

CAN WE MOVE FROM CONFLICT TO COOPERATION: WATER RESOURCES
PLANNING IN THE SOUTHEASTERN UNITED STATES

by

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(Under the Direction of James E. Kundell)

ABSTRACT

Water resources management challenges continue to grow across the southeastern United States as a result of population growth, economic and industrial development, increasing energy demands, and continuing needs to provide water for production of food and fiber. Attempts to allocate resources to meet human and ecosystem needs as well as non-utilitarian values have been complicated by climatic events, water pollution, interstate disputes over transboundary resources, and intrastate conflicts among users for available supplies. Federal and state governments have implemented various programs and initiatives to address pending and developing challenges. Because multi-state (regional) approaches are not directly contemplated by the federalist system ascribing federal and state authority, such approaches have received less consideration towards resolving water resource management problems.

This research employs a case study design to examine organizational structures and institutional arrangements associated with the Delaware River Basin Commission, Gulf of Mexico Program, and the Western States Water Council to explore the attributes of collective action structures, survey institutions and institutional arrangements primarily at collective choice and operational levels, and identify the types of functions and collaborative programs implemented. The case study results are supplemented by survey research to ascertain the views, opinions, and preferences of selected senior state environmental agency officials from across the

region. Most notably, respondents were asked about the need for and benefit of a collaborative mechanism for regional surface water resources planning and coordination among regional states and potential impediments to establishing such mechanism.

Based on case study evaluations, the study ascertained numerous characteristics of viable institutional arrangements for water resources management. Among those are a shared sense of resource conditions, threats and responsibility to address any threats (regional identity); a prior history of state officials working on environmental or natural resources challenges; advocates among state leaders; and the presence of external triggers. While support exists for adopting institutional arrangements for regional surface water planning and coordination, state leaders identified several potential impediments along with potential strategies to overcome some barriers.

INDEX WORDS: surface water resources management, water policy, regional water planning

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CHAPTER 1

INTRODUCTION

Federal, state, and local officials across the southeastern United States face increasing water resource management challenges in assuring the availability of sufficient, high quality water to meet increasing demands for uses associated with rapid population growth and urbanization, water-dependent industrial and commercial development, irrigation to support food and fiber production, and additional thermoelectric power generation. Anthropogenic instream uses include navigation and water-borne transportation, hydroelectric power generation, water-based recreation, and assimilation of wastes. Water resource considerations must also account for and include support for aquatic species and other wildlife and habitat protection.

Efforts to manage water to meet this range of needs and uses are complicated by spatial and temporal differences in precipitation, uncertainty resulting from climatic events, such as droughts and floods, limited groundwater availability in some areas, the location of large population centers on smaller portions of river basins, water pollution or insufficient water quality, lack of regulatory controls over withdrawals, aging and failing infrastructure, and the breadth of other social values (*e.g.*, aesthetic, spiritual and cultural values) regarding water and its use.

Over the past three decades, areas of the Southeast have experienced significant water shortages due to drought conditions. Although the need for additional supplies to meet increasing demand has concerned water resource managers, the onset of drought conditions has periodically increased attention toward water resource management issues on the public policy agenda because users in the region have been historically accustomed to having significant annual rainfall and thus, abundant water supplies. Water shortages have resulted in substantial impacts ranging from crop failures to potential depletion of public water supplies. Richard Seager and his colleagues at Columbia University observed that the 2005-

2007 drought was “pathetically normal and short, far less than what the climate system is capable of generating” (Science Daily 2009). Considering the impacts of that drought, Professor Seager commented that damages resulting from the drought conditions “came not from exceptional dryness but booming population and bad planning” (Science Daily 2009). Further elaborating, he explained that that climate conditions in the 19th century were drier, but minimal impacts occurred due to the sparse population. Today’s urban centers make society vulnerable to slight downturns. Professor Seager also cautioned, “Climate change should not be counted on to solve the Southeast’s water woes, and is, in fact, as likely to make things worse as it is better” (Science Daily 2009).

In his book, *Unquenchable: America’s Water Crisis and What To Do About It*, Professor Robert Glennon recounted some impacts of recent droughts. Orme, a small community in Tennessee, ran out of water and had to transport water from Alabama for delivery to its citizens. Bowater, a small pulp and paper plant in South Carolina, had to temporarily close because insufficient surface water flows would not allow it to meet wastewater discharge limits (Glennon 2009). Glennon further observed that water shortages resulted in the Nuclear Regulatory Commission denying “two permits for power plants in Georgia,” and Atlanta coming “within 90 days of having its principal water supply, Lake Lanier, dry up” (Glennon 2009). Regarding water shortages in Georgia, he was critical of Georgia’s response to the shortage and asserted, “What Georgia has not done is restrict new use of water” (Glennon 2009). The professor proposed that after setting aside a quantity necessary to satisfy the “human right to water” (about 7 to 15 gallons per day), the remaining quantity should be allocated and re-allocated using market signals. As a result, water use would be driven from lower value uses to higher value uses.

Increasing surface water resource scarcity has already caused conflict and controversy among states in the Southeast. Officials from Alabama and Florida began expressing concern in the late 1980s and early 1990s over increasing withdrawals in North Georgia, particularly a proposal by Atlanta to increase its allocation from Lake Lanier for water supply. As a result, litigation was filed against the U.S. Army Corps of Engineers, which operates dams in the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint river basins, but action was stayed pending efforts to negotiate water allocation

formulas through two federal-interstate compacts, the Apalachicola-Chattahoochee-Flint Rivers Compact and the Alabama-Coosa-Tallapoosa Rivers Compact, both receiving the consent of Congress in 1997. Subsequent negotiations failed to arrive at an allocation formula. In 2009, Senior U.S. District Court Judge Paul Magnuson determined that water supply was not among the originally authorized purposes of Lake Lanier and that the current water supply levels exceed the U.S. Army Corps of Engineers' authority under federal law. Judge Magnuson's ruling gave the Corps of Engineers three years to obtain authorization from Congress or reduce the lake's water supply withdrawal amount to levels last seen in the 1970s. However, on June 28, 2011, a three-judge panel of the U.S. Circuit Court of Appeals for the Eleventh Circuit overturned the district court ruling determining that water supply for the Atlanta metropolitan area was an authorized purpose of Lake Lanier and that the Corps had the authority to determine the appropriate allocation for water supply purposes. The appeals court also set aside the three-year deadline, and instead, gave the Corps of Engineers one year to make a final determination of water allocation from Lake Lanier. In September 2011, the appeals court denied requests by Florida and Alabama for a re-hearing by the full court.

Continuing the dispute, Florida initiated efforts in October 2013 to file an original action against Georgia in the U.S. Supreme Court seeking an equitable apportionment of waters. The state's petition is pending.

Water resource issues have increased tensions between officials in Georgia and Tennessee as representatives of Georgia attempt to correct an improperly drawn state boundary. A revised boundary would result in the state becoming riparian to the Tennessee River, thus expanding alternatives for additional water supply in North Georgia. In a 2013, resolution directing state officials to approach Tennessee officials regarding negotiation of a boundary revision, the Georgia House of Representatives suggested that the state may result to litigation, if a negotiated settlement cannot be reached (HR 4, Regular Session (Ga. 2013)).

In response to concerns over withdrawals in the Savannah River Basin, the South Carolina Water Resources Center and Georgia Water Resources Institute held a conference in November 2004 to discuss

issues related to water allocation and use and water quality, including the potential for a Savannah River Compact. In 2005, the governors of Georgia and South Carolina formed the Savannah River Committee by executive orders to address water resource concerns. The Georgia Environmental Protection Division and the South Carolina Department of Health and Environmental Control established the Savannah River Partnership to consider water supply and water quality issues. In September 2013, Georgia Governor Nathan Deal and South Carolina Governor Nikki Haley met to discuss a range of water issues (Cary 2013).

Although many interstate disputes in the Southeast appear centered upon increasing water use in North Georgia, similar concerns are occurring in other areas. In 2007, South Carolina filed an action against North Carolina in the U.S. Supreme Court seeking an equitable apportionment of the waters of the Catawba River. The state's concern involved water transfers from the Catawba River Basin to the Yadkin River Basin to support uses in the Charlotte, North Carolina area. In a 2010 settlement agreement, the two states, and interveners, Duke Power Company and the Catawba River Water Supply Project, agreed to use the Comprehensive Relicensing Agreement previously negotiated between the states as part of Duke Power's relicensing of its Catawba-Wateree Hydro Project, as the basis for limiting further interbasin transfers (*South Carolina v. North Carolina* No. 138, Orig. (Settlement Agreement, December 3, 2010)). The agreement was brokered by the bi-state Catawba-Wateree River Basin Advisory Commission discussed later in this chapter. The states further agreed to (1) regulate water withdrawals and uses from the Catawba River Basin, (2) update a basin water supply study every 10 years, (3) coordinate policies regarding approvals of interbasin transfers, (4) implement drought response protocols during periods of low flow, and (5) waive the right to file additional actions during the term of the hydropower license, except as new information may provide (*South Carolina v. North Carolina* No. 138, Orig. (Settlement Agreement, December 3, 2010)).

Although not a surface water management issue, Mississippi has been involved in litigation against the City of Memphis since 2005 regarding area groundwater withdrawals. In 2009, the U.S. Court of Appeals for the Fifth Circuit upheld a federal district court ruling that dismissed Mississippi's case for

failure to join Tennessee as an indispensable party (*Hood v. City of Memphis* 570 F.3d 625 (2009)). If Tennessee were joined, jurisdiction would move to the U.S. Supreme Court for an equitable apportionment of the Memphis Sands Aquifer.

Due to concerns over the impacts of drought conditions, growth, and development on the region's water resources, the U.S. Environmental Protection Agency hosted a conference sessions in 2003 bringing together officials and leaders from business and industry, agriculture, local governments, nongovernmental organizations, academia, and federal and state agencies across the region to contemplate the need for a region-wide water resources planning strategy. Concerns amongst these leaders were also raised, in part, by the increase in interstate disputes over surface waters. It was asserted that a regional water resources planning strategy could benefit regional governments and stakeholders due to (1) the common challenges faced by states because of their geographic proximity; (2) the potential impact of one state's action on regional states; (3) the inability of a single level of government to address the multitude of challenges; (4) the commonsense extension of the watershed- and river basin-based surface water resource management approaches being used by states; (5) improved prospects for development of cooperative solutions to complex issues, which may otherwise result in lengthy and expensive interstate dispute resolution; (6) enhanced capacity for consultation and cooperation among various levels of government and early engagement of stakeholders in making water resource management decisions; and (7) increased coordination to provide federal agencies with a better understanding of needed assistance in surface water management programs (Kundell, DeMeo et al. 2004).

At the close of the sessions, attendees were asked to prioritize previously-identified next steps. As ranked, the nine steps included: examination of incentives for water conservation and reuse; enhancement of interagency funding and cooperation; promotion of earlier interactions on water resources decisions through procedures established by the Southeast Natural Resources Leadership Group (see discussion later in text); expansion of technical assistance and training; foster increases in governmental financial, technical and managerial capacity in water resources management; formation of state advisory bodies to determine how a regional planning strategy could be developed; reorganization of agency programs to

facilitate watershed-based management; expansion of voluntary compliance programs; and implementation of water quality trading demonstration projects in specifically identified watersheds (Kundell, DeMeo et al. 2004).

STUDY AREA

The study area for this dissertation corresponds to that of state water pollution control programs overseen by the Region 4 office of the U.S. Environmental Protection Agency in Atlanta, Georgia. This area was selected because the Environmental Protection Agency regional office provided initial funding, state water resource management officials have an extensive history of coordination and cooperation in implementing state and federally delegated water pollution control programs, and some state management officials also have authority to control water use.

Resource Characteristics

This research focuses on rivers and streams in the southeastern United States (Figure 1). With a total area extending more than 394,000 square miles and comprising approximately 10 percent of the nation, the region incorporates portions of 14 level III ecoregions, including the Southern and Middle Atlantic Coastal Plains, the Piedmont, the Southwestern and Central Appalachians, and the Mississippi Alluvial Plain.

More than 25,000 square miles of total water area includes almost 5,000,000 acres of lakes, ponds and reservoirs and 460,000 miles of freshwater rivers and streams. Across the region, rivers form portions of numerous state boundaries (Figure 1). For example, of Georgia's 1,025 miles of non-coastal state boundary, the Chattahoochee River in western Georgia, the Savannah River in eastern Georgia, and the St. Marys River in southeastern Georgia collectively form 688 miles (Evans 2012). Seventy-five percent of Kentucky's boundary is formed by rivers, while less than one percent of the North Carolina border is shaped by waterways. The hydrologic connection among southeastern states is further supported as a result of the transboundary nature of 92 percent of the major river miles in the region (Figure 2) (Evans 2012).

Because average annual precipitation rates in the region range from 49 inches in Kentucky to 59 inches in Mississippi, the climate is generally categorized as humid and subtropical (Current Results Nexus 2012). However, climatic conditions vary considerably from the Gulf of Mexico coastal areas susceptible to hurricanes and severe storms and associated flooding to mountainous and upland areas of the region that experience more temperate summers and cooler winters with occasional freezing conditions and snowfall. Atlantic coastal areas experience hot, wet summers and temperate, drier winters. Tropical conditions prevail across Florida.

Socioeconomic Characteristics

Southeastern states have seen significant population growth since the turn of the 20th century with a 76-percent increase in population occurring between 1900 and 1950 (Forstall 1996). Since 1950, the area has added almost 40 million new inhabitants to reach a 2010 population of 61 million (United States Census Bureau 2012). Florida's population grew from 2.8 million in 1950 to 18.8 million in 2010, while the number of people residing in Georgia increased from 3.4 million to 9.7 million. Today, 20 percent of the nation's population resides in the Southeast.

With the region experiencing an anticipated decadal growth rate of nine percent, census projections estimate that 17.3 million more residents will live in the region by 2030 (United States Census Bureau 2005). Florida, North Carolina, and Georgia rank among the top 10 states nationally based on projected growth between 2000 and 2030 with growth in all three states expected to exceed approximately 50 percent (United States Census Bureau 2005).

Areas of the Southeast are also experiencing urbanization. While some locations remain significantly rural in character, population densities increased an average of 87 percent between 1970 and 2010 (United States Census Bureau 2012). Densities in Florida and Georgia more than doubled to reach 351 persons per square mile and 168 persons per square mile, respectively. Kentucky and Mississippi saw the least growth in density. By 2010, rural populations of most states reportedly comprised less than 30 percent (United States Census Bureau 2012). Mississippi and Alabama were the only regional states with

population densities below 100 persons per square mile. Florida's reported rural population was only six percent by 2010 (United States Census Bureau 2012).

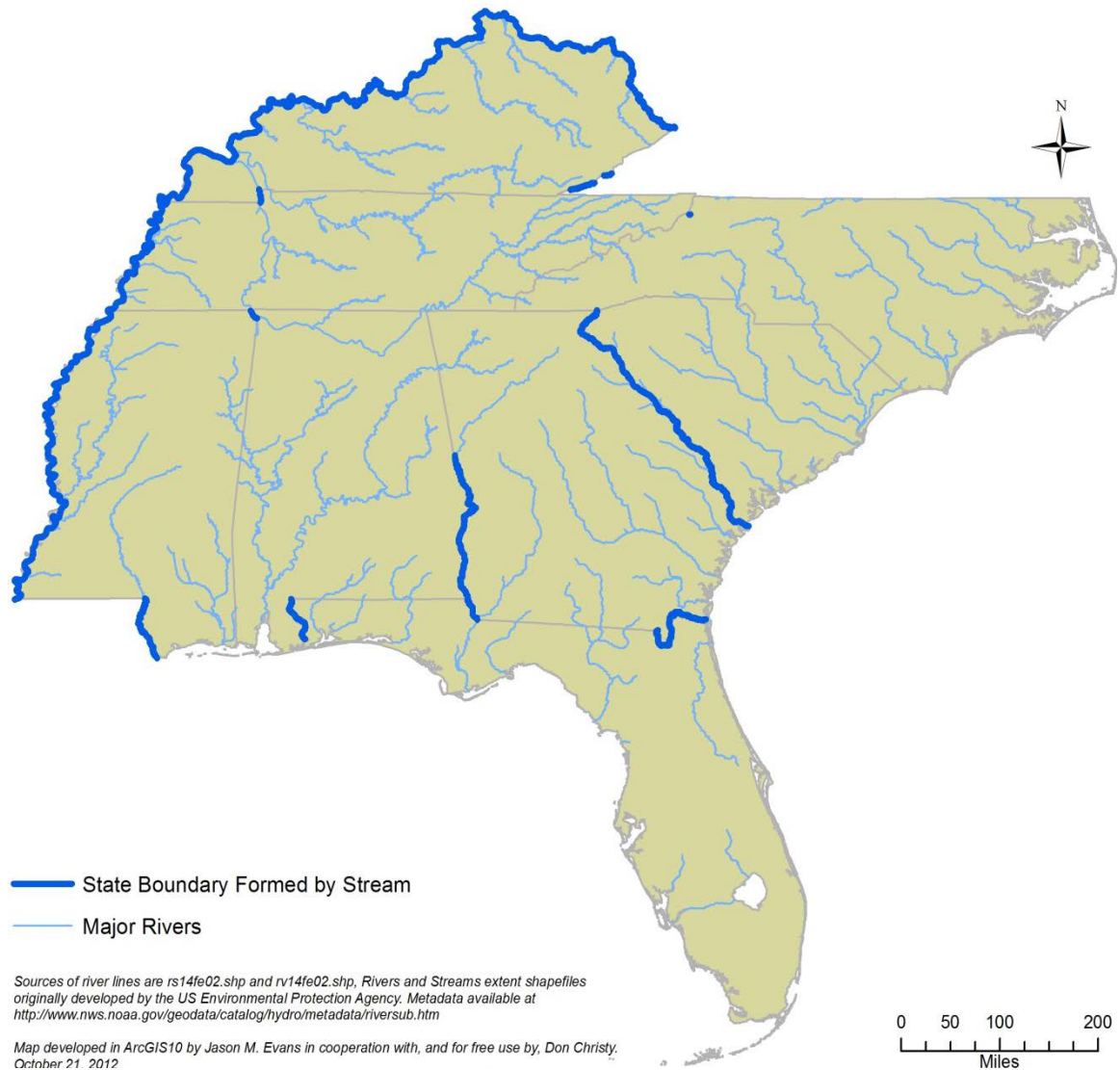


Figure 1. Streams as State Borders in the Southeastern United States (Evans 2012)



Figure 2. Cross-Boundary Rivers in the Southeastern United States (Evans 2012)

Twenty-seven areas in the Southeast are defined as metropolitan statistical areas with a population greater than 500,000 (United States Census Bureau, 2013). Twelve of these areas were among the top 50 fastest growing areas in the United States between 2000 and 2010 with four areas having growth rates exceeding 25 percent. Rapidly expanding metropolitan regions include Raleigh, Charlotte and Chapel Hill in North Carolina; Columbia and Charleston in South Carolina; Atlanta in Georgia; and Nashville in Tennessee (United States Census Bureau 2012).

Economic conditions in the region have improved since 2009 when the region experienced a significant decline. Changes in the real gross domestic product between 2011 and 2013 range from a 1.2-percent increase in Alabama to a 3.3-percent upturn in Tennessee with most southeastern states hovering around the national average 2.5 percent (United States Bureau of Economic Analysis 2013).

State economies across the region are very diverse; however, all states continue to benefit from strong agricultural production ranging from broilers, swine and beef cattle to row crops (cotton, soybeans, and corn) to fruits, vegetables, and ornamental plants. Activities in this sector contributed more than \$48 billion to local and state economies with most states benefiting \$4 billion to \$8 billion annually (Economic Research Service 2013).

Southeastern states also support robust industrialized economies. Prevalent industrial sectors include food processing, petroleum refining, printing and publishing, and manufacturing of textiles and apparel products, chemicals and allied products, furniture, automobiles and other transportation equipment, paper and allied products, electronics and electronic equipment, and fabricated metal products. Many of these industrial processes are considered water intensive.

Areas of the region possess significant reserves of mineral resources, including coal, lignite, phosphate, kaolin and other clays, granite, crushed stone, sand and gravel, portland cement, and limestone. Oil and gas production occurs in several states.

Due to the temperate climate, tourism is also a significant economic asset. From Mammoth Cave and the Kentucky Derby in Kentucky to casino gambling and fishing along the Mississippi River and Gulf Coast to camping and hiking in the mountainous areas of the region, attractions and scenic beauty draw millions of tourist to the Southeast annually and account for approximately \$162 billion across the region (United States Travel Association 2013).

Activity in many of the economic sectors relies on adequate supplies of high quality water. The U.S. Geological Survey estimates off-stream water uses on a five-year basis. Estimates of total surface water withdrawals in the southeastern states for 2005 show a slight increase over the 2000 approximations. Withdrawals for public supply, agricultural uses, and thermoelectric power production

continued to increase, while industrial and commercial surface water withdrawals showed a decrease over the period (Kenny, Barber et al. 2009).

As is the case with other areas of the United States, cooling water for thermoelectric power production constituted 80 percent of the region's fresh surface water withdrawals. The remaining 10.5 billion gallons per day were distributed across the following uses: 40 percent to public supply and domestic use, 24 percent each to industrial and agricultural (livestock and irrigation), 11 percent to aquaculture, mostly in North Carolina, and the remaining 1 percent to mining (Kenny, Barber et al. 2009).

The U.S. Geological Survey also estimates per capita water use for public supply and domestic uses. Over the past several decades, per capita use in the Southeast has remained relatively static at less than 100 gallons per person per day. Applied to the previously-mentioned anticipated regional population increase, estimates indicate the need for an additional 1.5 billion gallons per day to meet the demands of the added 17.3 million residents by 2030.

Water quality in southeastern states has improved substantially over the past 40 years as states have implemented water pollution control regulatory programs and provided financial assistance for the construction of municipal sewage treatment facilities. A significant portion of this improvement has resulted from reductions in pollutant loading from municipal and industrial discharges. However, states continue to face challenges in meeting water quality standards. Based on 2010 water quality assessments and listings of impaired waters, almost 7,500 segments across the region remain impaired for at least one pollutant. Common pollutants may include pathogens, metals, nutrients, oxygen depleting substances, and sediment. Regional states have made progress in addressing these impaired waters, the U.S. Environmental Protection Agency has approved 7,000 total maximum daily load calculations approved since 1995 and regional states have begun their implementation (United States Environmental Protection Agency 2013).

Sufficient high quality water must also remain instream. Environmental flows support habitat for aquatic organisms and ecological functions, as well as maintain navigational, recreational, and waste assimilation uses. Water resource management officials have struggled with appropriate methods to set

these flows, beyond those amounts simply required for waste assimilation, while incorporating seasonal, annual, and spatial variations. A recent “collaborative scientific approach,” supported by the Nature Conservancy, charges a scientific panel to provide “credible estimates of environmental flow needs” (Richter, Warner et al. 2006). This adaptive management approach provides water managers a better mechanism to ensure sufficient allocations are made for resource support. Jobsis (2013) reported that Tennessee and Kentucky have “narrative standards for flows to protect aquatic life” and no states have numeric standards; however processes to develop standards are underway in Alabama, Georgia, North Carolina, and South Carolina.

Selected Institutional Arrangements for Water Management

Southeastern states have adopted a variety of institutional arrangements to provide for surface water allocation and use, pollution control, and water resource planning. In 2005, Christy *et al* completed an analysis comparing southeastern state water resource management laws in these areas. The results showed considerable variability in statutory requirements governing water allocation and use and water resources planning, which likely results from approaches to adopt policies addressing single issues and/or pending or looming crises. Substantial similarity existed among water pollution control laws, because all states in the region have federally delegated program responsibilities based upon the nature and stringency of state water pollution control laws. In addition to the statutory provisions, states also have significant bodies of case law addressing disputes over water use and pollution of rivers and streams. The subsequent paragraphs will briefly discuss selected state statutes pertaining to water use and allocation, water pollution control, and water resources planning.

Water Allocation and Use

Rights to use waters in rivers and streams historically existed under state common law. In the eastern United States, courts applied the riparian rights doctrine, as adapted from English common law, to settle surface water disputes. In accordance with the riparian rights doctrine, access to water was contingent on ownership of land abutting a watercourse and, as such, the right to divert a watercourse or withdraw and use water was among the owner’s property rights. Riparian rights ran with the land.

Landowners had no possessory rights to the water passing through the property, but held a usufructory right. Water could not be unreasonably detained or stored, or diverted in a manner that did not allow return to the abutting waterway before it left the owner's property. Under a strict interpretation, use of waters on non-riparian land was considered unreasonable *per se*. Every owner of lands abutting a watercourse had an equal right to use the water which flowed in the adjacent watercourse without diminution or alteration.

Early application of the doctrine was relatively uncomplicated as eastern states had numerous flowing rivers and streams containing abundant water resources. Moreover, water used primarily for domestic purposes and mill power was largely non-consumptive. The largest consumptive uses resulted from flooding of agricultural fields to irrigate crops. The population of urban areas, which were located near major rivers to facilitate commerce, remained relatively small.

As urban areas developed and the Industrial Revolution brought mechanized manufacturing, the inability to diminish the flow available to downstream landowners was seen as anti-development. Non-riparian municipalities, which had invested in the construction of public water supply systems, sought water supplies to support residential and commercial development. Surface waters were subject to contamination from improperly treated sewage and industrial effluents. In response to these societal changes, courts revised interpretations of the riparian rights doctrine to allow "reasonable use" by riparian landowners. Resolution of conflicts and disputes continued to be handled through common law. The reasonableness of a particular use was a question of fact to be settled by juries and such reasonableness applied solely to the uses under consideration. Although application of the reasonable use theory continued to engender substantial uncertainty, particularly for investment purposes, it has remained the common law basis for settling water rights' disputes in eastern states for more than 100 years.

While demands for offstream uses in southeastern states continued to increase, concerns over available water supplies rose. As discussed earlier, these concerns were further heightened by drought periods, initially during the 1950s. Many states considered adopting the appropriative water rights doctrine, as developed and used by states in the arid American West along with its administrative

permitting system used to determine the priority of access to water resources. Mississippi statutorily adopted an appropriative rights approach in 1956, but state courts essentially failed to recognize it in resolving water law disputes. Although the other southeastern states did not enact such statutory revisions, state officials began to consider other actions to address water resource challenges and improve water resources management.

Between 1950 and 1990, most southeastern states altered their common law riparian rights doctrines by adopting statutory water allocation and use provisions. In 1966, the Kentucky Legislature enacted a statute requiring persons withdrawing, diverting, or transferring more than 10,000 gallons per day to get a permit authorizing that withdrawal from a particular source for a specific use. Exemptions were provided for most agricultural uses, domestic uses, oil and gas production, and thermoelectric power generation.

