agriculture or other nature-based purposes. For instance, Georgia’s Conservation Use Valuation Assessment Program (CUVA), provides for lower ad valorem taxation when a landowner enters into a ten-year conservation covenant. The number of CUVA properties in the Basin has not been documented.


Found online at: http://www.gnahrgis.org.


The charts we have compiled and posted at http://www.rivercenter.uga.edu begin to document these activities but are not exhaustive.


Uncertainties database online at: http://research.nwcouncil.org.


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Coordination with Other Agencies; Stakeholder Involvement; Draft Deadline").

88 See page 32 of the Georgia Comprehensive State-wide Water Management Plan, written by the GA Environmental Protection Division in 2008 and found online at:


89 See the Community Planning Act (especially West’s F.S.A. §163.3194).


92 Current and previous consolidated Annual Reports can be found online at:


93 See page 6 of “NWFWMD (2013). Consolidated Annual Report. Online at:


94 A detailed budget overview can be found in NWFWMD (2012), see note 90.


99 40 CFR 131 (see http://www.dep.state.fl.us/water/wqssp/docs/cfr131.pdf). Water body classifications denote the designated use of segments of specific water bodies, which can be fishing/swimming, drinking water, or some other category. WQS criteria are numeric or narrative standards specific to classifications. An anti-degradation policy protects existing instream uses and the water quality necessary to support them. 40 CFR 131.12(a)(1). States may develop WQS that are stricter than basic federal requirements. Clean Water Act § 510.


102 “Waters of the United States” is a legal term of art that has been the subject of several key law suits in recent years. It refers to navigable waters and waters with a relatively permanent surface water connection or “significant nexus” to navigable waters. Rapanos v. U.S., 54 U.S. 715 (2006).

103 MS4 permits require communities to develop a stormwater management plan that includes education and outreach, illicit discharge detection and elimination, construction site runoff control,
post-construction runoff control, and pollution prevention/good housekeeping. See GAEPD, Phase II MS4 Storm Water Management Program Preparation (Feb. 2013).


114 Fla. Stat., Chapter 373, Pt. IV.

115 Florida Admin. Code Chap. 40A-44; for information on farm ponds see http://www.nwfwmd.state.fl.us/permits/regdocs/farm_pond_brochure.pdf.

116 Metropolitan North Georgia Water Planning District – About Us, at http://www.northgeorgiawater.org/AboutUs/about-us.


125 http://www.epa.gov/compliance/basics/nepa.html


127 See http://www.sam.usace.army.mil/Missions/PlanningEnvironmental/ACFMasterWaterControlManu alUpdate.

133 http://www.al.com/opinion/index.ssf/2014/01/gov_bentley_should_release_wat.html
135 Robert Abruzo interview with Tom Littlepage, ADEM Office of Water Resources.
137 http://www.dep.state.fl.us/water/waterpolicy/rule.htm
139 http://www.nwfwmd.state.fl.us/rmd/water_supply_planning/regional_water_supply_planning.html
143 See http://gefa.georgia.gov/governors-water-supply-program
145 Rule 62-40.310(d), F.A.C.; and see http://www.nwfwmd.state.fl.us/rmd/wsa/intro.pdf
148 http://www1.gadnr.org/frbp/Assets/Documents/Plan22.pdf (irrigation conservation at 33-34)
149 http://www.GAEPD.org/Documents/outdoorwater.html
Flood Smart, Frequently Asked Questions:
http://www.floodsmart.gov/floodsmart/pages/faqs/what-is-a-flood-insurance-rate-map-and-how-do-i-use-it.jsp

For specific requirements involving floodplain management, see 44 CFR 60.3.

See http://www.bringitbackhome.org/what-is-home-rule.html


See, e.g., Legislation creating the Shelby County Planning Commission of Shelby County, Alabama; Baldwin County Planning and Zoning Act, Act No. 91-719 (Aug. 8, 1991).


Ga. R. & Reg. 391-3-16-.01(7)(c)3 (2014).


USEPA Office of Water, Class V Wells, at http://water.epa.gov/type/groundwater/uic/class5/.


See http://ga.water.usgs.gov/nawqa/

http://www.epa.gov/waters/ir/

See institutional options report at 21.

Natural Resources Conservation Service’s Watershed and Flood Prevention Program:

Susquehanna Flood Forecast and Warning System:
http://www.susquehannafloodforecasting.org/about.html