The North Carolina General Assembly enacted the Water Use Act in 1967 to regulate withdrawal of water in areas experiencing chronic water availability problems. The law authorized the establishment of capacity use areas and the subsequent permitting of new withdrawals exceeding 10,000 gallons per day in any area. In 1991, provisions were enacted mandating the registration of large surface water withdrawals and certain large interbasin transfers. The law was further revised in 1993 to require issuance of a certificate by the Environmental Management Commission prior to any interbasin transfer of 2 million gallons per day or more. Provisions regarding interbasin transfers of surface waters were substantially rewritten in 2007 to revise the criteria for granting certificates of transfer, expand notification requirements, and establish deadlines for a preliminary determination by the commission.

A 1972 Florida law supplanted the state's common law doctrine by imposing requirements on persons seeking to make consumptive use of water resources. Historically, the Department of Environmental Protection and its predecessors provided oversight with day-to-day implementation being handled by five water management districts. Legislation enacted in 2012 required the department to adopt rules for environmental resource permits that must generally be applied on a statewide basis. Water management districts must implement programs consistent with those rules.

After adopting the Groundwater Use Act in 1972, the Georgia General Assembly made corresponding amendments to the Georgia Water Quality Control Act requiring permits for large withdrawals and diversions of surface water. Farm water uses were largely exempted; however, in 1988, the General Assembly enacted provisions governing those uses. The resulting institutional arrangements, an administrative permitting system for large withdrawals and common law applicable to other withdrawals and diversions, has been dubbed a “regulated riparian rights” system (Dellapenna 1994).

The South Carolina Legislature adopted the Surface Water Withdrawal and Reporting Act in 1982 to require certain persons withdrawing more than 3 million gallons per month to register with the Department of Health and Environmental Conservation and to report information regarding water withdrawals. In 1985, the Legislature also adopted permitting requirements for interbasin transfers of surface waters from 15 river basins in the state. Beginning January 1, 2011, South Carolina law required any person withdrawing 3 million gallons per month or more to obtain a permit from the Department of Health and Environmental Control, unless otherwise exempted. Agricultural users must register their surface water use with the department.

Mississippi revised its statutes in 1985 to require permits for surface water withdrawals, subject to some exemptions. If the Commission on Environmental Quality declares the existence of a water use caution area, the Environmental Quality Permit Board may require permits for withdrawals exceeding 20,000 gallons per day, including requirements on users otherwise exempted.

Under the 1993 Alabama Water Resources Act, persons withdrawing large water withdrawals must register with the Office of Water Resources and obtain a certificate of use. The Alabama Water Resources Commission may delineate capacity stress areas, where uses exceed or may exceed availability. Following designation of an area, persons making large withdrawals must obtain a permit from the Alabama Department of Environmental Management.

In Tennessee, the Inter-basin Water Transfer Act, adopted in 2000, required permits for transfers involving certain parties occurring in 10 statutorily specified river basins. Except as otherwise exempted, the Water Resources Information Act required any person withdrawing 10,000 gallons or more per day to

register with the Tennessee Department of Environment and Conservation. Persons withdrawing water resulting in an alteration of the physical, chemical, and associated properties of state aquatic resources must also obtain a permit, unless otherwise exempted.

Water Pollution Control and Water Quality Management

High quality surface water is vitally important to southeastern states. As water demands have grown, surface water resources have become increasingly vulnerable to contamination from a variety of commercial, industrial, residential and agricultural sources. Urban runoff contains pollutants from construction projects, city streets, and lawns. Irrigation return flows often include agricultural chemicals. Overflows from rural areas and waterside developments harbor pathogens and other toxic chemicals. Municipal and industrial wastewaters, treated as required by law, still contain traces of pollutants. Accidental spills and releases also threaten to lower the quality of surface water.

Disputes involving water pollution were historically litigated in state court systems applying common law principles of nuisance, negligence, and trespass. Early state water pollution control statutes were generally targeted to prohibit certain acts.

Congress began to address water pollution specifically beginning in 1948 with the passage of the Federal Water Pollution Control Act. Through a series of amendments in the 1950s and 1960s, the federal role in water pollution control expanded, particularly with regard to interstate waters. During that timeframe, legislatures in southeastern states also enacted state water pollution control statutes. These laws typically called for water quality standards and some type of controls on municipal and industrial sources of water pollution. Enforcement by state health agency personnel was limited due to procedural issues, inadequate funding, and other priorities.

With the enactment of the 1972 Federal Water Pollution Control Act Amendments, Congress provided a comprehensive federal framework for water pollution control to ensure the implementation of certain requirements nationally. The amendments continued federal grant assistance for the planning, design, and construction of municipal sewage treatment plants and included an areawide waste treatment planning process to engage state and local officials in determining solutions for areas having substantial

water quality problems. The act also required the Water Resources Council to prepare Level B plans for all river basins in the United States by January 1, 1980. These plans are reconnaissance-level evaluations of water and land resources toward the resolution of complex challenges identified by framework studies. Varying in scope, the plans typically focus on needs over a “middle term” (15 to 25 years) horizon, involve a broad range of interests in plan development, and identify actions for implementation by federal, state, and/or local agencies (Water Resources Council 1973).

New federal regulatory provisions created the National Pollutant Discharge Elimination System permit program, which served as a vehicle for requiring use of best treatment technologies by municipal and industrial sources. States must set water quality standards, monitor and assess the quality of state waters, develop total maximum daily loads to address impaired waters, and engage in a continuing planning process, describing how state implementation will ensure water quality standards are being met.

The 1972 amendments also furthered the federal-state partnership by allowing the U.S. Environmental Protection Agency to delegate federal permitting and enforcement authority to states meeting certain requirements, most notably that the laws of the state provide adequate authority to implement the delegated programs. As a result, legislatures across the region enacted laws allowing state agencies to receive federal authority. State statutes generally prohibit water pollution; authorize adoption of rules and regulations, including the necessary procedural requirements; require permitting of direct and indirect discharges; provide for establishment of water quality standards; specify civil and criminal enforcement and penalties; and include appropriate appellate processes. All states in the Southeast have received federal delegation to issue discharge permits; however, no state is authorized to issue federal permits for the discharge of dredged or fill material. In addition, states are not authorized to issue permits for biosolids management, as well wastewater discharge permits into waters on Indian lands and into offshore waters under federal jurisdiction. The Region 4 office of the U.S. Environmental Protection Agency permits these activities.

The 1987 amendments to the Federal Water Pollution Control Act focused on reducing toxic substances in wastewater discharges and controlling pollution from nonpoint sources. Permits were

required for discharges of stormwater. The act also directed states to develop and implement nonpoint source pollution management programs. States primarily address nonpoint pollution sources through voluntary, incentive-based, non-regulatory programs, most commonly through recommendation of best management practices. Federal grants provide funding for implementation of state nonpoint source pollution management programs.

While federal requirements establish a minimum program addressing pollution of navigable waters, states may enact and many have enacted water pollution control requirements that are broader in scope or more stringent than federal requirements. For example, states may have laws pertaining to erosion and sedimentation control or soil and water conservation. States also require water pollution control permits for sources that do not discharge to navigable waters.

State Water Resources Planning

As discussed previously in this section, water resource planning programs can take many forms and are implemented at many levels of government. Lund (2006) pointed out, “Rational planning is a systematic procedure to resolving problems in the future.” Federal water resources planning has traditionally involved major public works projects and programs and studies of large areas.

States water resource planning activities include preparation of comprehensive water resource management plans and development of strategic or program implementation plans, often in response to federal requirements under the Clean Water Act or the Safe Drinking Water Act.

Like laws and policies regarding water allocation and use, state statutory water resource planning requirements vary greatly. Observing that plans typically vary by scale and the type of resource being managed, Kundell, DeMeo et al. (2000) developed the following classification system for state water resource planning depending on the focus of the plan. Service development plans are associated with providing a service, such as water supply or wastewater management, and are commonly developed by local governments and utility authorities. In its efforts to provide water and sewer service to every citizen, the Commonwealth of Kentucky is engaged in this type of planning.

Agency water plans include strategic plans or program management plans and specify goals and objectives along with associated performance measures. These plans focus on administrative activities, not the resource being managed. States using this planning approach commonly have different plans addressing flood management, drinking water quality, and water quality control, as may be required for implementation of federal environmental protection programs. All states in the Southeast develop these plans for at least one water resource-related purpose.

Resource plans usually address either water supply or water quality issues from either a statewide or sub-state (*e.g.*, river basin) perspective; however, unlike agency plans, the primary focus is on improving the resource. Notable approaches among this category are the development of river basin management plans, which may address concerns over water availability and water quality. Water resource planning in North Carolina and Tennessee generally falls into this category.

In implementing water quality management programs, most states have employed a basin management planning approach, or some variant thereof, where rivers basins are grouped into four or five clusters and undergo surface water quality assessments by cycling through a process providing for an initial assessment of waters, monitoring and data collection, data analysis and identification of impaired waters, development of plans to address impairments, and implementation of those plans. It is anticipated that each step will take approximately one year, resulting in a five-year rotation.

Comprehensive water plans address both water quality and water availability issues for surface waters and groundwater on a statewide basis. Development of plans typically requires considerable interagency coordination and provides substantial opportunities for public participation. State plans in Florida, Georgia, and South Carolina fall into this category.

While the Alabama Water Resources Act establishes the state policy framework for water allocation and use, it does not require the development of a comprehensive state water management plan. However, officials from the Office of Water Resources have been working with representatives of four other state agencies since 2011 to identify water management issues in Alabama. The working group submitted its report to Governor Robert Bentley in August 2012 (Alabama Water Agencies Working

Group 2012). Governor Bentley subsequently extended the term of the working group and directed it to recommend a statewide water management action plan and associated legislation to ensure implementation of the plan by December 1, 2013 (Bentley 2012). As of April 21, 2014, Governor Bentley had not released the statewide water management action plan.

In 2013, the Office of Water Resources also released the Alabama Drought Management Plan, which provides for assessment of drought conditions, interagency coordination in drought response, issuance of drought declarations, and identification and implementation of actions to mitigate drought impacts (Christy, Myszewski et al. 2005, Viessman and Feather 2006). Under its Nonpoint Source Pollution Control Program, the Alabama Department of Environmental Management has worked with the Alabama Clean Water Partnerships to develop river basin management plans for 11 basins. The program also supports the development of sub-watershed management plans.

Florida law provides for the development of a comprehensive state water management plan, as well as district water plans for the five water management districts. The plans support a watershed approach to management, address water supply needs, provide for enhancement of water quality and natural systems, and set forth terms for flood protection and floodplain management. The state plan identifies management priorities and presents strategies to address them, and includes district water management plans and regional water supply plans (Christy, Myszewski et al. 2005, Viessman and Feather 2006). The 2007 Florida Drought Action Plan served to improve interagency coordination and identify short- and mid-term actions to address then-current drought conditions (Florida Department of Environmental Protection, Florida Division of Emergency Management et al. 2007).

Under the 2004 Comprehensive Statewide Water Management Planning Act, Georgia built its 2008 state plan based upon regional water development and conservation plans developed by 10 regional water planning councils and the Metropolitan North Georgia Water Management District, created in 2001. The state plan highlights goals, objectives, and strategies addressing water supply and allocation and water quality to meet human and aquatic resource needs. It also serves as a guide for developing regional plans, which upon approval by the Georgia Environmental Protection Division, will be

implemented through permitting and other programs. Prior to the 2004 statutory revisions, Georgia engaged in river basin management planning along the state's 14 major river basins. The 2003 Georgia Drought Management Plan provided for the issuance of drought declarations, interagency coordination, and implementation of pre-drought strategies and drought responses (Georgia Department of Natural Resources 2003).

Kentucky law does not require comprehensive water resource management plan; however, since 1990, the state's 120 counties have been required to develop water supply plans containing strategies to meet anticipated long-term needs and provisions to address resource shortages. County planning serves to further a goal of providing water and sewer service to every citizen of the Commonwealth by 2020. Originally enacted following drought conditions of the late 1980s, planning provisions were amended in 2000 to authorize state oversight by the Kentucky Infrastructure Authority and to require area development districts to coordinate county planning through water supply planning councils (Christy, Myszewski et al. 2005, Viessman and Feather 2006). The Kentucky Energy and Environment Cabinet released its Drought Mitigation and Response Plan in 2008.

Mississippi law requires the development of a state water management plan to guide the use and development of water resources. Although a planning framework was initially completed in 1995, no further development of a state plan has occurred. As the result of impacts from Hurricane Katrina, service delivery planning has increased in coastal areas as water supply, wastewater, and stormwater management infrastructure is being replaced. The Mississippi Department of Environmental Quality does not engage in state-level drought planning.

Since 1989, North Carolina and its local governments have engaged in water supply planning. The 2001 State Water Supply Plan, as supplemented by appended river basin plans, compiled water supply needs identified in more than 500 local water supply plans. State law requires local governments owning/operating public water supply systems to develop local plans with a 20-year planning horizon (Christy, Myszewski et al. 2005, Viessman and Feather 2006). Statutory revisions in 2007 required certain local governments operating public water supply systems and large community water systems to

develop water shortage response plans. North Carolina statutes also provide for the development of an annual water resources development plan by the Department of Environment and Natural Resources and implementation of basinwide water quality planning processes (Christy, Myszewski et al. 2005, Viessman and Feather 2006). North Carolina's Drought Assessment and Response Plan is contained in the state's Emergency Operations Plan.

The South Carolina Water Resources Planning and Coordination Act of 1967 charged the South Carolina Water Resources Commission (subsequently transferred to the Department of Natural Resources) with development of a comprehensive state water resources policy. In accordance with that authority, the agency completed development of the second edition of the South Carolina State Water Plan in 2004, which provided an assessment of the state's water resources and specifies guidelines and procedures for management of those resources (Christy, Myszewski et al. 2005, Viessman and Feather 2006). In 2009, the South Carolina Emergency Management Division released the Drought Response Plan.

Tennessee law does not specifically require water resource planning at any level of government; however, it does direct the Commissioner of Environment and Conservation to encourage and support regional water planning, whenever possible (Tennessee Department of Environment and Conservation 2013). Following the 2007 drought, the department, with the support of a multi-agency Water Resources Technical Advisory Committee, began implementation of pilot programs supporting regional water supply planning in the north-central and South Cumberland Plateau areas of the state. Reports on the pilot projects in 2011 resulted in the issuance of guidelines in March 2013 encouraging regional water resources planning in other areas of the state (Tennessee Department of Environment and Conservation 2013). The agency also issued guidance on regional water supply planning.

Water Management Agencies/Organizations

Like most regions of the United States, management of water and its related resources involves numerous governmental agencies. Federal agencies include the Army Corps of Engineers, Environmental Protection Agency, Forest Service, Natural Resources Conservation Service, Geological Survey, Fish and

Wildlife Service, National Oceanic and Atmospheric Administration, Federal Emergency Management Agency, Coast Guard and Federal Energy Regulatory Commission.

The Southeast is also home to regional or multi-state organizations with water resource management responsibilities. Perhaps, the most widely known is the Tennessee Valley Authority, which was created in 1933 to coordinate development in the valley region of Mississippi, Alabama, and Tennessee. Operating more than 30 reservoirs and almost 30 power generation facilities, the agency is heavily involved in regional water resource management.

North Carolina is a member of three bi-state commissions addressing water resource management issues. The 18-member Roanoke River Basin Bi-State Commission was established in 2002 allowing representatives of North Carolina and Virginia to discuss and cooperatively consider solutions to water availability and water quality challenges affecting the basin (N.C. Gen. Stat. §77-91 (2013)). Furthermore, in 2004, state law established the Catawba/Wateree River Basin Advisory Commission and the Yadkin/PeeDee River Basin Advisory Commission comprised of representatives of North Carolina and South Carolina (N.C. Gen. Stat. §77-111 (2013)). The commissions are charged with identifying and proposing solutions to water resource management problems.

States in the Southeast have also participated in interstate compacts involving water resource-related issues. The 1958 Tennessee-Tombigbee Waterway Development Compact provided a mechanism for representatives of Alabama, Kentucky, Mississippi, and Tennessee to cooperate in promoting development of a navigable waterway connecting the Tennessee and Tombigbee rivers. With the waterway's completion in 1985, the development authority has changed its focus to promote the economic potential created by the project.

In the mid-1950s, representatives of Tennessee and six other regional states also negotiated a compact to address water pollution problems in the Tennessee River Basin. Statutes authorizing participation in the Tennessee River Basin Water Pollution Control Compact were enacted in by legislatures in Tennessee, Kentucky, and Mississippi. Congress granted its consent in 1958. However,

legislative bodies in Alabama, Georgia, North Carolina, and Virginia never ratified the compact provisions and thus, the compact never became effective.

State agency involvement in managing water and related resources includes responsibilities for environmental regulation, public health protection, natural resources conservation, fish and wildlife protection, water resources data and information management, soil and water conservation, technical assistance, public education, pesticide regulation, emergency preparedness and response, and regulation of natural resource extraction.

Some states have enacted laws authorizing the establishment of sub-state districts for various water resource-related purposes. Institutional arrangements provide for drainage districts, flood control districts, soil and water conservation districts, and watershed conservation districts.

From a water resource management perspective, local governments are often providers of drinking water and/or wastewater management services. In that capacity, some local governments may also regulate industrial discharges to publicly owned treatment works.

The ACF Stakeholders group is an organization of individuals and other interested parties attempting to seek water sharing arrangements among users in the three-state basin area (Appalachicola-Chattahoochee-Flint Stakeholders 2014). The Cumberland River Compact is also a stakeholder-driven group which seeks to reduce water pollution, address issues at the land-water interface, and revitalize the bi-state Cumberland River (Cumberland River Compact 2014). In addition, the Southeast Watershed Forum identified over 350 organizations engaged in watershed restoration or protection activities (Southeast Watershed Forum 2013).

RESEARCH APPROACH

In addition to the barriers and obstacles mentioned earlier in this chapter, efforts to effectively manage surface waters may also be confounded by the characteristics of the resource and the lack of congruence between resource boundaries and political boundaries.

From economic theory, water resources (both surface water and groundwater) are typically considered common-pool resources as a consequence of two characteristics. A river provides a flow of

resource units that may be withdrawn or consumed. One person's consumption of a portion of that flow generally precludes contemporaneous consumption by another person, thereby resulting in subtractability of supply. As a result, present use affects future availability. In addition, physical exclusion of potential users from water resources, particularly surface waters is extremely difficult and/or costly (Ostrom 1990). Therefore, rivers and streams may be subject to exploitation without regard to sustainability of the resource.

A variety of institutional arrangements have been employed to manage common pool resources ranging from forests to fisheries to grazing lands to water resources. Today, many of these arrangements are moving toward a collaborative management or co-management approach that combines government control with efforts of local groups organized through collective action. Under this approach policy prescriptions are developed and implemented through adaptive management. Based upon the body of research regarding characteristics of common pool resource management institutions, this dissertation will examine institutional arrangements associated with three organizations involved in one or more aspects of water resources management through the lens of the institutional analysis and development framework and informed by common pool resource theory, particularly the scholarship of Tanya Heikkila and Andrea Gerlak on large-scale systems.

Arrangements associated with these organizations recognize that boundary and jurisdictional issues pose particularly difficult challenges. Because hydrologic unit boundaries seldom correspond to political borders, individual jurisdictions, such as state and local governments, have limited capability to address water resource management challenges. Decisions made in one jurisdiction may have significant effects in other jurisdictions, specifically those made by upstream users affecting downstream users in the case of surface waters. Although water management officials generally agree that management along hydrologic unit boundaries provides the best course of action, implementation of the concept remains problematic, especially for interstate or transboundary waters. Research in this dissertation is further informed by studies on the array of potential institutional arrangements available to coordinate surface water resources planning among states in the southeastern United States.

More specifically, this research employs a case study approach examining selected collaborative interstate water resources management organizations considering the following questions:

- How are these organizations structured, particularly at the collection action level?
- How do they function across three institutional levels (operational level, collective choice level and constitutional choice level)?
- What collaborative activities do they undertake to improve surface water resource management within their jurisdiction?

To elicit opinions regarding the level of concern among state leaders and officials regarding water resource management issues, the precedence of those issues on state policy agendas, and recent state actions to address water resource concerns, a survey instrument was developed and employed. The survey also asked present or former senior state environmental agency officials or their designees from the eight-state study region about views on the need for regional surface water resource coordination and planning, and preferences regarding the type of arrangements used to provide coordination and planning and the appropriate functions of any organization created to provide those services. Respondents were also asked about significant impediments to creating institutional arrangements and potential strategies to address those impediments and concerns.

ORGANIZATION OF DISSERTATION

The remainder of this dissertation is presented in four chapters. Chapter 2 provides background on the challenges of addressing water resource management issues in the American system of government and on historical water resource planning efforts. The chapter further provides a review of relevant literature on common pool resource management and elaborates on the research methodology used in this dissertation. Chapter 3 contains the case study results for the Delaware River Basin Commission, the Gulf of Mexico Program and the Western States Water Council. Chapter 4 presents the results of the survey

research conducted as part of this dissertation. Chapter 5 explains the findings based upon the research and identifies areas for additional research.

CHAPTER 2
BACKGROUND AND METHODOLOGY
WATER RESOURCES PLANNING AND MANAGEMENT
Federalism

Water resource policy, as well as planning and management, are subject to the institutional environment in which policies and programs are developed. Those institutions establish the basis for the federal-state relationship in water resources management.

The American system of government is built upon federalist principles, which provide for the dispersal of political power and assignment of governmental functions among levels of government and across branches of government within a single level. While the doctrine prevents the concentration of political power and increases access of the public to governmental bodies, its implementation commonly results in fragmented decision-making. Federalism is not a static doctrine, but has changed over the years, primary through legislative enactments and judicial decisions.

The United States Constitution provides the framework for distribution of power between federal and state governments and between the executive, legislative, and judicial branches of government within the federal system. In the early years of the Union, the Founding Fathers contentiously debated the need for and desirability of having a weaker central government supplemented by stronger state governments as opposed to a strong central government. The Articles of Confederation, initially created to govern national affairs, adopted the former view of governmental authority. As the result of shortcomings in the Articles, the United States Constitution was developed furthering the latter concept of authority.

Besides denoting the powers and duties of each branch of government, the Constitution sets forth the enumerated powers of the federal government in Article I, Section 8. While the section contains 18 clauses, three clauses are more relevant for this discussion (Palmer, Palmer et al. 2007). The General Welfare or Spending Clause, embodied in Article I, Section 8, Clause 1, authorizes Congress to levy and

collect taxes and appropriate funds to promote the general welfare of the United States. The Commerce Clause, contained in Article I, Section 8, Clause 3, authorizes the regulation of commerce with foreign nations and Indian tribes, and among states. Finally, the Necessary and Proper Clause (Article I, Section 8, Clause 18) authorizes Congress to make laws necessary to implement the powers contained in Section 8, as well as other provisions of the Constitution. Among the other provisions, the Property Clause (Article IV, Sec 3, Clause 2) provides Congress the authority to dispose of federal lands and to make rules and regulations respecting those lands.

Other Constitutional provisions contribute significantly to understanding federal-state relationships. Section 10 of Article I, commonly referred to as the Compact Clause, provides that no states shall enter treaties without the consent of Congress. In *Virginia v Tennessee*, 148 U.S. 503 (1893), the Supreme Court clarified that congressional ratification is required only when the agreement has the potential to affect the political balance within the federal system or a power delegated to the national government. Since this decision provides a narrow exception, most compacts require Congressional consent.

Relationships between states and between federal and state laws are further clarified. Article 4, Section 1 serves as the basis for state-state relationships by requiring each state to give full faith and credit to laws, records, and judicial proceedings of the other states. Conflicts between federal and state laws are resolved through the Supremacy Clause (Article VI, Section 1, Clause 2), which provides the U.S. Constitution and federal laws are the supreme laws of the land. However, the Supreme Court has also used inconsistency with congressional power to regulate interstate commerce as the basis for invalidating state laws.

Balancing the enumerated Article I powers, the Tenth Amendment provides that powers not delegated to the federal government or denied states are reserved to the states. In addition, it has been interpreted as reserving “police powers” solely to the states for the protection of public health, safety, and welfare, as well as public morals (Palmer, Palmer et al. 2007).

Articles I through III of the Constitution vest powers and duties in the legislative, executive and judicial branches of government, respectively. Article III outlines the general cases and controversies subject to judicial review and provides that the U.S. Supreme Court shall exercise appellate jurisdiction, except in cases affecting ambassadors and other public ministers, or where states are a party. In those cases, the Supreme Court may exercise original jurisdiction; however, the Court has determined that its exercise of original jurisdiction is discretionary and should only apply to cases meeting a high standard.

State constitutions provide a similar framework for allocation of power between state and local governments and among the branches of state government.

Early implementation of federalism resulted in dual sovereignty—that is, the federal government and states both had the power to tax and spend and raise and support a military. The federalist doctrine during the period has sometimes been referred to as “layered cake federalism,” because each level (layer) of government attended to its functions without a great deal of cross-over. The federal government generally attended to foreign affairs, national defense, and regulation of commerce, while state governments exercised police powers, engaged in economic regulation, and tended to local affairs.

However, during this period which ended with the Civil War, two U.S. Supreme Court cases expanded federal authority. In *McCulloch v. Maryland*, 17 U.S. 316 (1819), Chief Justice John Marshall relied on the Necessary and Proper Clause in striking down a Maryland law imposing a tax on all banks in Maryland not chartered by the legislature. At the time, the only such bank was the Second Bank of the United States. Marshall noted that although the U.S. Constitution did not include the establishment of a national bank among the enumerated powers, the subject clause allowed Congress to act in such a manner as to effectuate its constitutional duties. As such, the federal government could exercise implied powers beyond those enumerated in the Constitution.

In *Gibbons v. Ogden*, 22 U.S. 1 (1824), the Court strengthened federal authority to regulate interstate commerce. This authority was subsequently further extended to include anything that had a substantial economic effect on commerce, even if that effect was only (*Wickard v. Filburn*, 317 U.S. 111

(1942)). Palmer, Palmer et al. (2007) provide a discussion of jurisprudence associated with the Commerce Clause and the Tenth Amendment.

Following the Civil War, the federal government became more active in regulating economic affairs as the United States entered the Industrial Revolution. States continued to focus on those powers traditionally exercised.

Implementation of New Deal programs, which ended the era of dual federalism and provided the national response to the economic crisis of the Great Depression, resulted in a drastic change in federal-state relations, commonly recognized as cooperative federalism (Stewart Jr, Hedge et al. 2008). The power of the federal government expanded dramatically through statutory enactments, judicial decisions, and federal program funding. Congress sought to expand the regulation of activities pursuant to its interstate commerce authority by enacting New Deal programs (Palmer, Palmer et al. 2007). Furthermore, while the Supreme Court had limited the federal government's Commerce Clause authority between 1880 and 1937, it did not strike down another statute as exceeding that authority between 1937 and 1995 (Palmer, Palmer et al. 2007). Federal assistance through grants-in-aid provided federal funding to assist states with a variety of programs, thus expanding federal involvement in many areas.

Kincaid (1990) and Stewart Jr, Hedge et al. (2008) characterized the federal-state relationship between 1960 and 1972 as creative federalism, because it was widely believed that the federal role was needed to achieve broader social objectives to which state and local governments provided impediments. During those years, Congress enacted federal laws establishing policies and programs for state and local implementation.

Many scholars have associated the emergence of new federalism with changes in the 1970s that sought to streamline government, decentralize federal programs, replace grant-in-aid programs with block grants, and provide state and local governments with more implementation authority (Stewart Jr, Hedge et al. 2008). The new federalism principles were furthered by Ronald Reagan's policies of reducing the size of government, further devolving authority to state and local governments, and reducing federal

spending by decreasing grant funding and requiring greater cost sharing. In some cases, those policies have continued in effect through subsequent administrations.

A crucial point bears mentioning here. In their research considering potential institutional arrangements for regional management of water resources in the Delaware River Basin, Martin, Birkhead et al. (1960) observed the existence of a general consensus that some policy problems lay beyond the jurisdiction of state and local governments to resolve, but lack significant national interest to achieve consideration from the federal government. In accordance with federalist principles, government functions were being carried out by federal, state or local governments, and therefore, little recognition existed regarding any need for multi-state regional governance. Moreover, ardent protection of sovereignty under the current system resulted in more resistance to establishment of regional organizations.

Derthick (1974) confirmed that some regional organizations (*e.g.*, the Port Authority of New York and New Jersey), were created for specific purposes; however, no sustained movement for the creation of regional organizations generally occurred due to lack of consensus on the appropriate powers for any organization and resistance for current federal and state agencies.

Federalism and Water Resources Management

Water resources management is complicated by federalism. First, water flows in hydrologic boundaries, not political boundaries. In addition, attempts to address water resource issues are subject to the same fragmented approach as other public policy issues.

The U.S. Constitution contains no specific provisions concerning federal or state authority over water resources. As a result, it has historically been accepted that water management is a state responsibility, except as such responsibilities may impact interstate commerce, in the broadest sense. Like the authority to implement other environmental and natural resource protection laws, federal authority for water resource management and control mostly stems from the Commerce Clause. Initially, federal interests were confined to navigation, but over the past 200 years, those interests have expanded to include flood control, irrigation water supplies, public water supply, hydroelectric power generation,

water pollution control, and water resources planning. To preserve states' rights to allocate surface waters, Congress has included provisions in federal environmental statutes specifically reserving those rights to state governments. However, arguments have been made that the U.S. Supreme Court has narrowed that authority over time with its jurisprudence on federal reserved water rights, despite Congressional efforts to make those rights subject to state adjudications in western states.

In providing a historical examination of federal water resource management, Gerlak (2006) described national water policy as “fragmented, incremental and crisis-driven” and the historical role of federal government as “informative, fascinating and schizophrenic.” Nineteenth century federal water resource management was characterized by federal plans to use the nation's waterways as a transportation system in accordance with the 1808 Gallatin Report. In 1850, Congress directed the Army Corps of Engineers, which was created in 1802, to engage in its first planning exercise, determining the most practical plan to control flooding along the lower Mississippi River. Congress created the first regional water management organization, the Mississippi River Commission, composed of seven, presidentially appointed members in 1879 and charged the Commission to facilitate improvement of the river for navigation, flood control, and commercial purposes. Following the Flood of 1927, the organization's focus turned more toward flood control and federal law was changed to provide that the Commission would serve in an advisory capacity to the Chief of Engineers. After more than 130 years, the Commission continues to carry out its functions, primarily through the U.S. Army Corps of Engineers' Mississippi Valley Division.

The turn of the 20th century saw the continued rise of the conservation movement with its initial focus on efficiency of resource use. Theodore Roosevelt, the movement's highest profile supporter was sworn in as President of the United States in 1901. Rational planning at the federal level largely governed resource development and use (Stewart Jr, Hedge et al. 2008). With the passage of the Reclamation Act of 1902, the federal role expanded to include the development of water supplies to support irrigation in with the Reclamation Service (now the Bureau of Reclamation, an agency in the Department of the Interior) constructing and operating large federal infrastructure projects in the western United States. The

principles of the conservation movement included a tenet that resource use should provide the greatest good for the greatest number of people for the longest time. Between 1907 and 1959, 20 commissions or committees evaluated aspects of national water policies and problems. (United States Senate Select Committee on National Water Resources 1959). A summary of selected endeavors is included in the following paragraphs.

President Theodore Roosevelt appointed an Inland Waterways Commission in 1907 to consider reasons for and resolutions to a lack of full use of inland waterways for transportation of goods. In his message transmitting the Commission's 1908 preliminary report, Roosevelt wrote:

Our river systems are better adapted to the needs of the people than those of any other country. In extent, distribution, navigability, and ease of use, they stand first. Yet the rivers of no other civilized country are so poorly developed, so little used, or play so small a part in the industrial life of the nation as those of the United States. In view of the use made of rivers elsewhere, the failure to use our own is astonishing, and no thoughtful man can believe that it will last. The report rests throughout on the fundamental conception that every waterway should be made to serve the people as largely and in as many different ways as possible. Each river system, from, its headwaters in the forest to its mouth on the coast, is a single unit and should be treated as such.

The report, which recognized rivers as public assets, expressed caution over monopolies taking over river development, and endorsed multiple-purpose development of rivers. It also recommended the establishment of a National Waterways Commission to coordinate federal water resources planning and development through creation of a comprehensive plan for the improvement and control of river systems.

By the 1920s, the focus of the conservation movement had evolved to embrace multiple-use projects, which in some cases favored preservation (Stewart Jr, Hedge et al. 2008). Advocates of multi-purpose use sought efficient management through use of the scientific method (Reuss 1992).

Despite the evolution of thought, the appropriate role of the federal government in water resource development remained a matter of considerable debate. Some leaders held that federal activities should be

restricted to navigation, while other officials supported extension of those activities to development of hydropower and irrigation water supplies (consistent with the Reclamation Act), drainage of swamp lands, erosion control, and purification of streams for use as water supplies.

Contemporaneously, western states were experiencing disputes over supplies and were attempting to resolve those disputes, primarily through litigation (judicial allocation). The emergence of interstate compacts as a mechanism to resolve western interstate water disputes can at least be partially attributed to the Reclamation Service's attempts to encourage resolution of those conflicts before any commencement of large-scale water projects. A final mechanism for resolving these disputes arose with Congress' passage of the Boulder Canyon Project Act of 1928, which congressionally allocated the waters of the lower Colorado River Basin. Of the three mechanisms, Congressional apportionment has only been used one additional time and the U.S. Supreme Court has diligently attempted to dissuade states from using the judicial apportionment to address water resource issues. See *New York v. New Jersey*, 256 U.S. 296 (1921); *Vermont v. New York*, 417 U.S. 270 (1974); *Texas v. New Mexico*, 462 U.S. 554 (1983).

Comprehensive planning for river basin development made significant strides as the result of the River and Harbors Act of 1927, which authorized the U.S. Army Corps of Engineers to complete comprehensive surveys of river basins and prepare plans for improvement of navigable streams, including the development of any potential for hydroelectric power, flood control, and irrigation. As a result, the Corps of Engineers, by 1935, completed more than 200 reports, commonly referred to as "308 Reports," because the list of subject streams was printed as House Document Number 308.

Changes affecting water resources management continued through the 1930s. The Great Depression resulted in the creation of work programs, such as the Public Works Administration, which were responsible for the construction of dams and other large public works projects. Other public works programs affecting water resources involved the Works Progress Administration and the Civilian Conservation Corps.

A national focus on natural resources planning, which included water resources, emerged as a result of studies by several boards and commissions, including the National Planning Board, National

Resources Board, National Resources Committee, and National Resources Planning Board. Most of these organizations, composed of federal agency officials and private citizens, were charged with developing plans for full development and wise use of natural resources. From a water resource perspective, studies and surveys used the watershed or river basin as the unit of evaluation and plans proposed uses of water for multiple purposes.

In the early 1930s, President Franklin Roosevelt supported the creation of valley authorities to foster regional economic development. Congress created the Tennessee Valley Authority, a federal government-owned corporation, in 1933, to serve such a purpose in the Tennessee Valley and to support navigation, flood control, and electrical generation in furtherance of development. The Tennessee Valley Authority emerged as the first regional water resource management agency. Contrary to the fears of many officials, the agency worked with state and local governments to accomplish its mission instead of becoming an authoritative super agency. Furthering his program, Roosevelt proposed the creation of six other valley authorities (Roosevelt 1937). Despite the opinions that the highly publicized success of the Tennessee Valley Authority would create broad support for additional authorities, no further legislation was enacted (Clark 1946).

Of particular note, the Depression Era also produced institutional arrangements that provided a classic example of cooperative federalism in water resource management. In 1935, Congress passed the Soil Conservation Act, which placed the Soil Conservation Service in the Department of Agriculture to implement programs for soil and water conservation, watershed protection, and flood prevention. To facilitate the implementation of its programs, the Service developed a model state act providing for the creation of state commissions and local districts. As a result, the national agency was better able to implement its demonstration projects through local districts.

The Flood Control Act of 1936 firmly established the federal government's role in flood control authorizing the U.S. Army Corps of Engineers to construct numerous projects. Under the act, project eligibility depended on certain assurances by state and local governments and the benefits of a project

exceeding costs. The latter requirement ended the Corps' participation in economically inefficient projects.

In 1943, the Federal Interagency River Basin Committee (commonly referred to as "fire brick" due to its acronym FIARBC), composed of representatives of the Corps of Engineers, Federal Power Commission and the departments of agriculture and interior, assumed the responsibilities of the National Resource Planning Board. Membership was later extended to include officials from the departments of commerce, health, education and welfare, and labor. Although the committee only served in an advisory capacity until 1954, its establishment represented the initial attempt at coordination of federal water resource management programs. The committee had limited coordination with state officials.

The Interagency River Basin Committee initiated the creation of several regional interagency committees that sought to further coordinate federal activities. Committees were established in the Missouri River Basin (1945), Columbia River Basin (1946), Pacific Southwest river basins (1948), Arkansas-White-Red river basins (1950); and New England basins (1950). These coordinating committees were never able to substantially improve interagency coordination or achieve integrated planning due to their advisory nature, failure to create strong relationships with state agencies, and lack of independent staff to implement duties (National Water Commission 1973).

The original Missouri River Basin Inter-agency Committee included representatives from four federal agencies and four states. With the assistance of the Council of State Governments, a draft Missouri River Basin Compact was tendered in 1953 creating a federal-interstate planning commission with no implementation authority (Harris 1983). Objecting to direct federal participation, a Presidentially appointed committee, the Missouri Basin Survey Commission, proposed creation of a 5-member governing body appointed by the President to direct the activities of federal agencies (Harris 1983). State involvement would have been limited. A third proposal providing for greater state participation was developed in 1957. However, none of the proposals were enacted (Harris 1983).

Presidential commissions of the late 1940s and early 1950s contemplated the reorganization of federal government agencies. In general, these commissions supported federal agency management and

coordination based upon major river basins, the establishment of a review board for federal water projects, and some reorganization of water resource responsibilities among federal agencies. The calls for preparation of comprehensive water development and management plans for all major river basins with state participation to the extent possible and the reorganization of some federal water resources responsibilities were affirmed by the 1959 report of the U.S. Senate Select Committee on Water Resources.

The Inter-Agency Committee on Water Resources (ICWR, referred to as “ice water”) replaced the Federal Interagency River Basin Committee in 1954 as the organization to provide coordination of water resource management activities among federal agencies. President Eisenhower charged the committee with improving the coordination of existing federal water resource-related programs and activities (Eisenhower 1954). The committee developed proposed standards for economic analysis of water resource management projects (Inter-Agency Committee on Water Resources 1958).

Under the creative federalism approach, the federal government began providing incentives for state engagement in water planning in the 1960s and set national environmental standards and priorities that state governments were expected to enforce (Huffman 2008). Kincaid (1990) observed that the approach worked, “by accommodating political change without seeming to do violence to tradition and by compensating state and local officials for federal intrusions into their authority with fiscal assistance and with federal assumption of policy decisions too painful to be made by some state and local authorities.”

Presidents Eisenhower and Kennedy supported comprehensive water resources planning for all major river basins. Eisenhower (1960) called for legislation authorizing the President to establish water resources planning commissions as needed in the various river basins or regions. Although he did not receive the authority from Congress, he appointed two ad hoc river basin study commissions, one for the Southeast and the other for Texas.

President Kennedy set a goal of developing comprehensive plans for all major river basins by 1970 and requested that Congress authorize planning commissions for basins, where existing plans might not be adequate (Kennedy 1961).

Federal water resources planning reached a high point with the adoption of the Water Resources Planning Act of 1965 (Public Law No. 89-80, 79 Stat. 245), which sought to provide for the best possible development of the nation's natural resources through the coordinated planning of water and land-related resources. The law established the Water Resources Council to oversee national efforts. Recognizing that rivers needed management and institutional arrangements should cover an entire river basin, the law authorized the President to establish regionally-based river basin commissions (Title II Commissions), upon request by the Water Resources Council or a state governor. To establish a council, written concurrence had to be obtained from all affected states. These commissions were charged with developing Level B river basin plans to coordinate between national planning and local project specific plans. The new law authorized federal matching grants to enhance state water resources planning.

Of the 21 national water regions, Title II river basin commissions were established in the following areas: New England River Basin Commission, Great Lakes Basins Commission, Souris-Red-Rainy River Basin Commission, Ohio River Basin Commission, Missouri River Basin Commission, and Pacific Northwest River Basin Commission (Willardson 1989). In addition, the Upper Mississippi River Basin Commission was expanded to include 22 states.

In a 1981 assessment of the effectiveness of the river basin commissions, the Comptroller General observed that the goal of river basin planning was to match the needs of water users with the available supply. The evaluation found that the river basin commissions did not achieve optimum planning and they "have not become the principal coordinators of water resource projects as intended--preparing up-to-date, comprehensive, coordinated, joint water plans and meaningful long-range schedules of water resources priorities"(Comptroller General of the United States 1981). The report recommended Congressional action, if the commissions were to be more successful in meeting some legislative objectives. Those legislative changes would have ensured continued state participation and regional water resources planning input to federal agencies for purposes of budget submissions (Comptroller General of the United States 1981).

In identifying reasons for failure of the river basin commissions to meet their mission, the 1981 Comptroller General report observed that federal and state agencies do not believe that the commissions have authority to prepare comprehensive plans, which are outside the traditional process for developing project-specific plans. However, specifying a primary reason for the failure, the Comptroller declared that the federal and state members of those commissions chose not to use their authority to support the collective decisions of the commissions. While the Comptroller supported continuance of the Water Resources Council and the river basin commissions with some legislative refinement, the U.S. Department of the Interior disagreed with the analysis and recommended that no funds be provided. In 1981, President Reagan withdrew funding and subsequently dissolved the Title II commissions by executive order.

Following the demise of those commissions, states moved to informal means of coordination through the establishment of the Missouri River Basin Association, Upper Mississippi River Basin Association, Arkansas-White-Red Rivers Inter-Agency Committee, Lower Mississippi River Conservation Committee, Great Lakes Commission, and New England Commission. These organizations, which provided soft management functions, provided for informal federal participation (Donahue 1988, Kenney 1995).

Continuing efforts to improve water resources management, Congress established the National Water Commission in 1968 to provide an overall assessment of issues. In its 1973 report, the commission identified the following recurring themes: (1) future water demands are not inevitable, but result from policy decisions within the control of society; (2) national priorities are shifting away from water resources development to restoration and enhancement of water quality; (3) water resources planning must be tied more closely to land use planning; (4) policies must encourage water use efficiency; (5) decision-making processes for water resources projects should include sound economic principles; (6) a re-examination of laws and legal institutions is needed in light of contemporary problems; and (7) development, management, and protection of water resources should be controlled at that governmental level nearest the problem (National Water Commission 1973, Viessman 1998).

The 1960s also witnessed the rise of the modern environmental movement catalyzed by Rachel Carson's book, *Silent Spring*. In response to public outcry, Congress passed water pollution control, species protection, and coastal zone management laws over the next 15 years. Planning provisions were contained in each of those 1970-era laws.

With the rise of new federalism in the 1980s, water resources planning not otherwise enshrined through the implementation of federal laws was either generally returned to the states with the devolution of program responsibilities or focused on water projects. New institutional mechanisms, such as interstate councils, emerged to facilitate planning. An example of such coordination is the establishment of the Northwest Power and Conservation Council, which sought to balance water resource needs for hydroelectric power generation and preservation of the salmon fishery.

Federal agencies also increased use of memoranda of understanding to establish informal working relationships. While effective implementation depended on cooperation, these mechanisms allowed agencies to retain control of resources during difficult budgetary periods.

Cole, Feather et al. (2005) observed that planning during the 1990s focused on integrated resource planning to achieve multiple objectives and adaptive management planning allowing resource managers to learn from implementation of management processes resulting in revision of unsuccessful processes. Federal agencies also broadened their traditional program specific planning to consider broader impacts on ecosystems. Ecosystem planning was adopted as a base approach by some federal agencies (Cole, Feather et al. 2005).

Given the pending shortages of water resources, particularly in the western United States, Gerlak (2006) found that national water policy is now emphasizing collaborative approaches between federal and state governments, whether through the creation of large institutional structures or cooperative agreements. Adaptive management principles are receiving consideration to deal with uncertainties and to provide flexibility in decision-making. Institutional arrangements are becoming more problem and process oriented (such as the Comprehensive Everglades Restoration Project).

CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

The complex, interdisciplinary nature of water resource management problems has motivated scholars from numerous disciplines to conduct research employing diverse methodological tools. Disciplines include biological and physical sciences, engineering, social sciences, and neo-classical economics. Due to an ever-increasing appreciation that solutions to water resource management problems lie in addressing relationships between persons and the biotic and abiotic environment, in lieu of structural modifications to the environment, an aspect of water resources management that is beginning to receive more attention is institutional analysis and design. The remainder of this chapter will provide the conceptual and methodological approach employed in this dissertation.

Institutional Analysis and Development Framework

Overview

To enhance the capacity for institutional analysis, Elinor and Vincent Ostrom and their colleagues at the Workshop for Political Theory and Policy Analysis at Indiana University developed the Institutional Analysis and Development Framework (Ostrom 1986, Ostrom 1990). The framework provides a “systematic method” for examining how institutions affect the behavior of individuals in collective action situations (Ostrom 1999).

Before moving to a more detailed discussion of the framework, it is important to define key terms. Institutions are “shared concepts” developed and used by individuals in recurring interactions structured by rules, norms, or strategies (Ostrom 1999). As Professor Ostrom notes, institutions may be formally established through written laws, regulations or policies, or informally arise, simply existing as the result of customs, habits, or practices. Kenney (1995) explained that, from a water resource management perspective, “Institutions determine how, and by whom, water resources are utilized or governed in a specified region.”

Rules refer to mutually-understood commitments that require, allow or authorize, or prohibit actions and are predictably enforced by a person(s) charged with monitoring behavior and imposing sanctions for violations. Norms are mutually-understood commitments that are enforced by participants

through imposition of costs or by offering inducements. Finally, strategies consist of individual plans given the structure of incentives and the expectation of behavior by other individuals (Crawford and Ostrom 1995, Ostrom 1999, Ostrom 2010).

Institutional arrangements may include enforceable laws and regulations, public and private organizational arrangements, or shared informal norms or standards (Heikkila 2004). For purposes of this dissertation, coordination mechanisms, such as compact commissions, are collections of institutional rules or institutional arrangements, and may sometimes be referred to as organizations (Kenney 1995). As will be discussed further, effective institutional arrangements depend on physical setting (resource characteristics) or environment and community characteristics (Heikkila 2004).

The Institutional Analysis and Development Framework sets forth features that should be analyzed in determining how institutions affect actions of individuals and outcomes. The primary unit of analysis is the action arena, which includes the action situation and actors. Action situations are social spaces (*e.g.*, forums) where participants having various preferences interact, exchange goods and services, solve problems, or engage in conflict (Ostrom, Gardner et al. 1994, Ostrom 1999). Actors include individuals or organizations exhibiting preferences chosen based upon available information and selection mechanism, and other behaviors (Ostrom 2005). Actors may have positions in more than one level and may move among the different levels to seek their best outcomes within a given set of rules (Schlager and Blomquist 1996).

The structure of an action arena is affected by biophysical conditions, community attributes, and rules-in-use, as opposed to rules-in-form (formally adopted rules) (Ostrom 2005). Biophysical conditions, which can include the physical extent of the resource, any resource problems, resource mobility (flowing/stationary), storage capacity, biotic and abiotic interactions, and the economic nature of a good, provide information on the physical environment in which an arena sits. Community attributes encompass a wide range of variables such as stakeholder participation, history of prior efforts, community leadership, and local economic conditions. Rules-in-use establish what actions are permitted, required, or prohibited—that is, the dos and don'ts used by actors in everyday activities in an action situation (*e.g.*,

how something is done here) (Schlager 1999, Ostrom 2005). The framework posits that interactions with other individuals also affect actions and outcomes. For purposes of further discussion, Kenney and Lord (1999) simplified the framework components in their consideration of natural resource management institutional arrangements to provide that an action situation consists of the environment (biophysical conditions and community attributes), actors and their associated behaviors, and institutional rules.

Behavioral Models of Man

When considering the anticipated behaviors of actors, the framework relies on models of human behavior. The most well-known model, *homo economicus*, describes individuals as seeking to maximize well-being, as a consumer, and profit as a producer. The model contains controversial assumptions, including a motivation to act solely in a self-interested manner, the existence of well-structured preferences, and access to complete information. Kenney and Lord (1999) distinguished two other models: the adaptive, problem-solving man portrayed through evolutionary biology, and “organization man,” who acts in a socialized manner as a “rule-bound actor.” The authors further observed that the model most useful for institutional analysis combines attributes of all three models to represent an individual recognizing the vital role of self-interest while accepting the value of learning and socialization in taking actions (Kenney and Lord 1999). However, unlike the modeled actors, human behavior and decision-making is limited by available time and resources, cognitive capacity of an individual, complexity and uncertainties of situations, and the lack of perfect information resulting from the exercise of “bounded rationality” and “satisficing,” seeking a satisfactory solution rather than an optimal one (Simon 1982). As a result, actors are significantly influenced by rules, but competent to evaluate and revise those rules based on experience. Kenney and Lord (1999) observed the potential limitations of the models of behavior relating to water resource management disputes, which in many cases may involve passionate views and contentious encounters.

Seven Types of Rules

Under the Institutional Analysis and Development Framework, seven types of rules are identified (Ostrom 1986, Ostrom 1990). Kenney (1995) and Kenney and Lord (1999) identified some water resource-related examples, which are included below.

- Scope rules delineate the institutional domain to which the rules are applicable, such as a river for purposes of operational level rules.
- Position rules set forth the roles that actors (stakeholders) play, such as regulator, water user, monitoring official, adviser, or litigant.
- Boundary rules identify how actors enter or leave positions and may include requirements for financial resources, technical or procedural understandings or other qualifications. Some individuals may fill more than one position, but are charged with implementing separate responsibilities based upon each role.
- Authority rules define which actions shall be taken, may be taken, may not be taken, and shall not be taken. These rules may be contained in statutes, regulations, operations' manuals, unofficial operating procedures, or even, customs.
- Information rules specify the manner in which information is generated, distributed and used in decision making.
- Aggregation rules map the actions of individuals holding positions into a collective result, in many cases, voting. Kenney and Lord (1999) describe an alternative pattern where aggregation rules would determine how "the actions of a reservoir operator, water utility manager, and instream flow monitor combine to produce an outcome composed of water deliveries and instream flows" consistent with institutions of the prior appropriation doctrine.

- Payoff rules identify the distribution of costs and benefits and may be used to recognize winners and losers in action situations.

Three Levels of Analysis

Recognizing that decision situations occur across several levels (that is rules are nested within other sets of rules), the Institutional Analysis and Development Framework recognizes three levels of rules: operational, collective choice, and constitutional choice (Kiser and Ostrom 1982, Ostrom 1990, Ostrom, Gardner et al. 1994). Operational rules impact day-to-day activities and usually reflect decisions made by resource users in accordance with one or more institutions, such as rules governing access to surface water supplies. Operational level rules include management options and water law, whether derived from common law or statutory requirements (Kenney and Lord 1999). Actors generally want to get most favorable water management rules at the operational level.

Collective choice level rules identify how operational rules are made and may be revised, including which actors can participate in that collective choice process (policy-making). As the name implies, collective choice rules are made in groups settings, such as legislatures, courts, and committees and often involves negotiation, litigation, voting, and other forms of cooperative or conflict resolution actions. Water resources planning is carried out at the collective choice level (Kenney and Lord 1999).

Constitutional level rules specify the means for making and revising collective action rules. As the highest level of rules, which usually are made by legislatures and courts, these rules are not considered open for changes as the result of water resource management problems (Kenney and Lord 1999).

Operational Level Problems

Water resource management problems at the operational choice level, like problems facing other natural resources, commonly result from dissatisfaction of the distribution of benefits and costs or adverse impacts (Kenney and Lord 1999). From economic theory, the authors set forth a typology classifying problems into four categories. Depletion problems describe conditions where the time distribution of

resource use rates is shifted from the future to the present (Ciriacy-Wantrup 1971). As an aside, it is noteworthy that conservation, the opposite of depletion, applies to rates of resource use shifting from present time to the future. Depletion problems may often occur where a resource is open access and its use rivalrous. Because there are no rules regarding use of the resource, no property rights exist (Bromley 1992). Some scholars have posited that surface water resources fall into this category; however, surface water resources in the United States are typically considered common pool resources as some institutional control usually exists for large extractions. Depletion problems, which affect common pool resources, often result from a disagreement among actors who want to use resources at high rates and parties seeking to favor future use or no use at all (Kenney and Lord 1999).

Underinvestment problems occur when the anticipated future productivity of a resource is disproportionately limited by a lack of current management expenditures, thus resulting in a smaller-than-desired future availability. Public goods (goods where use by any individual cannot be excluded and where such use does not diminish the availability of the good for use by others) are often subject to underinvestment problems. For example, the provision of clean air is subject to underinvestment problems; however, air pollution (an externality) is controlled through regulation or market incentives.

Depletion and underinvestment problems exhibit symmetry from an economic perspective—that is, use of a resource by one user imposes costs on that user and other users and vice-a-versa. Conversely, in problems such as maldistribution and the presence of externalities, resource use by one actor imposes costs on others, but not vice-a-versa. The concept is important because in situations exhibiting symmetry, all parties are at least partially incentivized to resolve problems; however, in asymmetrical situations, some actors benefit by the status quo (Kenney and Lord 1999).

Maldistribution problems, more commonly referred to as scarcity, occur due to the perception of the inadequate allocation of a finite resource-based good or service. In strictly economic terms, scarcity exists when an insufficient quantity of a resource exists, at a zero price, to meet the desires of all users and any allocation of those resources results in opportunities for one user(s). Controversy often exists over the use of economic efficiency or equities as the basis for resource allocation. Because actors (users)

are directly competing for resources, problems result when operational choice rules leave some users dissatisfied due to inefficiency or inequity in distribution (Kenney and Lord 1999).

Externalities are costs or benefits resulting from an action or transaction imposed on a third party who did not agree to incur the cost or benefit. More simply cast, externalities result when all benefits or costs of a decision do not solely affect the decision-maker. Externalities are usually incidental and unintended effects resulting from competition in resource use. Negative externalities mostly involve harms or uncompensated costs to third parties or society. Pollution is a classic example of a negative externality, because without intervention, the generator has no incentive to reduce activities resulting in pollution. Kenney and Lord (1999) observed that externalities may not be captured by existing institutional rules because use and the effects of externalities may be spatially and/or temporarily separated.

Collective Choice Level Problems

Kenney and Lord (1999) recounted that the resolution of operational level problems often occurs at the collective choice level where operational rules are made. As is the case with the operational level, problems can also exist at the collective choice level. However, these problems are of a completely different nature and may be classified into three categories: interest conflicts, value conflicts, and cognitive conflicts (Kenney and Lord 1999). Interest conflicts develop from disagreements over the allocation of resources caused by the economic and other direct impacts of use which in many situations results in one party gaining and another losing. Value conflicts stem from disagreements over what is right and wrong. For example, value conflicts may pit a preservationist against a utilitarian. Cognitive conflicts arise from disagreements over the facts of a matter. These types of conflicts must often be addressed in collective choice bodies (Kenney and Lord 1999).

Common Pool Resource Theory

Numerous theories are compatible with the Institutional Analysis and Development Framework, including: microeconomic theories, game theory, transaction cost theory, social choice theory, and theories of public goods and common pool resources (Ostrom 1999). Beginning in the mid-1980s,

scholars began to apply the framework in common pool resource management studies. Consistent with the framework, researchers at Indiana University developed a theory of common pool resources, as well as several models of common pool resource appropriation that have been subjected to field and/or laboratory testing.

The theory of common pool resources provides researchers insights into the reasons individuals engage in collective action, create institutions to address common pool resource dilemmas and what types of rules make those institutions successful (Ostrom 1990).

Ostrom (1990) provided the following overview. The theory uses the individual as the unit of analysis and is predicated upon the *homo economicus* behavior model discussed above. Acting in a self-interested manner, an individual may achieve short-term personal benefits, but he/she does so at a cost to society. As a result, suboptimal outcomes, commonly referred to as common pool resource dilemmas, are produced. Because these dilemmas often involve complex situations where problems may be poorly defined and complete information may not exist, individuals will likely behave in a boundedly rational manner, as discussed above (Ostrom 1990). Therefore, individuals may not always act to maximize their well-being; however, they might be incentivized to act through collective action to achieve better solutions (more optimal outcomes).

Collective action suggests that two or more people sharing a common interest will act to achieve that interest. Impediments to and incentives for collective action exist. Olson (1965) suggested that incentives to free-ride (receive the benefits without paying the costs) exist in any group pursuing collective action. In collective action efforts to establish institutional arrangements to avoid dilemmas, rules must be included to avoid/reduce free-riding problems.

Transaction costs often impede collective action toward establishment of institutions to address common pool resource dilemmas. These transaction costs include search costs, bargaining costs and monitoring and enforcement costs (Ostrom 2001). The time, money and effort spent in identifying alternatives and potential collective action partners result in search costs. Bargaining costs result from the negotiation by potential participants in an institutional arrangement. Once institutional arrangements are

reached and rules are established, monitoring and enforcement costs are sustained to ensure compliance with the rules (Ostrom 2001). As anticipated, institutions are created where benefits outweigh costs.

Researchers have identified certain characteristics of resource users that may favor the formation of institutions through collective action to address common pool resource problems by reducing transaction costs (Ostrom 2001). For example, users that share a substantial dependence on the resource base for their livelihood may have a low discount rate because they seek to sustain the resource for future generations (Ostrom 1990). In addition, users may be more likely to work together if they have autonomy to create and implement rules and have some prior experience in organizing efforts (Ostrom 2001).

Some resource attributes may also facilitate collective action. In general, joint efforts are more likely to emerge, if a resource is not so degraded that restoration appears infeasible and where dependable indicators exist for assessing the resource condition (Ostrom 2001). Institutions also more likely to come forward if users can identify resource boundaries (thus allowing them to determine who is using the resource) and where resource flows are relatively predictable (Ostrom 1990). Imperial (1999) observed that collective action problems can be overcome through proper institutional design.

The literature on common pool resources examines management challenges and identifies the physical characteristics of a resource, community attributes, and rules-in-use that may be associated with the phenomenon of interest (Ostrom 1990). Most studies involve smaller-scale resource systems or single institutions, including coastal and inshore fisheries (Ostrom 1990, Schlager 1994), irrigation systems (Hilton 1992, Tang 1994, Lam 1996), groundwater basins (Blomquist 1994), community forestry (Ostrom 1990, Agrawal 1994), and communal land management (Ostrom 1990).

Complementing the work on common pool resource management, significant research has been done in the area of collaborative approaches to watershed management (Lubell, Schneider et al. 2002, Imperial 2005, Sabatier 2005). The results of these studies have demonstrated that resource users have been able to engage in collective action and establish institutions providing self-governance of common pool resources, as substantiated by empirical research. Hundreds of watershed projects, groups and partnerships have been established to perform numerous different functions (McGinnis 1999, Lubell,

Schneider et al. 2002). As is the case for common pool resources management, much research has focused on smaller collaborative organizations, watershed groups (Chess and Gibson 2001, Lubell, Schneider et al. 2002, Bryan 2004, Lubell 2004, Lubell 2004, Bidwell and Ryan 2006). These groups pool knowledge and resources, develop common understandings of present water resource uses and problems and potential future conditions, and engage in collective decision-making, typically through consensus processes (Conley and Moote 2003). Because a broad cross section of stakeholders with a wide range of interests participate in the consensus-building process, proposed solutions may have greater legitimacy and social capital (trust) is built to facilitate further interactions in overcoming conflicts (Koontz and Johnson 2004). Collaborative organizations may also facilitate the development of relationships between the “top” (governmental officials) and the “bottom” (communities) (Sabatier 2005, Gerlak 2008).

While definite advantages exist, concerns have been raised regarding the extent to which use of a consensus process or unanimity rule in decision-making results in an “everyone must get something” mentality to ensure actions (Woolley and McGinnis 1999).

Of particular relevance to this dissertation research is a finding that common pool resources that are part of a larger system are most successfully managed through institutions that include governance at multiple levels (Ostrom 1990). The concept of polycentric governance involves a governance system where multiple, overlapping “centers of power” exercise independent management authority, but choose to act considering other centers of power through processes of cooperation, competition and conflict resolution (Ostrom, Tiebout et al. 1961, Ostrom 1990). Based on an examination of literature on adaptive management in water resource governance, Huitema, Mostert et al. (2009) found theoretical backing supporting the use of polycentric systems. The polycentric nature of the systems allows better management of uncertainties and makes organization less vulnerable to failure. Disadvantages result from loss of economies of scale (increased transaction costs due to coordination among many units) and loss of “democratic accountability” (Huitema, Mostert et al. 2009). Speaking to another common criticism,

Imperial (2005) emphasized that duplication of efforts does not always result in an unneeded redundancy and increased transaction costs dissipate over time as trust among units build.

Although past studies have largely attended to management of common pool resources at smaller scales, recent initiatives have begun to focus on large-scale, regional, or multi-user/multi-jurisdictional institutions. These initiatives seek to define the characteristics of collective efforts, explain the formation of these institutions, and identify factors that make these institutions successful (Heikkila and Schlager 2008). Lubell (2000) compared estuaries participating in the U.S. Environmental Protection Agency's National Estuary Program (NEP) with non-participating estuaries and found that the presence of governance institutions had a positive effect on political actors' perceptions of policy.

Recent evaluations of regional collaborative resource governance have examined multi-jurisdictional institutional arrangements in large-scale ecosystems. In a 2005 study, Heikkila and Gerlak considered factors potentially affecting the formation of regional collaborative resource governance in four areas. The study examined the development of regional institutional development in light of the variables contained in common pool resource theory, the emergence of "policy entrepreneurs" (from Blomquist 1992), the presence of outside institutional factors, and the use of science in decision-making. The Northwest Power and Conservation Council, created in 1980 through an interstate agreement between Idaho, Montana, Oregon, and Washington, seeks to balance the regional needs for power generation through coordinated planning while restoring fish populations in the Columbia River Basin. The Chesapeake Bay Program, a partnership involving representatives from Maryland, Pennsylvania, Virginia, the District of Columbia, and the U.S. Environmental Protection Agency targets program activities to reducing pollution in and restoring the bay. The CALFED San Francisco Bay/Sacramento-San Joaquin River Delta Program, a 1994 partnership between several federal agencies and the State of California, works to improve the state's water supply and ecological conditions in the Bay-Delta. Authorized by the Water Resources Development Act of 2000, the Comprehensive Everglades Restoration Program is designed to restore and protect the South Florida Ecosystem. Program activities are coordinated through the South Florida Ecosystem Restoration Task Force, which includes

representatives of federal agencies, tribal governments, state agencies, local governments, and the South Florida Water Management District.

Consistent with the theory and empirical evidence for smaller-scale systems, the study found that collective action in the formation of regional institutions was facilitated by a common understanding of resource conditions and the significance of problems, as well as a history of relations between the stakeholders resulting in better communication and more trust (Heikkila and Gerlak 2005). The enhancement of institutional development as a result of prior cooperation and frequent communications (referred to as building social capital) is also consistent with research on smaller-scale systems (Lubell, Schneider et al. 2002).

Study findings further confirmed that the emergence of leadership among the stakeholders (policy entrepreneurs) and “external institutional triggers,” such as lawsuits, Congressional acts, or comprehensive studies supported institutional development. In addition, while scientific information is often filtered through several sources and, thus not completely value-free, such information tended to play a greater role in refining aspects of newer programs (Heikkila and Gerlak 2005).

In a subsequent study, Gerlak and Heikkila (2006) examined collaborative governance within the same four institutions. The Institutional Analysis and Development Framework was used to assess collaboration at three levels, the operational or implementation level, collective choice or policy-making level, and constitutional choice levels. As provided in the framework, characteristics of the natural environment and “community” attributes were considered (Gerlak and Heikkila 2006). Although each institution has a different organizational arrangement, common obstacles such as conflicting goals, inflexible legal and administrative procedures, and limited financial resources were present.

Consistent with many of the resource conditions and user attributes that lead to collective action on smaller scales, the 2006 study also found that each area faced serious water resource management challenges resulting from multiple causes. Institutional arrangements were further facilitated due to economic interdependence and a history of cooperative efforts on other issues (as noted in the previous study results). All organizations maintained a commitment to adaptive resource management. In

identifying difficulties, Gerlak and Heikkila (2006) emphasized that organizations also grappled with incorporating science into the decision-making process and identifying appropriate performance indicators subject to monitoring. Additionally, the study results profoundly noted, “politics and economic interests are always in the mix” (Gerlak and Heikkila 2006). Despite the multitude of challenges, these organizations continue to address water management issues.

Coordination Mechanisms for Interstate Water Management

As noted above, the organizations studied by Heikkila and Gerlak were created using a variety of coordination mechanisms or institutional arrangements. Mechanisms have been classified using structural criteria (Hart 1971, Water Resources Council 1973) and functional criteria (Derthick 1974). However, Kenney (1995) created the following typology for water resource-related mechanisms based upon the legal foundation and jurisdictional membership.

Interstate Councils

Interstate councils may be established by federal legislation (*e.g.*, Northwest Power and Conservation Council), multi-state legislation, multi-state resolution, or informal agreement, such as the case of the Western States Water Council that will be discussed further in Chapter 3 (Donahue 1987). Aggregation rules usually involve unanimity decision-making, while authority rules typically limit actions to soft management functions. Decisions are implemented agencies and organizations through traditional institutions in each member state. Advantages of this form of mechanism include flexibility and the relative ease related to establishment of an organization. Disadvantages include a general lack of formal federal participation and a high dependence on political support for continued operations.

Basin Interagency Committees

As discussed earlier in this chapter, basin interagency committees have historically been used in attempts to foster improved coordination among federal agencies. In some cases, provisions were made for state participation. These committees are commonly created by memoranda of understanding or executive orders. Because the authority is strictly limited to advisory capacity, aggregation rules do not play a significant role, but unanimous decisions carry greater legitimacy. Participating agency staff and

budgets usually support committee activities. As such, committees are easier to create and low cost to operate, in most cases. A significant weakness results from lack of implementation authority and the need to rely on existing agencies, which may accept or reject recommendations, to implement decisions. Little motivation exists to reach agreement on issues or courses of action.

Interagency-interstate Commission

Another mechanism with historic roots is the interagency-interstate commission, which may be created by legislation. Classic examples include the Title II commissions created under the Water Resources Planning Act of 1965 to develop comprehensive basin-wide plans. Each participating member contributes financial support. Authority rules usually specify soft functions and aggregation rules provide for decisions by unanimity or consensus. Commissions were perceived to have a great legitimacy, because of the legislative underpinnings, co-equal federal-state relationship, and independent staff. While not a Title II commission, the Gulf of Mexico Program, Policy Review Board fits appropriately into this category due to its creation under the Federal Advisory Committee Act, federal-state interagency membership, and independent staff.

Interstate Compacts

Interstate compacts are widely used in the allocation of interstate water resources in the American West. Most compacts are administered by a compact commission, comprised of gubernatorial appointees and non-voting federal representatives. Compact commissions are generally charged to address a single issue or limited suite of issues associated with water allocation, pollution control, flood control and planning, and project development and implementation (National Water Commission 1973). Decisions typically require unanimous consent. Budgets and staffing vary considerably. Because several commissions lack adequate budgets and staff, the mechanism operates more like an interstate council (Kenney 1995).

The Council of State Government's National Center on Interstate Compacts tracks information regarding almost 200 agreements addressing matters ranging from environmental protection to transportation regulation, from provision of services to criminal justice activities, and from the traditional

areas of boundary resolution to regulation of rivers and water resources. However, 24 agreements have been ratified by only one state and are not effective. Of the remaining 175 interstate compacts in effect in 2003, 59 were bilateral, such as Mississippi-Louisiana Rapid Rail Transit Compact (Voit, Vickers et al. 2003). The Utton Center identified 50 water-related compacts with 26 agreements affecting water allocation, mainly implementing equitable apportionment. Most of these compacts are more than 50 years old (Muys, Sherk et al. 2007).

Early in the history of compact development, Minard (1937) pointed out that efforts to achieve voluntary agreements have been hampered by “sectional prejudice, political expediency, and other irrelevant, often selfish, considerations which have no relation whatever to the merits of the proposition...” More recently, the National Water Commission (1973) endorsed compacts as the best institutional approach for multi-state water resources planning and management. The General Accounting Office added that use of interstate compacts was a promising new area to explore (Comptroller General of the United States 1981). The U.S. Advisory Commission on Intergovernmental Relations (1972) claimed that the compact had the potential to produce closer coordination of federal and state water management efforts. Despite the fact that the interstate compact mechanism has been extolled for its success in intergovernmental coordination, the rate of compact development and approval has declined since the 1960s (Nice 1987).

In 2005, the National Science Foundation funded researchers at the University of Arizona to study interstate compacts as collective choice mechanisms for resolving environmental conflicts. Examining institutional arrangements of 14 interstate river basin compacts, the researchers found that despite their use of unanimity rules or consensus decision-making, interstate compacts are not as inflexible as believed and commissions do have capacity to adapt to changing conditions (Schlager and Heikkila 2007). Although a given conflict may be addressed in different forums, compacts have mostly addressed “zero sum distributional conflicts” by changing operational rules (Heikkila and Schlager 2007). Thus, commissions are highly unlikely to address complex conflicts (those involving multiple issues),

matters raising differences between state laws and compact commitments, and disputes between upstream and downstream states, particularly those involving distributional issues (Schlager and Heikkila 2009).

Federal-interstate Compact Commissions

Federal-interstate compact commissions involve institutional arrangements where the federal government participates as an equal partner. As will be discussed further in Chapter 3, the establishment of the Delaware River Basin Commission provided the initial test of this mechanism. By authorizing very broad water management responsibilities, the compact resolved constitutional issues on river basin management. Compact commission members include governors of participating states (their alternates) and a federal representative, either appointed by the President of the United States or named in statute. In most cases, aggregation rules require majority-based decision-making. Participating parties fund activities and Independent staff implement policies and programs. The only other operating federal-interstate compact commission is the Susquehanna River Basin Commission, enacted in 1970. Proposals for other federal-interstate compact commissions failed for the Missouri River Basin and the New England river basins. While the Potomac Valley Compact sought to create a federal-interstate compact commission, the enacted compact did not include a federal signatory. The Interstate Commission on the Potomac River Basin allows federal representatives full voting privileges.

The now-terminated Alabama-Coosa-Tallapoosa River Basin Compact and the Apalachicola-Chattahoochee-Flint River Basin Compact created federal-interstate commissions composed of state officials and a non-voting federal member.

Commenting on the utility of this mechanism, the Comptroller General of the United States (1981) observed, “The future effectiveness of federal-interstate compact commissions will depend to a great extent on the members’ willingness to support and fully participate in them, even at the cost of occasionally sacrificing their individual prerogatives.” Joseph Dellapenna (2007) claimed that the best model for an institutional arrangement where water is managed as a public good across political boundaries through a regime of public management that coordinates private uses and public needs and has the ability to respond to changes is the Delaware River Basin Commission.

Federal Regional Agency

The establishment of a federal regional agency with responsibilities for water management has occurred once, in 1933. As discussed previously in this chapter, the Tennessee Valley Authority is a government owned corporation headed by a presidentially-appointed board of directors. During its tenure, the agency has focused on flood control, power production, navigation, and regional economic development, and relevant water resource management concerns related to those issues. Strengths of this mechanism include its basin-level focus, significant formal authority, and integrated planning and development emphasis. As discussed, its principal weakness is the lack of replicability.

Single Federal Administrator

A single federal administrator mechanism has also seldom been used. In accordance with the 1922 Colorado River Compact, a single federally appointed administrator (the Secretary of Interior, in that case) has statutorily sanctioned decision-making authority over use and management of a resource. River masters, appointed by the U.S. Supreme Court to oversee judicial allocations of rivers, also arguably fall into this category.

Considerations in Establishing Arrangements for Regional Coordination of Water Resources

Authors and scholars have identified numerous important principles in establishing institutional arrangements for regional coordination of water resources management activities. A significant aspect involves the appropriateness of scale or regional identity (Kenney 1995). While scales can range from a single river basin to multi-river basins, scope rules must be careful to ensure that the resource scale allows stakeholders to have some sense of shared stewardship (Leitman, Dzurik et al. 1996). Regional identity may be enhanced by common social development patterns, shared cultures, and similar economic dependencies and development patterns. A strong regional identity results in an improved shared understanding of resource conditions, including resource boundaries and the finite nature of the resource, and a facilitated development of a shared vision for future conditions. Development of a regional identity may occur through social learning (Leitman, Dzurik et al. 1996). The concept of regional identity evolved from geographer's research on regionalism. Paasi (2003) provided additional information on this topic.

Authority rules must clearly specify powers and duties. Depending on the nature of the institutional arrangements, rules may address program and project coordination, monitoring, data collection and analysis, planning, development of policy recommendations, and conflict/dispute discussion and resolution forums, sometimes referred to as soft management functions. In the alternative, rules may also authorize programmatic implementation through project approval requirements, permit issuance, and enforcement (hard functions) (Kenney 1995, Leitman, Dzurik et al. 1996).

Success can be facilitated by development of proper position rules. Participation can vary from just federal, state and local government officials to a broad base of stakeholders. While increased participation by interested parties increases the legitimacy of decisions, it also complicates organizational implementation of ensuring that such participation is meaningful. Development of a polycentric structure can ease organization dilemmas (Kenney 1995, Leitman, Dzurik et al. 1996).

Development of appropriate operational processes and strategies facilitates implementation. Clear goals and objectives that are reevaluated on a periodic basis help focus efforts on tasks to be accomplished and means to accomplish those tasks (Leitman, Dzurik et al. 1996). Aggregation or decision rules clearly identify how decisions will be reached (*e.g.*, unanimity, consensus, super majority, or simple majority). Application of technical decision-making processes and appropriate use of technology, such as model development, can reduce the impact of politics on decision-making (Kenney 1995). To the extent possible arrangements should avoid conflicts with the missions of existing organizations. Other attributes such as balancing autonomy with accountability, application of adaptive management principles to address uncertainties, and the presence of an independent staff, should receive consideration (Kenney 1995, Leitman, Dzurik et al. 1996).

Other factors include minimization of perceived threats to state sovereignty, use of legal structures providing sufficient implementation authority commensurate with functions and responsibilities, and provisions for obtaining appropriate funding (Kenney 1995).

Perhaps, most importantly, Kenney pointed out that expectations must be realistic and managed. Organizational goals and objectives should reflect resource availability, public and political support, technical and administrative capacity, realistic timeframes for action, and water resource characteristics.

Lord (1984) identified more general considerations for considering mechanisms and developing institutional arrangements. Consideration of facts must be separate from consideration of values. Science and technology, which consider facts, can inform policy decisions, but cannot make these decisions or eliminate all uncertainty associated with them. Politics and ethics address value considerations. Benson (2005) observed, "Progress toward comprehensive management cannot be accomplished through scientific inquiry alone, but rather requires stakeholders and management agencies to work with scientists in a collaborative learning process, such as that framed by adaptive management principles."

Among the other relevant factors are the need to separate social values from self-interest and avoidance of use of technological changes to address institutional failures (Lord 1984).

Impediments and Inducements to Regional Action

Impediments

Based on their evaluation of institutional alternatives for the Delaware River Basin, Martin, Birkhead et al. (1960) identified several impediments to regional action. Because a watershed or river basin is a hydrologic concept with a sound scientific basis, challenges result from people's inability to relate their experiences to the concept of a river basin. People's experiences are generally determined locally, which to some extent inhibits the development of regional identity, particularly for places lying farther away in a river basin. As previously mentioned, this lack of regional identity or awareness impedes shared understanding of regional problems and challenges. Moreover, identity problems are exacerbated by numerous governmental agencies and units, private entities, and interest groups, each pursuing their own agenda.

Public policy decision-making tends towards crisis mentality or crisis management. As a result, thorough the consideration of all relevant factors, including the optimal scale for management actions,

may not occur. Martin, Birkhead et al. (1960) observed, “When the need for action has grown urgent, the time for thoughtful action has passed.”

Other complicating forces include intraregional rivalries for economic and industrial development, rural-urban controversies, and upstream-downstream challenges.

Philosophical tendencies, such as citizen’s predispositions regarding the “big government” versus “little government” conundrum, can also pose significant challenges. “Since the welfare of the individual is the end of government, public action must be kept as close as possible to the people, that ‘little government’ therefore has a substantial monopoly of virtue, and that ‘big government’ as a natural consequence is to be viewed with suspicion if not outright alarm” (Martin, Birkhead et al. 1960).

Supporting many of the previously discussed hindrances, Leitman, Dzurik et al. (1996) also included perceptions regarding competition for “turf” with existing agencies and the addition of a new layer of bureaucracy. Additional barriers may be posed by the potential for increased costs and lack of leadership.

Inducements

Inducements toward regional action can take many forms, including crisis and catastrophe, economic circumstances, leadership, and windfall (Martin, Birkhead et al. 1960). Numerous instances exist where crisis and catastrophe have stimulated adoption of otherwise potentially unattainable policy solutions. These situations involve public health emergencies resulting from water pollution, industrial pollution causing rivers to catch fire, floods and their related damage leading to establishment or changes in building codes, and droughts and water shortages foreshadowing revisions to state water policies and implementation of conservation measures. However, once the crisis is past, the old adage, “out of sight, out of mind,” often takes hold (Martin, Birkhead et al. 1960).

Economic characteristics of water resources often benefit from economies of scale. Programs and projects typically require large capital investments and, as a result, can operate more efficiently over large scales. Furthermore, regions of the country also face similar economic circumstances that may spur consideration of regional solutions (Martin, Birkhead et al. 1960).

The establishment of any regional organization commonly involves leadership (often referred to as “champions”)—that is, government officials or other interested parties working tirelessly to achieve the goal of regional coordination. This leadership, often not politically popular, requires that vision be applied on a larger scale, beyond a state, area or district (Martin, Birkhead et al. 1960).

As is the case with many situations, regional action almost always requires some form of financial incentive, usually from the federal government. Incentives may include federal funding for essential studies, implementation of programs, or federal water projects, if states are willing to work cooperatively. An example from the earlier discussion includes the Reclamation Service’s willingness to encourage states to resolve interstate water disputes before large projects would be funded. In addition, the collaborative success enjoyed by the Gulf of Mexico Program is to some extent a result of financial support contributed annually by the Environmental Protection Agency.

Limited transferability of institutional arrangements exists in river basin management. Nowhere is this limitation better demonstrated than with the Tennessee Valley Authority. Martin, Birkhead et al. (1960) observed that despite successes achieved by the Tennessee Valley Authority and the introduction of numerous other bills to create additional valley authorities, no other legislation has passed in more than 80 years. The authors assert that among the reasons for not establishing additional valley authorities are differences in the physical characteristics of regions, the nature and stage of economic and industrial development, and the political strength of area state and local governments.

Considering the complexities of regional water resources management, Kenney (2008) observed, “When chronic issues of competing values and ideologies are also considered, it is quickly evident why two centuries of research and experimentation have failed to produce a universally accepted institutional model for the governance of the United States regional water resources.”

RESEARCH METHODOLOGY

The study of governance structures of multi-state water resource management organizations requires research methods that facilitate the examination of institutional details of organizations. Quoting Eckstein, Blaikie (2000) defined comparative case study research as “the study of numerous cases along

the same lines, with a view to reporting and interpreting numerous measures of the same variables of different individuals.” To compare findings with previous studies, Yin (2009) pointed out that the need for similarity in study approach and unit of analysis.

Table 1 identifies the five categories of social science research methodologies (Yin 2009). Experiments allow researchers to manipulate behavior systematically while focusing on contemporary events. In survey research, investigators pose questions to respondents concerning matters of interest. An archival analysis methodology typically involves document review and content analysis. In compiling histories, researchers capture information on past events (*e.g.*, life history interviews). Case study research, actually a family of research methods, examines how and why phenomena happen in their natural and contemporary context (Blaikie 2000). A misperception exists that the listing set forth above should constitute a hierarchical array of research methods (Yin 2009).

Table 1. Relevant Situations for Different Research Methods (Yin 2009)

Method	Form of Research Question	Requires Control of Behavioral Events	Focuses on Contemporary Events
Experiment	How, why?	yes	yes
Survey	Who, what, where, how many, how much?	no	yes
Archival Analysis	Who, what, where, how many, how much?	no	yes/no
History	How, why?	no	no
Case Study	How, why?	no	yes

Case Study Methodology

Robert Yin, a prominent social science methodological scholar, sets forth the following definition of case study:

A case study is an empirical inquiry that

- *investigates a contemporary phenomenon in depth within its real –life context, especially when*
- *the boundaries between the phenomenon and context are not clearly evident.*

A case study inquiry:

- *cope with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result*
- *relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result*
- *benefits from the prior development of theoretical propositions to guide data collection and analysis.*(Yin 2009).

Case studies generally use the following series of steps in design and implementation:

- Define research questions;
- Select cases;
- Identify data collection techniques;
- Develop data collection and maintenance plan;
- Collect data;
- Process and analyze data; and
- Prepare report of findings.

Cases should be selected to illustrate the research phenomenon. In developing case studies, researchers have considerable flexibility in obtaining information. Potential sources include documents,

archival records, interviews, direct participation, participant-observation techniques and other physical evidence (Yin 2009). Documents include reports, memoranda, letters, articles from periodicals, or any written material that is relevant to the study. Archival records generally include historical documents that may only be available under special circumstances. In examining documents and archival records, researchers must also be careful to assess the accuracy of information. Interviews often provide important information in case studies that corroborate information obtained from other sources, probe for additional information to fill data gaps, or obtain comments or opinions on phenomena. Researchers employing a case study methodology may observe the focus of the study through formal means (through specific assessments) or more casual means in conjunction with other study activities. The use of participant-observer techniques allows the researcher to become a participant in a case study by playing various roles. While utilization of this technique may provide some advantages, it may also result in potential biases. Examination of other physical evidence (sometimes referred to as artifacts) can also contribute important information to case studies. Not all sources of information are relevant for all case studies (Yin 2009).

Because case studies tend to produce significant quantities of data and information, plans for systematic management of that information should be prepared prior to collection. Some data may be managed electronically, while other information, such as field notes, should be maintained at a different location. Proper implementation of data collection and management techniques can ultimately help address concerns with validity and reliability (Yin 2009).

Several analytical techniques (*e.g.*, explanation building, cross-case syntheses) may be employed in case study development. Criteria for interpreting findings can include quantitative procedures (if data are coded) or qualitative techniques such as examination of rival explanations for results (Yin 2009). Concise, well-written reports document protocols, implementation, analysis, and findings.

As a research tool, the case study methodology provides several advantages. Case studies are often used in developing understandings of complex phenomena. Because study protocols draw on multiple data sources, the collected information generally provides a more detailed or richer treatment of information.

Case study research methods continue to be the subject of criticism regarding lack of rigor, the inability to generalize results, the overly extensive resource commitment required to complete studies, and the failure to directly address cause and effect relationships (Yin 2009).

The first and third criticisms appear to be more project-specific and can be controlled by the researcher. While it is true that the results of case studies cannot be generalized to populations, they can sometimes be generalized to a theory. The results of a single experiment are no more generalizable to a phenomenon being studied than the case study results would be to a population. Yin (2009) pointed out that the final criticism is relatively recent and results from the return of randomized field trials, particularly in the field of education. Despite these criticisms, case study research remains broadly used in political science and public policy analysis.

To some extent, criticisms of case study research methods result from confusion with qualitative research methods (*e.g.*, ethnographic method or participant-observation techniques). In addition, case studies have often been considered as the exploratory phase of larger research projects; however, case studies can include quantitative and qualitative information and are often used as primary research methods (Yin 2009).

Survey Methodology

Survey research methods have been used for more than 100 years to collect data and information on people's attitudes, experience, and knowledge (Graziano and Raulin 2000). In simplified terms, survey research typically conforms to the following process:

- Determine survey objectives;
- Identify data collection method(s);
- Determine sample frame, type of sample, and sample size;
- Develop/design questions;
- Collect data;

- Process and analyze data; and
- Report findings (Fowler 2009, Groves 2009).

As in case study research, the survey objectives will bind the research. Dillman (2002) observed that the five survey modes in extensive use today include face-to-face interviews, telephone interviews, mail surveys, Internet surveys, and touch-tone entry. While each mode has its advantages and disadvantages, technology today allows for broader use of mixed-mode surveys in attempts to improve response rates; however, he cautions that measurement consequences may be significant (Dillman 2002). In addition, the variety of survey modes allows better tailoring of data collection techniques to the population and the survey problem (Dillman 2002). Dillman (2006) observed that the types of questions that may be asked are affected by the mode chosen. He cautions researchers of the measurement consequences of changing how questions are asked to fit a selected survey mode.

More specifically to the methodology being applied in this dissertation, alternative procedures for interviewing can be described as structured interviews (each respondent is asked the same question with a limited range of possible responses) or unstructured interviews (surveyor may begin with a limited set of questions, but has the flexibility to change the questions or pose new/follow-up questions). Qualitative interviews, a form of unstructured interviewing, is “an interaction between an interviewer and a respondent in which the interviewer has a general plan of inquiry but not a specific set of questions that must be asked in particular words and in a particular order” (Babbie 1999). Since the interviewer essentially guides conversation, this technique has served as a better approach to obtain information about complicated phenomena (Babbie 1999).

Sampling, an important part of the survey process, is used to identify a segment (the sample) of the target population to serve as survey respondents. Samples may be determined through probabilistic (commonly referred to as random) or non-probabilistic means. Probability sampling designs include simple random sampling, systematic sampling, and stratified random sampling. Non-probabilistic designs include convenience sampling, purposive/judgment sampling, quota sampling, and snowball sampling (O'Sullivan and Rassel 1999). Statistical inferences (generalizations) can only be made from probabilistic

sampling methods. Non-probabilistic methods are typically used in exploratory research or research seeking to illustrate certain concepts or phenomena (O'Sullivan and Rassel 1999). The appropriate sample size is determined by several factors, including, but not limited to, the size of the target population, and plays a vital role in determining the strength of statistical inferences and avoiding sampling error (O'Sullivan and Rassel 1999, Fowler 2009).

Fowler (2009) and Babbie (1999) emphasized the importance of question design. Questions may be open-ended (respondent provides narrative answer) or closed-ended (respondent selects from a pre-selected range of answers). Questions should be clearly worded, short, specific, and properly formatted (avoid double-barreled questions – including two concepts in one question). The wording should also avoid bias, overly negative concepts, and sensitive subjects. To ensure that questions are properly designed, pre-testing is highly recommended (Fowler 2009).

Data collection will depend on the survey techniques chosen. Scheuren (2004) pointed out that interviews should be scheduled in advance, and to the extent possible, occur at a time and place that is convenient to the respondent. Interviewers should be familiar both with the survey instrument and the general topic. To minimize ethical dilemmas, respondents should be informed of the voluntary/mandatory nature of the survey, how the findings will be used, and any provisions associated with the confidentiality of responses (Scheuren 2004).

Among the strengths of survey research is its ability to ascertain and describe the characteristics of a large group of people. Because standardized surveys present a consistent definition of concepts, they may reduce uncertainties associated with the study of a phenomenon. Analytical flexibility is gained, because surveys usually include many questions regarding the topic of interest (Babbie 1999).

Survey research is often criticized for failing to capture the context of the studied phenomena. The use of a standardized survey approach consists of an inflexible method that tends to capture the “least common denominator.” In addition, criticism is also levied about the “artificiality” of responses, implying a variation between the response and “reality” (Babbie 1999).

Some types of survey research also face challenges regarding validity, particularly construct validity (the extent to which the empirical measure reflects the real meaning of the phenomenon being measured). Babbie (1999) indicated that the challenges may be addressed through better question wording and more careful probing; however, these measures may reduce reliability, a strong point of survey research.

Dissertation Research Design

The research design employed in this dissertation involved two phases: a qualitative multiple case study/comparative case study design and a survey/interviewing study design. The case study methodology, informed by the Institutional Analysis and Development framework and the theory of common pool resources, particularly research on institutional arrangements associated with large-scale regional collaborative governance structures, examined organizational, institutional, and programmatic aspects of the following three collaborative interstate water resources management organizations: the Delaware River Basin Commission; the Gulf of Mexico Program; and the Western States Water Council.

This methodology was selected because it permits better examination of complex phenomena (governance by interstate water resource management institutions); allows for a richer consideration of the context of that resource management; and permits a single-person research team the opportunity to study one aspect of a phenomenon in some depth within a limited budget and timeframe (Blaikie 2000).

Cases for this project were selected based on three factors. Each selected organization emanates from a different institutional arrangement at the constitutional choice level. The Delaware River Basin Commission an agency created pursuant to a 1961 federal-interstate compact to provide comprehensive water resources for the Delaware River Basin. The Gulf of Mexico Program, an administrative unit within the U.S. Environmental Protection Agency, was established in 1988 to support a federal-interstate council chartered as a federal advisory committee to address environmental threats to and concerns regarding the Gulf of Mexico and its resources. The Western Governors' Conference created the Western States Water Council by resolution in 1965 to study and recommend courses of action to address water resource management issues facing states in the Western United States. Secondly, each organization facilitates or

provides different collaborative activities. Finally, cases were selected to complement the existing research done by Heikkila and Gerlak (2005) and Gerlak and Heikkila (2006) on large-scale multi-jurisdictional systems, as previously described. To the extent practicable, research design and reporting are also consistent with their work.

Data and information to support the cases studies were primarily collected through analysis of documents, scholarly papers, gray literature, and archival records concerning the organizations and their structures, operations and collaborative water resource management activities, and relevant institutional arrangements. Data analysis employed a cross-case analysis approach.

Survey research methods were implemented to ask present or former senior state environmental agency officials or their designees from the eight-state region about their views on the need for regional surface water resource coordination and planning, and preferences regarding the type of arrangements used to provide coordination and planning and the appropriate functions of any organization created to provide those services. Opinions were also sought on significant impediments to creating institutional arrangements and potential strategies to address those impediments and concerns. Given the small number of states involved, the survey sample approximated the population of executive heads with an initial focus on former executives. Surveys were conducted by telephone using prepared questions. Follow-up questions were used to clarify responses and elicit additional information based upon a response. In accordance with the procedures approved by the University of Georgia Institutional Review Board, all interviews were recorded to ensure the accuracy of data collection and reporting and all responses were assigned codes to preserve the anonymity of the respondent. Data were analyzed to identify similarities and dissimilarities in responses and other information that may provide guidance on forming institutional arrangements for regional planning.

CHAPTER 3

CASE STUDIES

DELAWARE RIVER BASIN COMMISSION

Introduction

In 1961, Congress assented to the Delaware River Basin Compact, the first federal-state interstate compact, to provide a comprehensive management program for the water resources of the Delaware River Basin (Figure 3). The Delaware River Basin Commission, comprised of the governors of Delaware, New Jersey, New York and Pennsylvania and a federal representative, now designated as an officer of the U.S. Army Corps of Engineers holding a Presidential appointment as a regular army officer (Commanding General of the North Atlantic Division). Among the Commission's responsibilities is the allocation of waters among basin states (consistent with a 1954 U.S. Supreme Court decision), development and periodic revision of a comprehensive plan for development of the water resources of the Delaware River Basin, construction and operation of water management infrastructure, if necessary, and the implementation of a wide array of water resource management programs in the basin.

Resource Characteristics

The headwaters of the Delaware River lie in the Catskill Mountains of New York. The east and west branches of the river achieve confluence near Hancock (Delaware County), New York at an elevation of approximately 2,000 feet. Generally flowing in a southerly direction, the 330-mile river forms, in part, the state boundaries between Pennsylvania and New York, and New Jersey and Pennsylvania, as well as, for a short distance, the boundary between Delaware and New Jersey. The Delaware River and its tributaries (Figure 3) drain more than 13,500 square miles in parts of Pennsylvania, New Jersey, New York, and Delaware (collectively referred to as the basin states) (Kauffman, Belden et al. 2008).

The Delaware River is the longest undammed river east of the Mississippi River. Above Trenton, three states, New York, New Jersey and Pennsylvania, share approximately 200 miles of non-tidally influenced river. However, below Trenton, the river becomes an estuary widening into Delaware Bay. The main stem, which contains 21 subwatersheds, is fed by 216 tributaries (Kauffman, Belden et al. 2008; Kauffman, Homsey et al. 2011). Among those tributaries are the Mongaup and Neversink rivers in New York; the Lehigh and Schuylkill rivers in Pennsylvania; and the Musconetcong and Maurice rivers in New Jersey. Approximately 350 miles of waterways in the Delaware River Basin are currently enrolled in the National Wild and Scenic Rivers Program.

Land uses across the basin vary considerably. For purposes of this discussion, the Delaware River Basin has been divided into four subbasins (Kauffman, Belden et al. 2008). The regional character of the upper basin, lying in portions of New York and Pennsylvania, is generally rural with land uses being dominated by forest lands with some intermittent farmland, mostly for dairy farming. Water quality in this portion of the basin is characterized as good to exceptional (Kauffman, Belden et al. 2008).

Both upland and lowland areas exist in the central subbasin areas of Pennsylvania and New Jersey. Forests have remained the dominant land use with agricultural development occurring mostly in the southern part of the region. Areas of this region have also been subject to anthracite coal mining. Some older industrial areas near Allentown and Bethlehem, Pennsylvania sit along the Lehigh River, where development continues today. Moreover, other parts of the region continue to undergo urbanization. Federal and state protected areas also constitute a large land use in this area (Kauffman, Belden et al. 2008).

The lower region, covering parts of Pennsylvania, New Jersey, and Delaware, is dominated by forests in the uplands and agriculture in the lowlands. Anthracite coal mining historically occurred in the Schuylkill River Valley. As the Delaware River approaches Philadelphia, land use becomes predominantly urban. In the coastal areas of this region, agricultural land use increases as does the presence of wetlands (Kauffman, Belden et al. 2008).



Figure 3. Delaware River Basin (Evans 2013)

Land use in the Delaware Bay region of New Jersey and Delaware is heavily agricultural supporting crop cultivation and some poultry production. The more southern areas of this region have been subject to significant development as retirement communities and summer resorts (Kauffman, Belden et al. 2008).

The Delaware River Basin provides habitats supporting a wide range of species. Bald eagle and black bear populations have seen significant recovery in the upper basin. The once-famous American shad fishery also continues to experience recovery. Given those successes, some species remain seriously imperiled in the basin. While the Delaware Estuary serves as a significant stop-over for shorebirds in the Atlantic flyway, the red knot stop over population has been declining since 1997. Species of freshwater mussels remain substantially endangered in some areas and the brook trout habitat has fallen to 50 percent of its historic extent. Perhaps, most noteworthy, the Atlantic sturgeon appears to be in danger of extinction. Almost 180 species are currently listed as endangered in Delaware, New Jersey, New York or Pennsylvania (Kauffman, Belden et al. 2008).

Climatically, the Delaware River region receives approximately 48 inches of rainfall annually although amounts are not evenly distributed. Areas of the Schuylkill River Valley reported receive approximately 57 inches per year, while portions of the Lackawaxen River watershed and the Lower Estuary average about 38 inches (Kauffman, Belden et al. 2008). While this level of precipitation usually provides sufficient water resources to support the range of water uses, water shortages and floods in the region have served as catalysts for public policy and institutional changes.

Socioeconomic Characteristics

All or portions of 42 counties and 838 municipalities within four states contribute to and benefit from the resources of the Delaware River Basin (Delaware River Basin Commission 2012). Significant metropolitan areas along the Delaware River include Port Jervis in New York; Easton, Philadelphia, and Chester in Pennsylvania; Trenton and Camden in New Jersey; and Wilmington in Delaware.

Between 1920 and 2010, the population living in the Delaware River Basin more than doubled from about 4,000,000 to approximately 8,000,000 people (Kauffman 2011). Areas of higher population

growth between 1990 and 2000 included the Pocono Mountain regions and portions of southern Delaware, while the largest population increase between 2000 and 2010 occurred in Pennsylvania (Kauffman, Belden et al. 2008, Kauffman 2011).

Population densities are important indicators of man's impact on the environment. For example, areas of higher population density typically exhibit poorer water quality. Kauffman, Belden et al. (2008) reported that the average population density for the Delaware River Basin approximated 600 persons per square mile; however, distribution varied widely across the basin. Reported densities for watersheds in the upper basin ranged from 20 to 100 persons per square mile, while areas of the central basin averaged between 200 and 1,000 people per square mile. The highest densities were experienced in the Lower Basin region, averaging 200 to 3,700 individuals per square mile. Locations in the Bay area supported up to 300 persons per square mile (Kauffman, Belden et al. 2008).

Kauffman, Belden et al. (2008) provided an overview of economic activities in the Delaware River Basin. Upper basin areas of New York and Pennsylvania support water related recreational activities such as trout fishing, canoeing, and rafting. Ecotourism across the area and seasonal tourism in the Pocono Mountains are also economically important. Dairy farming is a significant agricultural engine in the New York portion of the subbasin. A portion of this area is underlain by the Marcellus Shale Formation.

Portions of Pennsylvania and New Jersey are covered by the Central basin. Manufacturing in older industrial areas along the Allentown-Bethlehem-Easton corridor contribute, while anthracite coal mining continues in the Lehigh River region. Other economically significant activities include tourism in the Pocono Mountains, trout fishing, ecotourism, and water related activities in the Blue Mountain region. A portion of this subbasin is underlain by the Marcellus Shale Formation, significant as a carbon source from fracking.

The lower basin includes areas in Pennsylvania, New Jersey and Delaware. Economically significant activities include coal mining in the Schuylkill River Basin, manufacturing, and blue crab and oyster harvesting in coastal areas. Merchant shipping is a significant economic engine in this subbasin.

The 130-mile long Delaware River and Bay ship channel extends from Cape Henlopen to Trenton. The Delaware River ports' system from Wilmington to Chester, Paulsboro, Camden, and Philadelphia is the 6th largest U.S. port based on imports (Kauffman 2011).

In the Bay area, which includes portions of Delaware and New Jersey, seafood harvesting, primarily oysters and horseshoe crabs, is a significant economic activity; however, annual harvests of horseshoe crabs have continued to decline since 1998 (Kauffman, Belden et al. 2008). Agricultural production of corn, soybeans, wheat and vegetables remains important in the western portion of the region. Poultry production is significant in southern Delaware.

During peak periods, water withdrawals from surface waters in the basin totaled approximately 8.3 billion gallons per day. About 70 percent of the surface water withdrawals were used for power supply purposes. Public supply, industrial withdrawals, and other uses each accounted for about 10 percent of surface water withdrawals. It is estimated that annual and peak surface water withdrawals will reach 9.8 billion gallons per day and 11.3 billion gallons per day, respectively by 2020 (Kauffman, Belden et al. 2008).

Selected Water Management Institutions

All states in the Delaware River Basin Delaware require permits for surface water withdrawals; however, some permit programs apply to specific types of users or in specific locations. New Jersey and Delaware also require permits for groundwater withdrawals statewide, but New York only requires withdrawal permits in certain areas.

All states have been delegated authority by the U.S. Environmental Protection Agency to operate the National Pollutant Discharge Elimination System permitting program. No states are authorized under the sludge management program and only New Jersey has authorization for the pretreatment program (Environmental Council of the States 2010).

State water resource planning programs vary considerably. Delaware has no comprehensive statewide plan, but undertakes some water supply planning. New Jersey has adopted a State Water Supply Plan and has watershed management plans for all or part of 20 watersheds. Like Delaware, New York has

no comprehensive state water plan, but water resources planning occurs regionally. Pennsylvania has had a State Water plan for more than 30 years. It is also noteworthy that Pennsylvania is a member of 8 water-related interstate compacts (Viessman and Feather 2006).

Water Management Agencies/Organizations

In addition to coordinating with groups and agencies through its advisory committees, the Commission and its staff also coordinate with other parties. For example, Commission staff work with the Delaware River master, created under the 1954 United States Supreme Court decree, to correlate data on water needs and stream flows from gauging stations across the basin and to study the impacts of development on the Delaware River. Other federal agencies with water resource-related responsibilities in the basin include the Army Corps of Engineers, Environmental Protection Agency, Forest Service, Natural Resources Conservation Service, Geological Survey, Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Federal Emergency Management Agency, Coast Guard and Federal Energy Regulatory Commission.

The Commission staff also work closely with eight state agencies and seven other regional agencies (Delaware River Basin Commission 2012, Delaware River Basin Commission 2012).

Among the 42 counties and 838 municipalities included in the basin, the Commission interacts with those public officials operating water and wastewater utilities.

To encourage public participation in water resource activities, the Delaware River Basin Commission engages a wide range of public interest groups and provides contact information for more than 125 local watershed associations and other related organizations on its website (Delaware River Basin Commission 2012).

Background

While it is beyond the scope of this dissertation to provide an extensive discussion of the history of the development and uses of the river over the past 300 years and the problems resulting therefrom, this section will highlight conditions, challenges and controversies that played noteworthy roles in the development of policies and institutional arrangements. The Council on Environmental Quality (1975),

Albert (1987), and Kauffman, Belden et al. (2008) provide an extensive history of development and water resources associated with the basin.

Conflicts and controversies over water resources in the Delaware River Basin have been primarily driven by four factors: the use of resources for hydropower production, disputes over the allocation of available flows for water supply, significant problems with water pollution, and the need for flood control infrastructure. As discussed further in this section, the last three issues played significant roles in the creation of the Delaware River Basin Commission and remain important aspects of the agency's activities.

Historically, river segments in the upper basin were commercially important, before the construction and use of railroads, to transport goods, particularly lumber, coal, ore, and farm products. To achieve optimum water transportation potential, a series of canals was constructed and maintained throughout the region (Albert 1987). Today, only two canals continue to be importance—the D & R Canal (uniting the Delaware and Raritan rivers), and the C & D Canal (joining the Delaware River with Chesapeake Bay). The use of canals for transportation peaked in the 1830s when railroads allowed more transportation of goods and people to land-locked areas. Albert (1987) reported that the last lumber rafts traveled down the Delaware River in 1923.

In the lower basin, navigable waterways supported a growing shipbuilding industry and maritime port and terminal facilities for the shipment of goods (Council on Environmental Quality 1975). Since these areas were more densely populated, the region's rivers also served as conduits for significant amounts of wastes from commercial and industrial facilities (e.g., rendering plants, tanneries, and textile and paper mills), street cleaning, and municipal sewage collection systems. Most wastes received no prior treatment before being deposited into the river. Waterways in the lower basin also supported a thriving fishery providing commercial harvests of shad and oysters from Delaware Bay. Mill dams sustained the need for power up and down the river and its tributaries. Limited water withdrawals supported domestic and commercial water supplies. For decades, instream and offstream uses coexisted due to the low intensity involved with each use.

As the generation of electricity through hydropower evolved into a substantial energy source waterways throughout the basin were studied for their hydropower potential. Rivers and streams in the basin have been dammed for hydropower production and other purposes. Notwithstanding consideration of numerous projects over the decades and construction of one short-lived dam in 1825, the main stem of the Delaware River remains undammed (Albert 1987). Albert (2002) asserted that the main stem has remained undammed for two primary reasons, a 1783 anti-dam treaty between New Jersey and Pennsylvania and a decision by those states and New York to develop the river and its tributaries primarily for water supply purposes. Lack of dam development on a waterway of this size is also exceptional given the perspective of water management officials in the early 20th century that dam construction encouraged regional development and prompted a regional focus on river basin planning. Improvements of the Delaware River for use in transportation also militated against dam construction.

While the anti-dam treaty prevented the construction of any dam crossing the entire river and thus complete obstruction of navigation, it did not prohibit the erection of numerous mill and wing dams. The proliferation of these dams along the river almost led to the first of many controversies over water resources in state and federal courts between New Jersey and Pennsylvania in 1815 (Albert 1987).

As interests grew in the use of water-driven turbines attached to generators for the production of electricity in the late 1800s, basin states sponsored studies evaluating the hydropower potential of rivers and streams. States also chartered numerous companies to construct and operate dams (Albert 1987). Proposals for dam development were presented to the states in the early 1900s. A plan to build 40 hydropower dams in the upper Delaware River Basin was frustrated by the anti-dam treaty (Albert 1987).

Efforts to control pollution provided substantial motivation for interstate cooperation among states in the Delaware River Basin throughout the 20th century and eventually led, in part, to the creation of the Delaware River Basin Compact.

The first pollution survey of waters in the basin, conducted in 1799, found substantial pollution from ships and sewers, particularly near Philadelphia (Albert 1988, Kauffman, Belden et al. 2008). These conditions lingered despite the Pennsylvania Assembly's attempts to address water quality problems in

1769 by legalizing the construction of sewers discharging into the Delaware River. However, by 1867, the city had 67 miles of sewers, which were eventually combined with storm drains (Albert 1988).

Raw sewage from major urban areas and industrial effluents discharged with little or no treatment continued to result in worsening water quality conditions. By the 1920s, the Delaware River shad fishery, once among the best in the United States, had all but disappeared due to heavy pollution and overfishing (Albert 1988). Sanitary surveys in 1929 and 1937 identified significant stream pollution problems in the non-tidal Delaware River (United States Environmental Protection Agency 2000). During World War II, pollution of the river was so severe that pilots were cautioned against becoming alarmed at the sulfurous smell of the stench. Persons working on the river were overcome by nausea. By the end of the war, conditions were present for a policy intervention to address worsening water quality conditions.

Flooding has been a problem in the Delaware River Basin for more than 100 years. Since most of the upper basin and portions of the central basin are less developed and populated, floods create greater impacts in the more developed areas of the lower basin. In its 2008 report, *A Multi-Jurisdictional Flood Mitigation Plan for Municipalities in the Non-Tidal, New Jersey Section of the Delaware River*, the Delaware River Basin Commission noted that between 1900 and 2007 two periods of intense flooding occurred at the Trenton gauge. Readings associated with floods in 1903 and 1904 exceeded the major flood stage as did similar flooding in 1955. As will be discussed later, the 1955 floods played a significant role in the creation of the Delaware River Basin Commission. During the 107-year period, almost 100 flood events exceeded the action stage level on the Trenton gauge with additional events occurring in 1936, 1940, 1942, and more recently between 2004 and 2006 (Delaware River Basin Commission, New Jersey Office of Emergency Management et al. 2008).

Increased water use in northern New Jersey was also concerning local public officials in the early 1900s, particularly in light of the growing demands from New York City and Philadelphia. New Jersey officials were seeing increased interest among private companies in using Delaware River Basin waters for hydropower generation (Albert 1987). As a result of these and other competing demands and challenges, representatives of New Jersey, New York, and Pennsylvania met in 1908 to discuss the

“development” of the Delaware River. The meeting resulted in a call for increased interstate cooperation and improved cooperation with federal agencies (Albert 1987). Conditions continued to languish until the early 1920s when New York began considering plans for a new water supply.

To resolve concerns, an initial effort to develop a compact between New Jersey, New York and Pennsylvania apportioning the waters of the Delaware River was authorized by the respective state legislatures in 1923. The eight-member Delaware River Treaty Commission was tasked with developing a tri-state agreement governing state water development projects (Duca-Sandberg 2011). It is noteworthy that these actions were being taken one year following the ratification of the Colorado River Compact, a first-of-a-kind interstate compact allocating the waters of a river basin. It was widely known that New York City officials estimated that water demand would exceed supply by 1935 and given the levels of contamination in the Hudson River, discussions on the location of the new supply focused on the construction of a 70-mile aqueduct from Port Jervis, New York to supply water from the Delaware River.

The Commission members (then-referred to as the Tri-State Delaware River Commission) signed an agreement in 1925, and submitted it to the respective state legislatures for approval (Albert 1987). The agreement proposed the creation of a permanent Tri-State Delaware River Commission and provided for an equal sharing of waters above Port Jervis by the three states and an equal sharing of waters below Port Jervis between New Jersey and Pennsylvania (Duca-Sandberg 2011). Each state could develop three-fifths of the drainage area lying in its jurisdiction (Albert 1987). The New York Legislature initially ratified the agreement, but the legislation approving the agreement stalled in the Pennsylvania House of Representatives and the New Jersey Legislature (Albert 1987). Because of opposition to a proposed 600 million-gallon-per-day withdrawal, the Pennsylvania General Assembly failed to approve the agreement. In addition, some Pennsylvanians held that their state had the largest percentage of the drainage area; therefore, the state deserved a greater allocation of waters (Albert 1987).

In New Jersey, the Legislature designated the state Chamber of Commerce as the Water Policy Commission and assigned it to study the proposal. In 1926, the Commission recommended rejection of the compact proposal due to the potential for varying interpretations for some sections (Albert 1987).

To address continuing concerns, the Tri-State Commissioners returned to negotiations. A 1927 agreement, the second Tri-State Delaware River Basin Compact, provided for a specific numerical allocation of Delaware River flows to each state (New York and New Jersey, 600 million gallons per day each, and Pennsylvania, 900 million gallons per day). The arrangements also provided for minimum flows to ensure sufficient supplies for downstream states (New Jersey and Pennsylvania) during droughts and summer months (Albert 1987). By 1927, some officials hoped that a ratified agreement would lead to federal financial assistance with projects necessary to implement the agreement. Again, the New York Legislature ratified the agreement quickly, but the proposal was delayed in the 1927 Pennsylvania biennial legislative session pending the outcome of deliberations in New Jersey (Albert 1987). New Jersey officials held public hearings and significantly debated the provisions on minimum flows into 1928 effectively killing the proposal because the Pennsylvania General Assembly would not be in session again until 1929 (Albert 1987, Duca-Sandberg 2011).

Realizing the apparent futility of reaching an agreement and needing to make progress on securing additional water resources, New York City applied to and received approval from the New York State Water Power and Control Commission in 1928 for development of portions of the Delaware River watershed for its water supply needs. New York City notified New Jersey and Pennsylvania officials of its intent to build dams in the basin for water supply purposes (Albert 1987).

In response, the Attorney General of New Jersey filed suit against the State of New York in May 1929 and joined New York City, the project sponsor, as an indispensable party (Albert 1987, Duca-Sandberg 2011). In the suit, addressed to the Court's original jurisdiction, New Jersey complained that the diversion would injure the state's hydropower production potential, municipal and industrial water supplies, water quality (flow for assimilation of wastewater), recreational uses (fishing), and navigation, as well as result in salinity increases jeopardizing drinking water supplies. The complaint also alleged that New York City's use of its present supply was wasteful. New Jersey also insisted that approval had to be obtained from the Secretary of War for the diversions in a navigable river and claimed that, since the city was not riparian waterways in the Delaware River Basin, the diversion was contrary to the principles of

riparian rights (*New Jersey v New York* 283 U.S. 336 (1931), Albert 1987). In relief, New Jersey sought an injunction against New York City for all diversions from the Delaware River and its tributaries. The Commonwealth of Pennsylvania petitioned for leave to intervene and the Supreme Court granted its request, but required the Commonwealth to file a statement of interest and relief. In early 1930, Pennsylvania filed its statement and became a party in the proceedings before the Special Master, Charles Burch of Memphis, Tennessee (Albert 1987). In its statement, Pennsylvania requested a specific judicial allocation of waters and the establishment of a river master to monitor compliance with any decree.

In 1931, the Supreme Court confirmed the Special Master's Report and entered a decree consistent with its opinion. The opinion, delivered by Justice Oliver Wendell Holmes, rejected New Jersey's argument that interbasin transfers should be prohibited under the riparian rights doctrine. In accordance with its precedents, the Court applied the principles of equitable apportionment and upheld New York City's proposal to divert water from the Delaware River and its tributaries. In explaining the Court's application of the doctrine of equitable apportionment, Justice Holmes set forth the often used quote, "A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it" (*New Jersey v New York* 283 U.S. 336 (1931)). New Jersey's contention that the diversion would harm navigability was also rejected, but the opinion provided that such diversion must remain subject to the authority of Congress and the Secretary of War. Moreover, the Court did not sustain other claims regarding impacts on water quality and supplies and interference with the hydropower potential, but saw the merit in requiring the treatment of some domestic wastes being discharged into the rivers. Both of Pennsylvania's prayers for relief were denied (*New Jersey v New York* 283 U.S. 336 (1931)).

Consistent with the proposed 1927 compact language, New York had requested an allocation of 600 million gallons of water per day; however, the decree enjoined the State of New York and New York City from diverting more than 440 million gallons per day from the Delaware River or its tributaries. The decreed diversion was also subject to several conditions. Before any diversion could take place, a sewage treatment plant at Port Jervis had to be constructed and operational to address the degraded water quality

in that segment of the Delaware River and industrial discharges into the Delaware and Neversink rivers had to be treated to a specified degree. Perhaps, most importantly for New Jersey and Pennsylvania, diversions were further conditioned on New York City's release of stored waters during periods of low flow on the Delaware River in accordance with a prescribed formula. Representatives of Pennsylvania and/or New Jersey could also inspect diversion works at reasonable times. Finally, the decree provided that the Court retains jurisdiction and parties may apply for further relief (*New Jersey v New York* 283 U.S. 805 (1931)).

The need for intergovernmental coordination was once again raised in 1934 with the release of the U.S. Army Corps of Engineers' "308 Report" for the Delaware River. As previously discussed, 308 Reports provided comprehensive surveys of river basins, generally as a step toward preparation of plans for improvement of navigable streams, including the development of any potential for hydroelectric power, flood control, and irrigation. Martin, Birkhead et al. (1960) observed that the report acknowledged the Delaware River as a high value water supply source and recommended that future water supply and power developments in the Delaware River Basin be coordinated and controlled by an interstate agency. The report further concluded that development of the Delaware River Basin was economically feasible, but federal investments in projects above Trenton, New Jersey did not appear justifiable (Albert 1987).

Having addressed water allocation issues to some extent, attention turned to resolving persistently poor water quality in portions of the basin. In 1936, the Stream Pollution Subcommittee of the Pennsylvania Commission on Interstate Cooperation hosted a conference on pollution issues facing regional waterways and invited interstate cooperation commission members from Delaware, New Jersey and New York, as well as representatives of federal and local agencies to participate (Martin, Birkhead et al. 1960). To address water resource management issues in the Delaware River Basin on a regional basis, state legislatures in New Jersey, New York, and Pennsylvania adopted reciprocal legislation in 1936 and 1937 organizing the Interstate Commission on the Delaware River Basin. Martin, Birkhead et al. (1960) identified two national influences supporting the Commission's creation. First, the National Resources Committee provided funding for staff resources for the first three years of operation. Second, a national

movement toward greater interstate collaboration in the late 1930s resulted in the creation of state commissions on interstate cooperation. These commissions mostly consisted of members of the state house of representatives and senate, as well as administrators or private citizens appointed by a governor. Sentiments to maintain state control of water resources and the perception of a greater need for interstate cooperation to resolve water resource challenges, in lieu of reliance on the federal government, was further intensified by the passage of the Flood Control Act of 1936, which expanded the U.S. Army Corps of Engineers' jurisdiction to include flood control.

The Interstate Commission on the Delaware River Basin was composed of five members from each state. Four members represented the legislative and executive branches of government, while the additional member was chosen from each state by existing Commission members (Martin, Birkhead et al. 1960). All costs and expenses were paid entirely from appropriations by member states.

In a 1939 speech, the Director of the Pennsylvania State Planning Board and member of the Commission, observed, "The Interstate Commission on the Delaware River Basin represents an experiment (the only one of its kind in America) to solve regional problems of conservation through the organized efforts of four state governments" (Pitkin 1939). Cited as a classic example of "voluntary regionalism" by Robinson (1940), the Commission served purely in an advisory capacity and was not authorized to exercise any regulatory or administrative powers. Despite a lack of specific authority, it maintained significant influence over the management of water resources in the Delaware River Basin for almost 20 years.

The organization was formally created to implement "a program to study the conservation, water supply, pollution, and other potential uses and benefits of, and to develop integrated plans to conserve and safeguard, the waters and resources of the Delaware River Basin" . Among its duties, the Interstate Commission on the Delaware River Basin (1) served as a "fact-coordinating body;" (2) developed procedures for the implementation of regional plans and policies; (3) sponsored implementation of properly developed plans; (4) coordinated activities among itself, the commissions on interstate cooperation of member states, the Council of State Governments, and state and federal agencies

responsible for pollution abatement, flood control, and water supply and use; (5) encouraged the development of interstate compacts and the enactment of uniform laws governing water pollution control, flood control, and use and control of water resources; and (6) advanced work recommended by its conferences . Initially, the organization's focus was on stream pollution and apportioning the waters of the Delaware River Basin. Because it had no regulatory authority, the Commission's approach to developing and enacting policy manifested through the adoption of uniform laws in its member states and implementation through existing state agencies.

Moreover, the Commission was also reportedly charged to eliminate "the need for centralized authority in water resources development" (Interstate Commission on the Delaware River Basin 1958). Some officials observed that this objective created a heavy anti-federal bias in the Interstate Commission's attitude in resolving water resource management challenges. However, Albert (1987) added that the organization's concern over expansion of federal authority may have been justified in light of the enactment of the Flood Control Act of 1936, proposals to create additional valley authorities, and a 1940 United States Supreme Court decision providing that federal powers extended beyond navigable waters. See *United States v. Appalachian Electric Power Co.*, 311 U.S. 377 (1940).

The organization's efforts led to considerable success at addressing water quality issues (Martin, Birkhead et al. 1960, Derthick 1974, Council on Environmental Quality 1975, Albert 1987, Featherstone 1999). As previously noted, wastewater from businesses, industries and publicly-owned facilities was historically discharged to waterways without any prior treatment. Working with agencies in the basin states to complete a two-year study, the Commission recommended a water pollution control policy including interstate water quality standards in 1938. New York and New Jersey were quick to adopt the proposed uniform legislation authorizing state health departments to cooperate in controlling pollution. By 1945, all basin states had adopted and were implementing water quality standards through a coordinated pollution control initiative.

In addition to its development of standards, the Interstate Commission on the Delaware River Basin's water pollution control efforts also resulted in a significant increase in the construction of new

sewage treatment plants in the basin. By 1959, the number of plants providing adequate collection and treatment had risen from 63 to 236, which accounted for 75 percent of available treatment capacity (Kauffman, Homsey et al. 2011). The Commission's initiatives were also successful at reducing industrial pollution. The Council on Environmental Quality (1975) reported the percentage of industrial wastewater dischargers providing some treatment prior to discharge increased from eight percent in 1941 to 71 percent by 1961. By 1975, almost all industrial facilities provided treatment. Although significant progress was made in controlling water pollution in basin waterways between 1940 and 1960, considerable challenges remained in addressing dissolved oxygen concentrations near the Delaware estuary and reducing concentrations of toxic substances and metals in the Delaware River (Albert 1988).

Concurrent with its higher profile efforts on water pollution control, the Interstate Commission on the Delaware River Basin had begun work on an allocation formula providing for the regulation of water diversions and use (Albert 1987). The organization had delegated the task of developing core principles for an agreement to a Technical Advisory Committee on the Quantity of Water, composed of state water engineers. The committee stressed the need for development of a comprehensive plan to serve as a basis for any allocation, but the Commission denied that request. After months of deliberation, the advisory committee proposed a general formula for the flows and releases of waters in the Delaware River Basin similar to that used in the 1931 Supreme Court decision. The formula was ultimately included in proposed legislation submitted to the legislatures in New Jersey, New York and Pennsylvania (Martin, Birkhead et al. 1960, Schlager and Blomquist 2008). New York and Pennsylvania adopted the legislation in 1943; however, the legislation was amended by the New York Legislature to accommodate concerns raised by New York City officials (Martin, Birkhead et al. 1960, Albert 1987). The New Jersey Legislature adopted the amended proposal in 1944. The inconsistencies in the legislation could not be successfully resolved.

While the organization had worked diligently on the development of its water quality policies and a flow allocation formula, it had resisted efforts to undertake comprehensive planning in the basin (Albert 1987). Nevertheless, the organization decided to reverse its policy direction and develop a plan. To initiate the process, it proposed the passage of the Delaware River Basin Resources Development

Compact, converting the Commission into a compact agency (Albert 1987). In lieu of the recommended approach, in 1949, legislatures in New Jersey, New York and Pennsylvania directed the Commission to “make a special survey to determine the advisability of carrying out an integrated project for the mutual utilization of the waters of the Delaware River Basin by the authorizing states” (Interstate Commission on the Delaware River Basin 1958). Filing its report with member states in 1951, the Interstate Commission on the Delaware River Basin recommended a multi-reservoir water development program and the enactment of an interstate compact creating the Delaware River Basin Water Commission to construct and operate the water supply infrastructure (Albert 1987).

Martin, Birkhead et al. (1960) emphasized that the proposal was not without controversy and identified eight prominent points in opposition to the organization’s proposal. The first two concerns involved opposition to specific reservoir sites. The construction of the proposed Cannonsville Reservoir would have resulted in the inundation of prime agricultural lands in New York, while resistance to the proposed Wallpack Bend Reservoir site involved flooding of lands in Pennsylvania. Opponents also claimed that the proposal lacked comprehensiveness, because it did not sufficiently consider hydropower potential. Since the proposal was prepared under the direction of a committee composed solely of state appointees, the proposal was faulted as having an anti-federal bias. Antagonists also stressed the undue focus on water supplies for large metropolitan areas. Some interested parties believed that additional water supplies for New York City should come from the Hudson River Basin and the assertion was made that Philadelphia should obtain additional supplies from other areas of Pennsylvania. In addition, challengers raised concerns over future allocations and the mechanisms for making those allocations. As expected, a final matter of contention involved the distribution of costs among the states. In hopes of postponing consideration of financial issues, the proposition provided no specific information. Despite the contentious nature and opposition, the proposal was ratified by legislatures in New Jersey, New York, and Delaware by 1952 (Interstate Commission on the Delaware River Basin 1958, Martin, Birkhead et al. 1960, Derthick 1974).

However, in Pennsylvania, the governor created the Pennsylvania Water Resources Committee to study water supply needs and determine how those needs would be impacted by the Commission's proposal. In 1953, the committee recommended that Pennsylvania should meet its needs through the development of water resources on the Lehigh and Pocono rivers. More importantly, it urged rejection of the proposal as providing greater benefit to the State of New York and New York City, thus potentially putting Pennsylvania at their mercy regarding future development of water supplies (Martin, Birkhead et al. 1960, Albert 1987). Notwithstanding the committee's opposition, the Pennsylvania House of Representatives passed the Commission's proposal in 1953, but the legislation never received consideration in the Pennsylvania Senate (Albert 1987).

Recognizing Pennsylvania's probable unwillingness to participate, the State of New York and New York City withdrew their support for the proposal and, in 1952, moved to petition the Supreme Court to modify the 1931 decree to allow the diversion of more water and to revise the formula for releasing water during low flow periods. (Interstate Commission on the Delaware River Basin 1958). After the motion was granted and New Jersey and Pennsylvania filed answers opposing the changes, the court referred the matter to a Special Master (Albert 1987).

To avoid a court-determined allocation, the Special Master sought a settlement in the case. Officials from New York and New Jersey were able to negotiate a formula for maintenance of minimum flows, the Montague formula. In the subsequent 1954 decree, New York City was authorized to divert the requested 800 million gallons per day, subject to certain conditions and releases in accordance with the "Montague formula," and water users in New Jersey were also allowed to divert 100 million gallons per day to supply metropolitan areas in northern New Jersey. Pennsylvania also obtained a portion of the relief it originally sought in that the court appointed a river master to oversee compliance with the decree. Furthermore, New Jersey agreed to repeal the anti-dam treaty and to work with Pennsylvania officials on a dam and water supply reservoir located on the Delaware River (*New Jersey v. New York* 347 U.S. 995 (1954), Albert 1987).

Following the 1954 decision, public officials in the basin states continued to discuss matters associated with the development of water resources. Philadelphia mayor, Joseph Clark, and the governors of New Jersey and New York assumed leading roles in determining the policy direction the region would pursue given the failure of the Commission's proposals. In New Jersey and Pennsylvania, committees began studying water resource needs and developed proposals in 1955. Although drought conditions prevailed in the early summer of 1955, those conditions were soon forgotten following flooding associated with Hurricanes Connie and Diane in August 1955. Albert (1987) observed that flooding resulted in a significant turning point for water resource management in the Delaware River Basin by increasing federal involvement in flood control and other projects and prompting cooperative state action among basin states.

In addition to state actions, the U.S. Army Corps of Engineers had undertaken several reviews of the 1934 308 Report over the succeeding years and had sustained the conclusion indicating no justification for federal involvement in the Delaware River Basin above Trenton. The review ordered in 1950 reached completion in July 1955 and arrived at the same conclusion (Albert 1987). However, following damages from the hurricanes, the Chief of Engineers returned the report to the Philadelphia District office and the U.S. Senate Public Works Committee ordered another comprehensive study, which commenced in 1956 and led to a 1962 report proposing improvements (Albert 1987).

State and local officials also initiated further efforts to coordinate water resource development. As the result of cooperative efforts between the governors of the basin states and the mayors of New York City and Philadelphia, the Delaware River Basin Survey Commission (soon renamed the Delaware River Basin Advisory Committee) was created in February 1956, and commenced two initiatives. With funding from the Ford Foundation, it contracted with researchers at Syracuse University to identify and study potential administrative structures for interstate water resources management (Martin, Birkhead et al. 1960). In addition, the Advisory Committee initiated a public information program to build better understanding and public support for developing the water resources of the Delaware River Basin. This program ultimately resulted in the creation of an educational organization, the Water Research

Foundation for the Delaware River Basin, and the Water Resources Association of the Delaware River Basin, which represents two hundred citizens' groups (Albert 1987).

The Syracuse study provided a systematic examination of the socioeconomic and political setting of the region and considered the views of numerous stakeholder groups. Noting that the scale of government involvement in the basin was significant, the study report estimated that 43 state departments and commissions and 14 interstate agencies were involved in some manner in managing water resources in the Delaware River Basin (Martin, Birkhead et al. 1960). In addition, 12 federal agencies were identified as having major water resource management responsibilities with 11 other federal agencies having less prominent roles (Martin, Birkhead et al. 1960).

The final report recommended a two-phase approach to the establishment of an administrative structure for water sources management in the Delaware River Basin (Martin, Birkhead et al. 1960). The first phase involved the creation of a federal agency, the Delaware River Agency for Water, to provide immediate coordination of development efforts. The proposed second phase consisted of negotiation of a compact leading to the creation of a federal-state compact commission with broad administrative powers. The authority granted to the proposed commission would not supplant the authorities and programs of existing federal, state, and local agencies, but the newly created commission would provide "overall planning, coordination, and supervision" (Albert 1987). This approach was recommended for three reasons. First, a federal agency could be created relatively quickly, while an interstate compact would likely take years to negotiate and ratify. Second, federal funding would provide resources for early operations. Finally, the first part of the approach is mindful of federal responsibilities and interest in water resources development, but over the long-term, states must maintain control over water resources management in general (Martin, Birkhead et al. 1960).

In September 1959, the basin governors or their representatives met with the participating mayors to review the Syracuse proposal. During its deliberations on further action, the Delaware River Basin Advisory Committee considered forming a compact commission consisting solely of state representatives, but determined that federal representation was essential given the government's responsibility for and

involvement in water resource management issues (Albert 1987). At least in part, the intent of having the federal government as a partner was to ensure better coordination among federal agencies and the commission staff and to provide an integrated program from the federal perspective. After consideration and discussion, the Committee rejected the creation of an interim federal agency and directed the advisory committee to draft legislation for the creation of a federal-state compact (Albert 1987).

Major issues complicating the deliberations included (1) representation for municipalities on the commission; (2) the number of members authorized to represent each party on the commission; (3) preferences for sale of power from any hydroelectric generation to public power authorities; and (4) the incorporation of elements of the 1954 Supreme Court decree in the compact provisions (Albert 1987). At the conclusion of deliberations, the proposal provided that each basin state and the United States government was authorized a single commission member. No separate representation was provided for municipalities and no resolution was reached on the question of power sales. The provisions of the proposed compact codified the diversions and releases contained in the Supreme Court decree and allowed the commission to authorize future allocations. In addition, it is noteworthy that negotiations regarding the compact proposal were occurring at a time when no water shortage existed basin-wide nor was one predicted.

In February 1961, the four governors and two mayors approved the final version of the legislation. By the end of May, legislatures in New York, New Jersey and Delaware had passed the required bills. However, opposition grew in Pennsylvania, but the governor prevailed upon those parties to withhold judgment and agreed to have their issues addressed in the federal compact legislation. The Pennsylvania General Assembly passed the bill in July (Albert 1987).

President Kennedy appointed Secretary of Interior Stuart Udall as the lead federal official on the proposal and ordered an evaluation of the constitutionality of a federal-state compact agreement, a first-of-its-kind proposal. Concurring with an earlier analysis by attorneys representing the Delaware River Basin Advisory Committee, the Department of Justice determined that such a proposal was constitutional (Phillips 1960, Derthick 1974). Federal water resource management agency officials remained generally

opposed to approval of the compact legislation citing concerns over funding and existing plans and commitments. Observations were made that state officials on the commission could out vote the single federal official, thus obligating the federal government to certain responsibilities. Then-existing compacts only had federal participation in an advisory capacity.

Udall recommended that the states follow the traditional compact approach placing the federal government in an advisory role. Derthick (1974) observed that compact proponents reacted poorly to the federal opposition and called upon President Kennedy to support the compact legislation. Administration officials urged federal administrators to meet with proponents to resolve concerns. Following that meeting, federal administrators offered no further objections and refrained from opposing the enactment of the compact due to the extraordinary interstate cooperation developed in proposing the compact and a belief that such a compact would not set a precedent (Derthick 1974). To address the concerns of federal officials, a section on reservations was added to the compact language. With the administration's support, the legislation was enacted and signed into law on September 27, 1961.

Establishment of the Delaware River Basin Commission

After passage of the compact legislation, focus turned to the implementation of the institutional arrangements in this new form of governance. As a matter of both federal and state law, the compact sets out well-defined provisions in its 15 articles governing the organization and powers of the Commission and its responsibilities in addressing seven aspects of water resources management. It also provides clear authority regarding intergovernmental coordination, financing of capital improvements, development of plans and programs, and annual budgeting and expenditures.

A review of the legislative intent, as captured in the preamble of the compact legislation, provides the policy reasoning and considerations that served as the basis for the compact. The Congressional intent describing the need for a compact and identifying its management goals is clearly expressed:

Whereas such a comprehensive plan administered by a basin wide agency will provide effective flood damage reduction; conservation and development of ground and surface

water supply for municipal, industrial, and agricultural uses; development of recreational facilities in relation to reservoirs, lakes, and streams; propagation of fish and game; promotion of related forestry, soil conservation, and watershed projects; protection and aid to fisheries dependent upon water resources; development of hydroelectric power potentialities; improved navigation; control of the movement of salt water; abatement and control of stream pollution; and regulation of stream flows toward the attainment of these goals;... (Delaware River Basin Compact 1961)

Another significant provision unambiguously sets forth the statutory purposes to (1) promote interstate comity; (2) *remove causes of present and future controversy*; (3) protect present development within the states; (4) encourage and provide for planning, conservation, utilization, development, management and control of the basin's water resources; (5) foster cooperative planning and action by the signatory parties regarding water resources; and (6) apply the principle of equal and uniform treatment to all water users who are similarly situated and to all users of related facilities, *without regard to established political boundaries* (Delaware River Basin Compact 1961).

Because the water resources of the Delaware River Basin are of local, state, regional and national interest, as determined by previously rendered United States Supreme Court decisions, the compact provided for joint exercise of powers and duties to address common interests. Moreover, the compact provisions emphasized, "the water resources of the Delaware River Basin, if properly planned and utilized, *are ample to meet all projected demands*, including existing and added diversions in future years (emphasis added)" (Delaware River Basin Compact 1961).

The preamble also captured the previously discussed, extensive history of interactions among the states and the federal government, including previous calls by the United States Army Corps of Engineers and the Interstate Commission on the Delaware River Basin for the creation of an interstate agency to coordinate and oversee the development of the basin.

The new law established an initial term of 100 years with extensions of 100 years being allowed, if no signatory state provides notice of its intent to terminate the compact. The provisions also required that such notification be provided to parties not less than 20 years before the expiration date.

Under the 1961 compact law, the Delaware River Basin Commission, comprised of the governors of the signatory states and one commissioner appointed by the President of the United States, was charged with implementing the compact provisions. Each member must appoint an alternate and may appoint an advisor to attend meetings. Governors have traditionally appointed heads of environmental protection agencies or water management agencies. President Kennedy initially appointed Secretary of the Interior Stuart Udall to serve as the federal representative. However, in 1997, the Emergency Appropriations Act amended the Delaware River Basin Compact by providing that beginning on October 1, 1997, the federal representative and the associated alternate members appointed to the Delaware River Basin Commission must be officers of the U.S. Army Corps of Engineers, who hold Presidential appointments as regular army officers subject to confirmation by the U.S. Senate (Emergency Appropriations Act 1997). In addition, amendments further clarified the term of the federal representative's appointment.

The Commission's voting rules provide that each member has one vote, and with two exceptions, prohibits any action from being taken unless a majority of the membership votes in favor of that action. Unanimous approval is required for the adoption of annual operating and capital budgets and for any divergence from the provisions of the 1954 Supreme Court decree. Because funding comes from legislative appropriations, the Commission remains accountable to the funding bodies in implementation of its activities.

While the geographic jurisdiction of the Commission is clearly established within the basin, the law authorizes it to act outside the basin, "whenever such action may be necessary or convenient to effectuate its powers or duties within the basin, or to sell or dispose of water, hydroelectric power or other water resources within or without the basin" (Delaware River Basin Compact 1961). Any action outside the basin requires the consent of the state in which the action is being taken.

The Commission possesses extensive powers and duties. Among the most significant is a requirement to adopt a comprehensive plan, following consultation with water users and interested public bodies in the basin, to guide immediate and long-term development. An annual water resources program with a six-year time horizon must be approved to provide for effective implementation of the plan. Annual operating and capital expenditure budgets must also be adopted. The Commission is not authorized to levy taxes, but it may issue revenue bonds to pay costs associated with capital projects. To supplement funding from legislative appropriations, the Commission may set and impose rates and charges for the use of facilities that it may own or operate and for its services.

Explicitly recognizing the provisions of the 1954 decree, the compact authorizes the Commission to allocate waters among the basin states, consistent with the doctrine of equitable apportionment applied in that decree. Notably, the compact provisions also assent to allow a divergence from the decree's provisions, upon unanimous vote of the Commission. In consummating the compact, states and their political subdivisions had to waive rights to petition the Supreme Court for any further modification of the decree.

Facilitating administration, the compact specifically authorizes the Commission to plan, *construct or operate* facilities needed to implement the compact; set requirements for planning, *design and operation* of facilities in the basin; sponsor water resources research; compile surface water and groundwater data and forecasting; conduct special groundwater investigations; publish and disseminate information and reports; and receive funding for projects, which allows the Commission to obtain extramural funding for some activities (Delaware River Basin Compact 1961).

As evidence of its intent to authorize a comprehensive water resources management program, any project *having a substantial effect* on the water resources of the basin must be reviewed and approved by the Commission. The law requires the Commission approve any project that *would not substantially impair or conflict with the comprehensive plan*. To ensure coordination and compliance with the Commission's regulations, the compact *prohibits the expenditure or commitment of funds* for the

construction, acquisition or operation of any federal, state or local government project, unless it has been included in the comprehensive plan.

The need for broad participation in the decision-making process by interested parties is also recognized by the compact's authorization for advisory committees composed of governmental officials and representatives of other interested parties and groups to counsel the Commission on the development and implementation of its plans and programs. Such groups may be created subject to the Commission's discretion.

Important limits are also placed on the authority of the Commission. Besides the prohibition on impairing the rights, privileges and obligations provided for in the 1954 decree, the Commission may not impose a fee or charge on diversions of waters permitted by the decree or the operation of any infrastructure supporting those diversions, without unanimous consent of the parties. The Commission is further prohibited from serving as the river master. It is also noteworthy that the compact, as a creature of state and federal law, supersedes some authority of traditional units of government.

Articles 4 through 10 of the compact authorize the Commission to implement more specific programs addressing water supplies, pollution control, flood protection, watershed management, recreational uses, hydroelectric power production, and regulation of water withdrawals and diversions (Delaware River Basin Compact 1961). Except for control over issues associated with navigation, no aspect of water resources management lies beyond the authority of the Commission. The following paragraphs provide a brief summary of those provisions.

To ensure the availability of adequate water supplies, the Commission may develop and implement plans, including for the construction and operation of dams and reservoirs regulating flows and may regulate and control the use of such facilities. Signatory parties are prohibited from allowing the diversion of any augmented flows, when releases of stored water are being ordered by the Commission.

Under its pollution control authority, the Commission may also construct and operate facilities, as it deems appropriate. It may assume jurisdiction to control future pollution and abate existing pollution and enforce its standards through the issuance of orders or civil litigation. While the compact establishes

the Commission's water pollution control regulations as a "floor," member states may adopt more stringent standards.

In addition to planning, constructing and operating facilities for flood control, the Commission is authorized to adopt *recommended standards* concerning land uses in flood-prone areas. It may acquire an interest in lands in flood-prone areas in order to restrict development. After appropriate study, it may also delineate floodplains and cause lands subject to flooding to be posted.

The Commission's duties regarding watershed management include control of runoff, prevention of erosion, and improvement of habitats for fish and wildlife. To those ends, the Commission is authorized to acquire and operate projects and promote land reclamation, but it must coordinate such activities with the appropriate state and local agencies.

Under the compact, the Commission *must provide* for the development of facilities providing water recreation opportunities and may plan, construct and/or operate such projects; however, as is the case with watershed management facilities, the Commission *may not operate a facility*, unless it finds that no other agency is available to do so.

Use of waters of the Delaware River Basin for hydroelectric power development is also provided for under the compact. Facilities for power generation and transmission may be provided by the Commission, subject to appropriate rates and charges. The Commission is also allowed to contract with public utilities or public agencies to develop hydroelectric power facilities.

The Commission possesses extensive powers to regulate water withdrawals and diversions from surface water and groundwater. It may delegate, and has delegated in many cases, day-to-day program implementation to states through a cooperative agreement. To address unsustainable use, the Commission may designate areas within the basin where demands exceed supply; resources in those areas require more intense management. In protected areas, a permit from the Commission is required for any withdrawal or diversion over an established threshold. Moreover, the compact provides that the Commission's authority regarding regulation of withdrawals and diversions preempts the authority of any signatory state over such activities.

Toward ensuring and improving intergovernmental coordination, compact provisions require the Commission to furnish technical services and advice to, and consult with, authorized state or federal agencies. In return, the compact signatories have pledged to provide technical and administrative services, as requested, and to cooperate with the Commission in compact implementation. However, most importantly, the Commission *may not compel* federal agencies to carry out its plans, but it *can prevent* them from carrying out unapproved plans.

As noted previously in the discussion regarding proposal of the compact, federal officials expressed concerns regarding the extent of the Commission's authority. Provisions were specifically placed in the compact to avoid restricting Presidential authority and to ensure no limitations were placed on the use of appropriated federal funds. The compact provisions allow the President to suspend provisions of a comprehensive plan by executive order, when he or she determines that such action is in the national interest. Over the past 50 years, the President has not suspended any provisions.

While provisions specifically state that nothing in the compact impairs the constitutional authority of the United States, the exercise of federal authority shall not substantially conflict with implementation of a provision in a comprehensive plan, if that plan was adopted with the concurrence of the federal representative, any such plan or amendment.

Rules of the Commission

The Delaware River Basin Commission implements the compact through its operational rules, as set forth in the 180-page Delaware River Basin Water Code, codified at 18 Code of Federal Regulations Part 410. Originally adopted in 1973, the most current compilation was produced in 2010. In addition, the Rules of Practice and Procedure specify the process for adoption and revision of the comprehensive plan and water resources program.

Provisions requiring consultation with the Commission on all projects (including federal, state and local projects) that will be undertaken in the basin, emphasize the need for consistency with the Commission's comprehensive plan, and restate the prohibition against committing or spending funds on projects not included in the plan. The screening criterion used to determine if a project will have

“substantial effect on the water resources of the basin” is explained (Delaware River Basin Commission 2010).

An important aspect of the Commission’s water resources management responsibilities is the implementation of its water conservation program, including water conservation requirements for new and existing users. The rules also (1) confirm the Commission’s water allocation authority, consistent with the 1954 decree, (2) clarify the procedures for declaring a drought emergency, (3) describe its priority for allocating water during those emergencies, and (4) operationalize the requirements for reductions in diversions and flow releases.

As a significant component of its management program, the Commission’s authority to operate control facilities for storage and release of waters is clearly laid out, including its rights to use and control water supplies from federal projects and facilities, its power to apportion non-federal costs of surface water projects among the states, and its authority to assume repayment of the non-federal share, as requested by a state, through the sale of water and other products. A description of the Commission’s process for setting rates and charges for surface water use, diversion or withdrawal is also specified.

The Commission may also regulate the withdrawals and use of groundwater, subject to the doctrine of equitable apportionment, to preserve and protect those waters. In the public interest, the Commission’s rules limit the amount of withdrawal for each project.

To help ensure future availability of supplies, the regulations affirmatively discourage the exportation of water from the basin and the importation of wastewaters threatening the assimilative capacity of waterways into the basin. Water projects proposing out-of-basin transfers or wastewater projects proposing to transfer waters into the basin are specifically subject to the Commission’s approval and projects where waters are being exported are further subject to “consumptive water charges” (Delaware River Basin Commission 2010).

Regionalization of water treatment and distribution projects is supported under the regulations. Additional requirements are placed on owners/operators of water supply systems to meter usage and sources and to report data and information periodically.

Other provisions in Article 2 require (1) use of non-structural measures, in part, to achieve flood damage reduction; (2) employment of best practices to reduce soil erosion; (3) maintenance of high quality waters to support fish and wildlife and recreational activities; and (4) protection and preservation of wetlands in the basin. The Commission also *encourages* the development of small-scale hydropower projects.

The Commission's regulations also set forth water quality standards applicable to all surface waters of the basin. The basin-wide surface water quality standards identify uses and criteria and specify anti-degradation requirements. To address water quality on non-tidal interstate streams and tidally influenced portions of the basin (the Delaware Estuary and Bay and associated tidally influenced streams), the Commission has divided those waterbodies into zones and established uses, criteria for pollutants, and requirements for effluent quality in each zone. Requirements for protecting groundwater quality in the basin are also set forth.

Regulations also provide for the minimization of concentrations of polychlorinated biphenyls and other toxic pollutants that may be subsequently designated as subject to regulation. Under these provisions, dischargers must develop and submit pollutant minimization plans.

The comprehensive plan and water resources program help provided a structured process for overseeing the development and use of the basin's resources. The Rules of Practice and Procedure explain the concepts behind the development of a comprehensive plan, the applicability of requirements to be included in the plan, the process of submitting projects for inclusion in the plan, and procedures for approval of projects by the Commission. Similar provisions are included for the annual water resources program. Additional details regarding project reviews are also provided, including a categorical listing of projects that have been determined to not have a substantial effect of water resources of the basin and are therefore not subject to the review process. Exemptions are provided for 19 categories of projects. The rules further specifically identify 18 categories of projects that require review (Delaware River Basin Commission 2002).

Other matters covered by the Rules of Practice and Procedure include a process for appealing decisions of the Executive Director and the procedures used in conducting hearings. These rules also set forth enforcement provisions for use by the Commission in addressing violations of its laws, rules, or orders and provisions governing the public's access to records and information.

Committee Structure

Like many regional water management organizations, the Delaware River Basin Commission employs a committee structure to obtain advice and recommendations on proposed policies, actions and programs. Featherstone (1999) observed that most policy matters receive initial consideration by one of the Commission's advisory committees. Technical experts and interested parties consider and discuss the details toward the resolution of any conflicts regarding a proposal. If proposals become too controversial, the Commission may hold a public hearing, seminar or conference to obtain additional input and deliberation. Advisory committee meetings often serve as forums for public discussion and dissemination of relevant information.

The subject matter and nature of advisory committees has changed over the years as issues have presented before the Commission. Seven advisory committees are currently active. The members, who include agency representatives and other interested parties, are appointed by the executive director with the advice of the commissioners. The following discussion provides information on the history and status of the current committees.

Regulated Flow Advisory Committee

In 1967, the Commission created a task force to examine the sustainability of the basin's water resources. The task force's mission was broadened in 1977, to provide recommendations on the criteria for declaration of drought emergencies, the implementation of associated conservation measures, and long-term operations planning for reservoirs. Renamed the Flow Management Technical Advisory Committee in 1983, it provided advice on drought planning and the need for new water storage projects to maintain flows. The Commission, in 2005, reconfigured the technical advisory committee to become the Regulated Flow Advisory Committee. Each signatory appoints two members to the 10-member advisory

committee, which now provides counsel on water resource issues that occur below reservoirs on regulated tributaries (Delaware River Basin Commission 2006)

Water Management Advisory Committee

In 1998, the Commission merged the Ground Water Advisory Committee, originally established in 1982, and the Water Conservation Advisory Committee, created in 1983, to form the Water Management Advisory Committee. That committee, comprised of representatives of 20 governmental agencies and interested stakeholder groups, is charged to provide counsel on water use and demand forecasting, implementation of water conservation measures, use of models for characterizing groundwater flow patterns and instream flow needs, protocols for reviewing integrated resource plans, and identification of watersheds where action teams may be needed (Delaware River Basin Commission 1998).

Water Quality Advisory Committee

The Water Quality Advisory Committee was originally established in the 1960s and has subsequently been reauthorized several times with its current term ending on of January 1, 2019. This committee, now composed of 11 interested persons, develops recommendations on policies and technical matters regarding water quality, and pollution prevention, control and abatement (Delaware River Basin Commission 2011).

Toxics Advisory Committee

In 2000, the Commission created the Toxics Advisory Committee to assist in developing and reviewing policies and procedures regarding water quality criteria for toxic pollutants, total maximum daily loads, and associated wasteload allocations. With members representing 12 interested parties, the advisory committee is scheduled to continue its work until June 30, 2023 (Delaware River Basin Commission 2013).

Monitoring Advisory Committee

To provide for coordination of monitoring programs across the basin, the Commission established the Monitoring Advisory Committee in 1999. With members representing state and federal agencies and

interested stakeholders, the 15-member committee continues to consider improvements in basin monitoring and to coordinate programs and data sharing (Delaware River Basin Commission 2006).

Water Charges Advisory Committee

The Water Charges Advisory Committee advises the Commission on the interpretation of studies conducted to evaluate aspects of the water supply charges program. The 15-member ad hoc committee consists of representatives of water users across the basin (Delaware River Basin Commission 2010).

Flood Advisory Committee

In 2000, the Commission created a Flood Advisory Committee made up of representatives from 19 specific agencies and stakeholder groups to recommend improvements in flood warning and response and to propose strategies improving flood loss reduction (Delaware River Basin Commission 2000).

The Delaware River Basin Commission also uses ad hoc advisory bodies to provide advice on specific topics. For example, a Commission resolution authorized the Executive Director to empanel experts to provide advice on the development and use of a eutrophication model for the Delaware Estuary (Delaware River Basin Commission 2012).

Advisory Committees have provided oversight on special studies, such as the United States Army Corp of Engineers' Level B Study, a study to oversee a basin-wide evaluation of groundwater resources, and an assessment of floodplain regulations. Following completion of these initiatives, the advisory committees were dissolved (Featherstone 1999).

In addition to the Commission's committees, the federal representative sought, until 1989, to better coordinate the positions of federal agencies involved in the basin through the Federal Field Committee. Members included representatives of the Army Corps of Engineers, Environmental Protection Agency, Federal Emergency Management Agency, Federal Energy Regulatory Commission, and the departments of Interior, Agriculture, and Commerce. Subsequent federal representatives chose not to use the group.

Administration

The Delaware River Basin Commission operates with a staff of about 50 positions, including 41 full-time employees (Delaware River Basin Commission 2012). Given budgetary constraints, some vacant positions exist. Figure 4 provides the current organizational chart.

As previously mentioned, the compact authorizes the Commission to generate its operating revenues from several sources of funds. Featherstone (1999) reported that the Commission's operating budget has historically been funded up to 85 percent by direct contributions from the parties in accordance with the following percentages: Delaware (12.5 percent), New Jersey (25 percent), New York (17.5 percent), Pennsylvania (25 percent) and the United States (20 percent).

In more recent times, some parties have faced difficulties meeting their financial obligations or have decided to forego those commitments. The \$5.7 million Fiscal Year 2012 adopted budget provided for participant contributions in the following amounts: Delaware (\$447,000), New Jersey (\$893,000), New York (\$335,000), Pennsylvania (\$893,000) and the United States (\$0) (Delaware River Basin Commission 2012). Once funded directly, any federal contribution now flows through the U.S. Army Corps of Engineers. The Commission's 2011 annual report, *Celebrating Our 50th Anniversary*, pointed out that the federal government has only provided its contribution once to the expense budget since 1996. As a result, funding for operating expenses is also obtained from grants, fees for special projects, surface water supply charges, and project review fees (Delaware River Basin Commission 2012). The Fiscal Year 2012 financial summary noted that states, in this case Delaware, have occasionally had difficulty in meeting their financial obligations.

Featherstone (1999) further reported that funding for the capital budget is obtained from the water sales program. For Fiscal Year 2012, the approved capital budget provided for revenues of \$4.1 million and expenses of \$3.7 million (Delaware River Basin Commission 2012).

Activities Program

The Delaware River Basin Commission has an extensive list of activities and accomplishments over its 52-year history. The following discussion will highlight some of these.

The Commission has significantly affected water allocation and use in the basin through its modification of diversions and releases of surface waters to address drought conditions and regulation of diversions of surface waters and withdrawals of groundwater.

Born in the early stages of a drought, the Commission had to declare its first “state of water supply emergency” in 1965. This declaration immediately implemented a fundamental provision of the new compact law, which authorized the Commission to resolve water disputes through an administrative process. To address water shortages and accommodate conflicting demands, the Commission assumed the central role in negotiating a successful, out-of-court policy on emergency water allocations. As a result, New York City was ordered to increase releases from its reservoirs and a flow regime was implemented to prevent the migration of a saltwater wedge upstream to Philadelphia’s withdrawal point (Featherstone 1999). In 1967, the drought ended, and requirements for water diversions and releases returned to those set forth in the 1954 decree.

Given its experience from the 1960s drought and the cancellation of the Tocks Island dam project, the Commission acknowledged the changes in river conditions that had occurred since the adoption of the 1954 decree. As a result, it adopted Resolution No. 78-20 inviting the parties to the 1954 decree to enter into good faith discussions to establish water management alternatives (Delaware River Basin Commission 1982). During the negotiation period, drought conditions prevailed in 1980 and 1981. A report outlining the results of those discussions was submitted in 1982 and the Commission adopted a resolution in 1983 amending the Delaware Water Code to include agreed-upon reservoir drought operating plans (United States Geological Survey 2012). The new drought operations plans focused on the achievement of a long-term salinity standard in the lower basin (Delaware River Basin Commission 1982). These milestone revisions to the 1954 decree and their subsequent amendments have been applied by the Commission on several occasions.

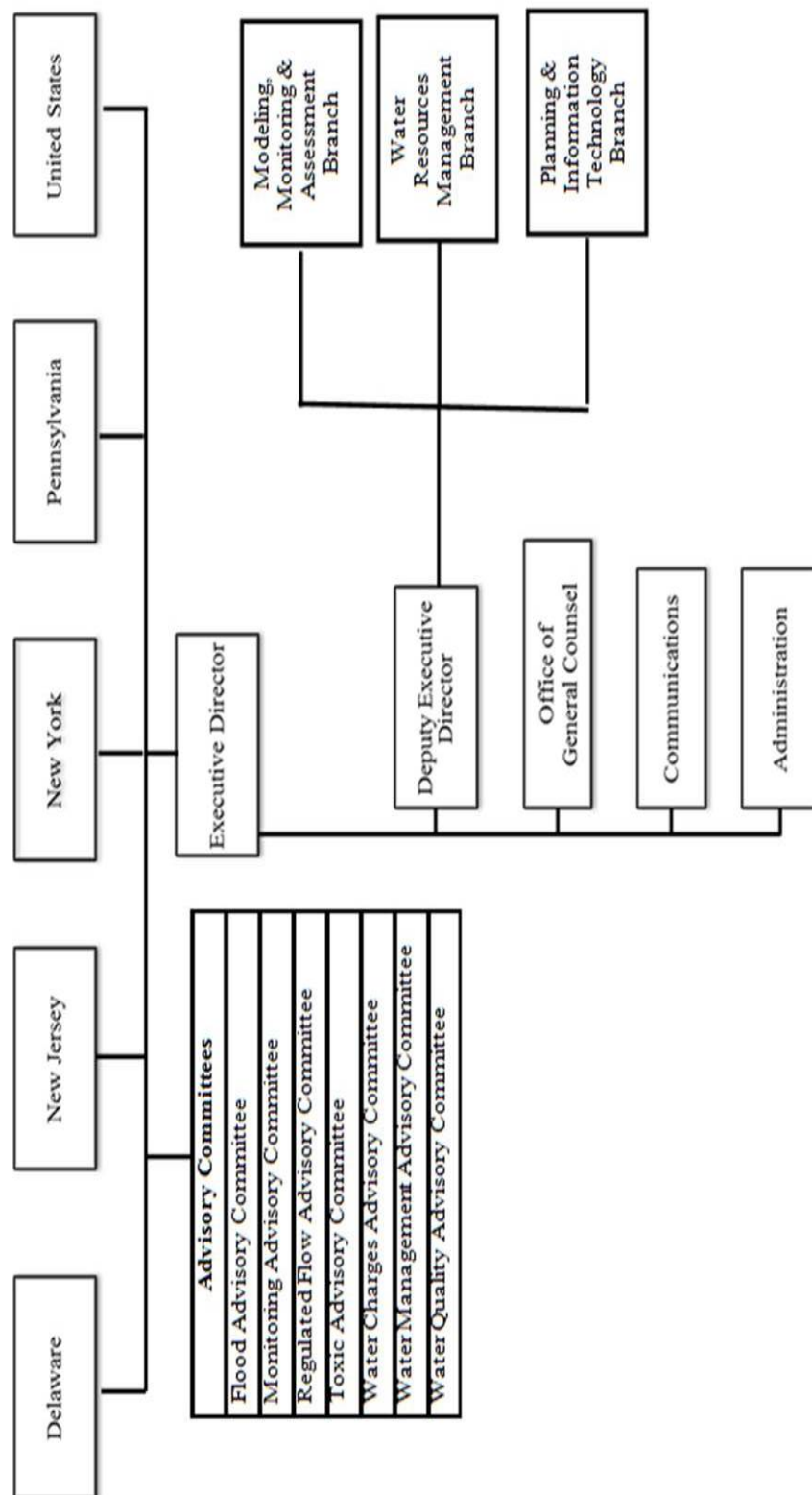


Figure 4. Delaware River Basin Commission Organizational Structure (Delaware River Basin Commission 2013)

Since the 1954 decree contained no requirements for minimum conservation releases, such releases from the Pepacton and Neversink reservoirs were based on informal agreements between New York City and the State of New York. However, in granting a permit for the Cannonsville Reservoir, New York State included a condition requiring basic conservation releases. The 1982 report also contained recommendations that the comprehensive plan should be revised to include augmented conservation releases, consistent with those employed during the trial program, to enhance fisheries below the New York City reservoirs (Delaware River Basin Commission 1982, United States Geological Survey 2012).

When the compact was enacted in 1961, state regulation of surface water diversions and groundwater withdrawals was not common practice in the eastern United States. Featherstone (1999) observed that in 1961, three basin states regulated surface water withdrawals, but only New Jersey regulated groundwater withdrawals. One reason that groundwater withdrawals were not more widely regulated resulted from the evolving understanding of the nature of groundwater and its flow.

As mentioned, the compact authorizes the Commission to regulate withdrawals and diversions and the Commission requires review of projects that can have a substantial effect on the water resources of the basin. The agency has directly implemented or participated in cooperatively implementing programs to address groundwater issues across the basin.

In implementing its authority, the agency adopted a policy in 1980 that limited new groundwater withdrawals based upon a maximum sustainable yield concept. Due to concerns over groundwater overdraft in areas of southeastern Pennsylvania, it also established a groundwater protection area in that portion of the basin and, in 1982, strengthened its regulations regarding projects subject to review. Instead of requiring review of projects with withdrawals exceeding 100,000 gallons per day, the revised regulations required a review of those withdrawals exceeding 10,000 gallons per day (Delaware River Basin Commission 2008). This policy intervention was particularly significant as no agency in Pennsylvania has legal authority to regulate groundwater withdrawals. Featherstone (1999) observed that the Commission's programs have brought consistency to the regulation of withdrawals and diversions across the basin.

In addition to the groundwater protected area in Pennsylvania, concerns about overdraft problems have historically existed in areas of southern New Jersey. To address concerns over declines in groundwater levels, the New Jersey Department of Environmental Protection established a critical areas program to reduce withdrawals in the area. The agency designated two areas as water supply critical areas and through its efforts, groundwater levels have begun to improve.

Since 1985, the Delaware River Basin Commission has also implemented a basin-wide well registration program, which requires owners of all new and existing wells withdrawing 10,000 gallons per day or more to register their wells with a designated agency in their state. As previously noted, all withdrawals exceeding 100,000 gallons per day are subject to project review by the Commission staff.

The Commission has also made significant progress in water conservation through the adoption of regulations requiring the source metering and reporting from well owners withdrawing more than 100,000 gallons per day. Other water conservation requirements include metering for water distributors, implementation of leak detection systems and water audits, establishment of standards for plumbing fixtures, and submission of water conservation plans with permit applications (Delaware River Basin Commission 2008).

Outcomes associated with Commission programs have also made improvements in water quality. Water pollution control programs have been implemented in the region since the 1940s as the result of actions by the Interstate Commission on the Delaware River Basin and state health departments. The Commission initially adopted water quality regulations in 1962, as part of its water pollution control program. However, the agency strengthened those standards, particularly for dissolved oxygen and bacteria, in 1967, and began basing implementation of the standards on wasteload allocations in 1968, a relatively new concept in water pollution control at the time.

Before 1972, water pollution control regulation in the basin primarily occurred as the result of actions of the Commission and state health departments. Although the Commission's water quality efforts primarily focused on interstate waters, some states had adopted the same standards for intrastate waters

(Featherstone 1999). In the event of a conflict between any standards, the Commission's standards prevail.

With the enactment of the amendments to the Federal Water Pollution Control Act in 1972, Congress designated the U.S. Environmental Protection Agency as the primary federal water pollution control agency and refused to explicitly recognize the Commission in the enactment of the law (Derthick 1974). The emergence of a new lead federal water pollution control agency posed some jurisdictional issues. Many provisions of the Federal Water Pollution Control Act required or authorized actions by states. Despite the broad powers conferred upon it by the compact, the Commission failed to receive recognition from federal agencies, particularly the Environmental Protection Agency, regarding any authority to act on behalf of its member states. Early on, this conundrum was particularly pronounced in the submission of water quality standards, which federal law requires states to submit. However, the Commission responded by working with the states to develop the standards, which were subsequently adopted by their regulatory agencies (Schlager and Blomquist 2008). This approach resulted in significant consistency among the basin state standards. Schlager and Blomquist further observed that the Commission has achieved great success in achieving near-uniform regulatory requirements by working with cognizant state officials and by reviewing state plans and other administrative documents.

Today, the Commission closely coordinates all aspects of its water quality control program with its member states and other federal agencies, as required by law.

The Commission has also played a significant role in protecting waterways having high quality waters. In 1992, it implemented an anti-degradation program to protect reaches of the Delaware River. Initially, the Special Protection Waters Program included the non-tidal waters of the upper Delaware River (those waters above the Delaware Water Gap), of which 107 miles had been included in the National Wild and Scenic Rivers Program since 1978 (Delaware River Basin Commission 2008). Following the addition of reaches in the lower river (between the Delaware Water Gap and Trenton) to the national system, the Commission also included those portions of river in its program. As a result, a

197-mile section of the non-tidal Delaware River is now included in the program (Delaware River Basin Commission 2008).

Under the Special Protection Waters Program, new municipal and industrial dischargers are required to obtain approval from the Commission if the effluent flow exceeds 10,000 gallon per day (the threshold for the remainder of the basin is 50,000 gallons per day). In addition, point source discharges must assure that alternatives have been considered and must demonstrate “no measurable change to existing water quality” (Delaware River Basin Commission 2008). Projects located in the drainage area and subject to Commission review must have a Nonpoint Source Pollution Control Plan (Delaware River Basin Commission 2008).

In its efforts to further protect the water resources of the Delaware River Basin and reduce water pollution, the Commission has implemented monitoring and control initiatives for a variety of highly toxic, persistent pollutants, including nutrients, copper, pesticides, and polychlorinated biphenyls. For example, the Commission adopted regulations in 1996 to control the discharge of toxic substances from wastewater treatment plants into the tidal portions of the Delaware River (Delaware River Basin Commission 2008, Delaware River Basin Commission 2012).

Part of the impetus for the creation of the Delaware River Basin Commission came from the record floods in 1955. As a result, the reduction of losses due to flooding has been an important component of the mission. Over the years, the agency has worked with the U.S. Army Corps of Engineers and other organizations in developing maps for forecasting floods and sponsoring projects to reduce flood losses. Since 1971, the Commission has engaged in development of basin-wide flood regulations, which serve as minimum standards, allowing local governments to adopt more stringent requirements if desired (Featherstone 1999). However, the Commission’s standards are more stringent than those rules needed to participate in the National Flood Insurance Program.

Because of record flooding on the main stem of the river between 2004 and 2006, the governors of the basin states charged the Commission with developing flood mitigation plans. The Commission convened a task force to develop recommendations and in 2007, the Interstate Flood Mitigation Task

Force submitted its report containing 45 recommendations for a “proactive, sustainable, and systematic approach to flood damage reduction” (Delaware River Basin Interstate Flood Mitigation Task Force 2007). These recommendations set forth proposals to address reservoir operations, structural and non-structural measures, stormwater management, floodplain mapping, floodplain regulation, and flood warning. Implementation of some recommendations is currently underway.

In September 1999, the governors of the basin states signed a resolution calling upon the Commission staff, in consultation with interested parties from the basin community, to develop a water resources plan, a policy document setting forth a unifying vision and goals for future water resources management (Delaware River Basin Commission 2004). The plan, developed in concert with a Watershed Advisory Council and basin plan advisory committees and completed in 2004, considers a 30-year horizon is being used to guide policy decisions and prioritize actions (Delaware River Basin Commission 2004). It recognizes that water resources must be managed comprehensively in an integrated manner—that is, management needs to include the interrelationships between (1) water quality and water supply/availability; (2) land use and water resources; and (3) surface water and groundwater. In the 2004 plan, goals and objectives were aggregated into the following five key areas: sustainable use and supply, water corridor management, linking land and water resource management, institutional coordination and cooperation, and education and involvement for stewardship (Delaware River Basin Commission 2004). Seeking strong institutionalized partnerships, the plan’s goals include (1) improving cooperation in basin water management, particularly on water quality management issues; (2) increasing data and information sharing among stakeholders, focusing on geographic information system and digital data, technology transfer and enhancing communication opportunities among stakeholders; (3) encouraging cooperative planning and management by securing adequate resources; (4) ensuring execution of water resources management in accordance with the policies in the basin plan; and (5) facilitating coordination through the use of planning and regulatory powers of regional authorities and the Commission (Delaware River Basin Commission 2004). The plan contains a notable guiding principle, “individually and collectively, we are responsible” (Delaware River Basin Commission 2004).

In the Commission's 2011 annual report celebrating its 50th anniversary, Carol Collier, the Commission's Executive Director, identified the following five achievements as the Commission's most significant accomplishments in its first 50 years:

- *Effective and adaptive drought management planning*
- *Improvements to water quality as the results of successful standards development and implementation*
- *Creation of the special waters program to protect high quality waters*
- *Development of a flood mitigation strategy*
- *Advancement of a monitoring, modeling and assessment program to identify conditions and trends.*

Most recently, the Commission has been engaged in the debate over the impacts of hydraulic fracturing. The Marcellus Shale formation underlies approximately 36 percent of the Delaware River Basin (Delaware River Basin Commission 2013). New drilling and recovery technologies have enabled economically feasible access to natural gas trapped in the formation. In 2010, the Commission directed the staff to prepare draft regulations governing well pads and those regulations were published for comment in December 2010. After considering more than 69,000 comments, a revised draft was released in anticipation of a Commission vote in November 2011. The vote was postponed to allow commissioners more time for review, but a subsequent vote has not been set.

Closing

In considering the development of the concept for a federal-interstate compact commission, Martin, Birkhead et al. (1960) recognized the following potential shortcomings of this type of administrative structure and the associated institutional arrangements. The effectiveness of a federal-interstate compact will depend on the extent to which the parties fully support and participate, including adequate funding. Extending on that thinking, the researchers noted that parties must also believe that severe water problems exist and solutions must be regionally based, because the absence of well-defined

problems with regional interdependencies will adversely affect participation. If an agency is to be successful in addressing problems, its ability to coordinate and plan will be directly related to its authority; therefore, providing insufficient authority will result in poor planning and coordination. In addition, success will require an administrative agency with professional staff. Conceivably, two of the more profound observations provided that federal-interstate compacts could not completely provide cooperative and integrative action among federal participants, because no federal agency can speak for all agencies. Moreover, federal-interstate compacts are *not immune to politics* and changes in political philosophies, but employing the right institutional arrangements can help with resilience.

While this dissertation does not provide a performance evaluation of the Commission and its programs, it is noteworthy that evaluations during three decades have found satisfactory performance. In its review of the performance of the Delaware River Basin Commission, the United States General Accounting Office made no recommendations to improve the agency's performance. (United States General Accounting Office 1986). In his 1999 performance evaluation, Featherstone determined that the Commission had been effective in meeting most of its objectives as set forth in the compact. Assessing conditions in the Delaware River Basin, Kauffman, Belden et al. (2008) found that the health of the river has improved or remained constant for many environmental indicators; however, challenges remain in addressing pesticide contamination, fish-consumption advisories, other stream impairments, loss of native species, and changes in land use.

Table 2 identifies selected accomplishments during the tenure of the Delaware River Basin Commission. An argument may be made that such accomplishments would not have occurred or would not have occurred in a timely manner without coordination, participation, or funding by the Commission

Table 2. Selected Accomplishments – Delaware River Basin Commission

Selected Accomplishments
Comprehensive plan/multi-year water resources program
Drought management/1983 Good Faith Agreement/Flexible flow management program (2007)
Special protection waters program (1992)
Water Resources Plan for the Delaware River Basin (2004)
Water quality management/Pollutant Minimization Plan (2005)
Delaware River Basin Interstate Flood Mitigation Task Force Report (2007)/Flood management plan

The institutional arrangements creating the Delaware River Basin Commission are exceptional, shared by only the Susquehanna River Basin Commission. Those arrangements have allowed the Commission to operate outside the traditional governance structure created under a federalist system. As a result, the Commission may have been able to achieve some objectives, such as modification of the 1954 Supreme Court decree, which it otherwise would not have been able to accomplish as a federal agency or a typical interstate compact commission. However, as discussed above, the Commission has struggled for legitimacy, as evidenced by its problems with federal funding and lack of recognition in the Clean Water Act revisions. The interagency coordination aspect of the compact has not achieved its promise, particularly as the stature of the federal representative was reduced from a Cabinet official to a commanding general of a division of the U.S. Army Corps of Engineers. The Commission recently announced retirement of its executive director after 15 years of service and the persistent challenges resulting from insufficient funding will likely result in further changes.

While a 1982 Western Governors' Association report stated, "The DRBC's framework for regional coordination under the Federal-interstate compact mechanism appears unrivaled by any existing or proposed institutional arrangement." Derthick (1974) observed that the Commission has done less than proponents hoped and opponents feared.

GULF OF MEXICO PROGRAM

Introduction

Since 1988, the United States Environmental Protection Agency has coordinated and provided funding for the Gulf of Mexico Program. This non-regulatory program has provided for collaboration among federal and state agencies with programmatic responsibilities associated with the Gulf of Mexico and citizens and other interested parties in the region to develop and implement programs and projects toward the goals of protecting and restoring the ecological health of the Gulf of Mexico and maintaining the economic vitality of the associated region.

Five states, Florida, Alabama, and Mississippi (Region 4 of the U.S. Environmental Protection Agency) and Louisiana and Texas (Region 6 of the U.S. Environmental Protection Agency), are directly involved in the program. In addition, the illustration shows the vast drainage area of the Gulf of Mexico. As discussed below, activities in this drainage area have historically contributed to and continue to influence water quality and ecological health in the Gulf.

Resource Characteristics

The Gulf of Mexico, also referred to as America's Mediterranean or America's Sea, is a semi-enclosed sea lying in the transitional zone between temperate and tropical climates. Its aerial extent covers approximately 600,000 square miles, measuring almost 1,000 miles from east to west and about 560 miles from north to south (Gore 1992, United States Environmental Protection Agency 2012). The Gulf is the fifth largest sea and ninth largest body of water in the world. Gore (1992) provides an extensive discussion of the geology and bathymetry of the 300 million year-old Gulf, pointing out that submerged shallow and intertidal areas account for 38 percent of the total area, while the continental shelf, which varies in width from 8 to 135 miles and extends from 65 feet to about 600 feet in depth, accounts for another 22 percent of the area. The remaining extent is comprised of continental slopes (20 percent) and the deep basins (20 percent). With an average depth of about 5,000 feet, the Gulf of Mexico is slightly more than 14,000 feet at its deepest point. The volume of water in the Gulf of Mexico is estimated to be almost 650 quadrillion gallons (United States Environmental Protection Agency 2012).

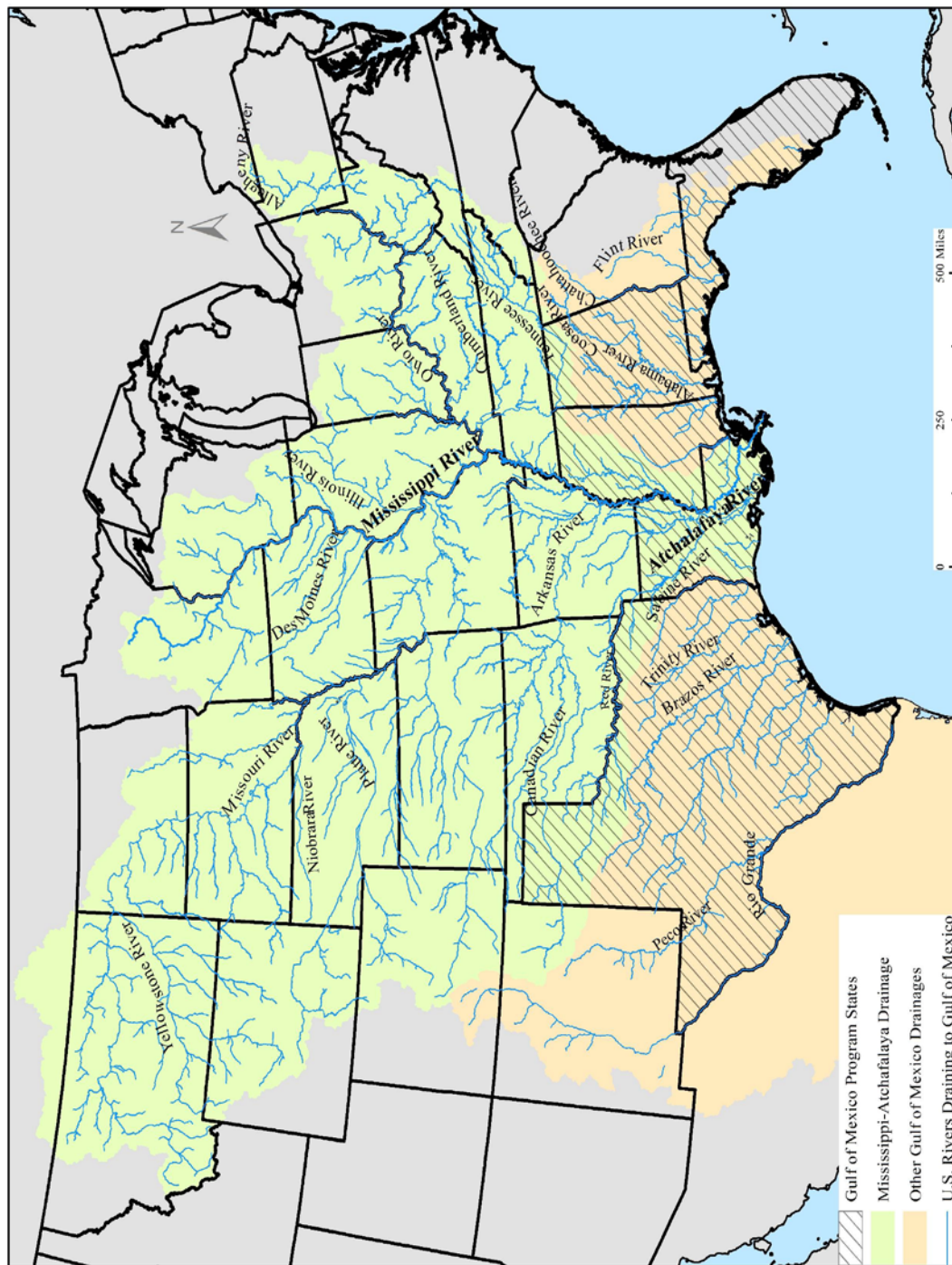


Figure 5. Gulf of Mexico and Mississippi/Atchafalaya River Basin (Evans 2014)

The prevailing current in the Gulf of Mexico, commonly referred to as the Loop Current, generally originates with waters flowing northward through the Yucatan Strait then splits into two components, the Gulf Basin component which moves westward toward the Bay of Campeche, circulates clockwise, and exits the Gulf of Mexico through the Straits of Florida (Gore 1992, United States Environmental Protection Agency 2012). The larger right-hand component flows along the northern coast of Cuba before exiting through the Straits of Florida (Gore 1992).

The total shoreline extends more than 3,800 miles with almost 1,650 of those miles lying within five American states from the Florida Everglades to Brownsville, Texas (United States Environmental Protection Agency 2012). The remaining portion of the Gulf of Mexico is bounded by six political divisions in Mexico (Tamaulipas, Veracruz, Tabasco, Campeche, Yucatan, and Quintana Roo) and five provinces in Cuba (Pinar del Rio, Artemisa, La Habana, Mayabeque, and Matanzas). Including the distances along bays and inlets, the extent of shoreline increases to more than 16,000 miles (United States Environmental Protection Agency 2012).

The Gulf of Mexico and its shoreline areas contain a diverse array of habitats from deep and shallow coral reefs to hypersaline lagoons with seagrass beds to emergent wetlands and marshes to mangrove forests (National Ocean Service 2008). While 31 percent of the Gulf coastal watershed area is composed of wetlands, those areas in southern Louisiana represent 40 percent of the nation's remaining coastal wetlands. The Gulf also has one of the most extensive barrier island systems in the country.

Gulf of Mexico habitats support a wide range of species. Barrier islands provide nesting sites for sea turtles, while mangrove forests afford breeding grounds and nurseries for marine animals (United States Environmental Protection Agency 1994). The 207 estuaries that border the Gulf provide critical habitat for estuarine-dependent commercial and recreational fisheries (Buff and Turner 1987), while tidal marshes and seagrass beds offer feeding, reproductive and nursery habitats for other aquatic species. Additionally, the Gulf provides habitat for 75 percent of the migratory waterfowl traversing the United States (United States Environmental Protection Agency 1989). Areas of the Aransas National Wildlife Refuge in Texas serve as the wintering grounds for most of the world's whooping crane population

(Weddle undated). Overall, the waters of the Gulf of Mexico support more than 15,000 species (McKinney 2011).

While the Gulf region receives waters from 33 major river systems in the United States (Buff and Turner 1987), 90 percent of that freshwater inflow arrives through the Mississippi and Atchafalaya rivers, which discharge over 3.3 million gallons per second into the Gulf (Rabalais, Turner et al. 1996, United States Environmental Protection Agency 2012). With a watershed of more than 1.25 million square miles, the Mississippi River drains 41 percent of the contiguous United States, including 31 states (Figure 5). Moreover, Milliman and Meade (1983) observe that, among the world's rivers, the Mississippi River system ranks third in watershed size and seventh in both freshwater discharge and sediment delivery. As will be discussed later in this section, activities on lands in this watershed significantly affect the water quality of the Mississippi River and the Gulf of Mexico.

In addition to the large drainage area lying in the United States, four significant waterways in Mexico, the Grijalva, Usumacinta, Panuco, and Rio Grande rivers, also empty into the Gulf. Like their American counterparts, these rivers also contribute pollutant loads and impact the Gulf and its habitats.

Lying in a tropical to subtropical climate, areas in and around the Gulf usually average more than 50 inches of rainfall annually. Darnell (1990) observed that hurricanes from a southerly or southeasterly direction occur on average once every two years and may generate waves of 19 feet or more. These weather events include high winds, heavy rains and severe flooding for coastal areas and produce strong currents on the continental shelf. Flooding poses a particularly difficult challenge since 47 percent of the land area, which is home to 28 percent of the human population, lies within the Gulf Coast Special Flood Hazard Area (National Ocean Service 2011). Darnell further pointed out that major cold waves may strike the Gulf coastal region under exceptional circumstances chilling waters in estuaries and shallow zones of the continental shelf, resulting in significant species mortality.

Socioeconomic Characteristics

In 2000, the five states in the Gulf coast region supported 56 million people. Between 1900 and 1950, the population in these states grew by 121 percent and increased another 164 percent between 1950

and 2000 (Forstall 1996, United States Census Bureau 2012). Projections are that the population will increase by an additional 26 million people by 2030 (United States Census Bureau 2005).

The population of the coastal regions of the Gulf states has more than doubled since 1970 reaching almost 21 million people in 2010, and as a result, more than one-third of the Gulf states' population lives within the coastal area (Crossett, Ache et al. 2013). The population of the region is expected to increase by 15 percent by 2020 and is estimated to reach more than 60 million by 2025 (McKinney 2008, Crossett, Ache et al. 2013). However, in examining the potential impacts of population increases, changes in population density generally provide a better indicator. In 1980, the population density of Gulf coastal counties was 113 persons per square mile. By 2003, that figure had increased to 164 persons per square mile, and by 2010, the population density in shoreline counties had grown to more than 200 persons per square mile (Crossett, Culliton et al. 2004, Crossett, Ache et al. 2013). Some impacts of this significant increase in population will be discussed in the next section.

The Gulf of Mexico region contributes significantly to the national economy. The National Ocean Service (2011) reports that the five states bordering the Gulf had a 2009 gross domestic product of \$2.4 trillion, which, if those states were considered a separate country, would make that region the seventh largest economy in the world. In 2009, the regional economy supported 8.3 million jobs and accounted for 17 percent of the gross domestic product of the United States (National Ocean Service 2011).

Reported commercial fishing landings accounted for 1.4 billion pounds of fresh seafood annually (based upon 2007 to 2009 reports)—that is, 78 percent of shrimp landings, 62 percent of total oyster landings, and 16 percent of commercial fish landings nationally (National Ocean Service 2011). As a result, the commercial fishing industry's contribution to the economy was valued at \$660 million yearly. Species of commercial importance include several shrimp species, blue crab, oysters, and numerous species of finfish, including grouper, red snapper, mackerel, menhaden, sea trout, and mullet (Darnell 1990). Van Sickle (1990) emphasized that this level of productivity is directly attributable to the Gulf's large estuarine zone, temperate climate, and distinctive circulation pattern (loop current). As a result, the Gulf's productivity is to some extent limited by habitat, particularly its estuaries (McKinney 1990).

Recreational fishing also plays an important economic role. Activities in the Gulf of Mexico included 23 million boat trips in 2006, which represented 31 percent of all marine fishing trips, and 56 percent of the marine recreational fishing harvest (National Ocean Service 2011). Species of recreational importance include herrings, marine catfish, sea bass, porgies, croaker, and red drum (Darnell 1990).

Tourism and recreational activities, other than fishing, also serve as part of the region's economic engine. Businesses in these industries employed approximately 650,000 people regionally, accounting for eight percent of total employment. Labor statistics show that wages for these workers were \$10.5 billion annually (National Ocean Service 2011). Visitors to the region also enjoyed state and national parks, protected areas such as estuarine and Audubon reserves, wilderness areas, and lands and water supporting hunting, fishing, camping, diving or just sunbathing.

Some of the nation's most vital energy resources are found in the area. The National Ocean Service (2011) reports that the 3,701 Gulf of Mexico oil and gas platforms accounted for 54 percent and 52 percent of the total United States crude and natural gas production in 2011, respectively. In addition, the Gulf of Mexico is crisscrossed by over 27,000 miles of active oil and gas pipelines and about 17,000 miles of out-of-service pipelines. Moreover, payments to the federal treasury for production leases on the Gulf's outer continental shelf exceeded \$80 billion between 1962 and 1992 (Senator Lloyd Bentsen (Tex) 1992). Looking to the future, the Gulf is home to about 60 percent of the nation's oil reserves and approximately 40 percent of the natural gas reserves (McKinney 2011).

In addition to the Gulf's production capacity, the region contains 47 percent of the national refining capacity and the related petrochemical industry produces a substantial percentage of the country's petroleum-derived chemicals (National Ocean Service 2011). To support these activities, transportation of significant quantities of petroleum and petroleum-derived products occurs in the Gulf through pipelines and by barges and tankers.

Vital to the nation's waterborne commerce infrastructure, thirteen of the 20 leading ports, based on tonnage shipped in 2009, were located in the Gulf, accounting for the shipment of 994 million short tons of cargo (National Ocean Service 2011). Between 1992 and 2011, shipments from ports through the

Gulf Intracoastal Waterway predominantly carried crude materials, petroleum and allied products, and chemicals and related products (United States Army Corps of Engineers 2012). Shipments from these ports also accounted for 50 percent of the nation's international trade tonnage.

Despite the growing urban character of coastal areas, agricultural production remains a significant economic engine in the Gulf states. In addition to harvests of cotton, corn, and soybeans, areas of these states also produce substantial quantities of vegetables, citrus and other fruits, and sugar cane. Gulf states are among the nation's largest producers of cattle and poultry. Silvicultural production is also a considerable economic driver in some areas.

Agricultural production also plays a major role in areas of Mexico that commercially produce sugar cane, cattle, swine, goats, vegetables, and grains. Cuban commodities include sugar cane, milk and dairy products, fruits, vegetables, and rice.

Given the vast resource base provided by the Gulf of Mexico, thousands of businesses and industries in coastal areas, particularly in Texas, Louisiana, and Mississippi, use those as raw materials. Among those commercial operations are seafood processors, petroleum refineries, natural gas processors, chemical manufacturers, and the host of businesses that support regional oil and gas exploration and production activities and seafood harvesting.

The Gulf has also traditionally played a significant role in the nation's defense infrastructure. Until 2006, Naval Station Pascagoula served as a homeport for guided-missile cruisers. The station also supported a large Coast Guard base. In addition, Ingalls Shipbuilding and related industries along the Gulf coast have historically constructed warships for the Navy (Buff and Turner 1987).

Because of the growing population centers, array of tourist and recreational activities, water-dependent businesses and industries, and agricultural production, the availability of high quality water is vital to Gulf coastal areas. Like most regions in the United States, the predominant water use in the Gulf of Mexico region in 2005 involved cooling water for thermoelectric power production (69 percent) (Kenny, Barber et al. 2009). However, about 25 percent of that water was drawn from saline surface water sources. Estimated total surface water use in the region accounted for about 26 billion gallons per

day in 2005 with approximately 16.5 billion gallons being taken from streams and rivers and the remaining 9 billion gallons withdrawn from saline sources (Kenny, Barber et al. 2009, National Ocean Service 2011).

Examining fresh surface water use in more detail, public supply accounted for only six percent and industrial users withdrew about 15 percent (Kenny, Barber et al. 2009, National Ocean Service 2011). To reduce pressures on fresh surface water sources, area industries also extracted some supply from saline sources. The remaining fresh surface water use was accounted for by irrigation (7 percent) and livestock, mining, and aquaculture (less than 1 percent). Overall water use in the Gulf coastal area has remained relatively consistent since 1985 (National Ocean Service 2011).

Selected Water Management Institutions

Of the five Gulf States, institutions for water allocation and use, water pollution control, and water resources planning in Alabama, Florida, and Mississippi were discussed in Chapter 1.

Louisiana law does not require permits for surface water or groundwater withdrawals. Some groundwater withdrawals must be registered with the state. State courts adhere to the riparian rights doctrine. Louisiana has been delegated the responsibility for administering and enforcing the federal water pollution control permit program, including the pretreatment program (Environmental Council of the States 2010). The state does not have a comprehensive state water plan (Viessman and Feather 2006).

Texas adheres to the appropriative rights doctrine in surface water allocation and permits are required for use of surface water and groundwater. Groundwater in Texas is subject to the absolute ownership rule (rule of capture) and no permits are required for withdrawals; however, some regulation may be imposed by sub-state agencies. Like the other states, Texas is authorized to implement the federal programs. Texas' water planning process involves the development of regional plans to address water resource issues (Viessman and Feather 2006).

Water Management Agencies and Organizations

Similar to the other case studies included in this dissertation, numerous federal, interstate, state, local, public interest, and private sector agencies, groups and organizations share an interest in water resources management and related activities associated with the Gulf of Mexico.

Federal agency involvement includes the U.S. Environmental Protection Agency (supports the Gulf of Mexico Program) and the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (National Marine Fisheries Service and the National Ocean Service). Participation by agencies of the U.S. Department of the Interior includes the U.S. Geological Survey, the National Park Service, the U.S. Fish and Wildlife Service, and the Bureau of Ocean Energy Management (formerly Minerals Management Service). Defense agencies include the U.S. Army Corps of Engineers and the U.S. Naval Research Laboratory. The U.S. Food and Drug Administration serves as the primary federal health-based agency. Over the years, officials from the departments of agriculture, energy, state, and transportation and the National Aeronautics and Space Administration have contributed significantly in policy discussions on matters affecting the Gulf of Mexico (United States Environmental Protection Agency 2012).

Responsibilities for management of the resources of the Gulf of Mexico are distributed among almost 20 agencies in the five Gulf states. These agencies are responsible for protecting, conserving, and regulating the use of marine resources (licensing recreational and commercial seafood activities) and coastal management. Other agencies include environmental regulatory agencies in each state, as well as agencies that regulate mineral, oil and gas exploration and production activities. Geological survey agencies play roles in monitoring and evaluating water resources. Other state interests include forestry and agriculture (United States Environmental Protection Agency 2012).

On an interstate or multi-state regional basis, Coastal America and the National Science Foundation have participated in Gulf programs. Coastal America, created in 1991, is an organization involving representatives of federal, state and local governments and private organizations in the use of available management tools to provide coastal stewardship by restoring and preserving coastal

ecosystems. Coastal America's Gulf of Mexico Regional Implementation Team has participated in regional programs, including supporting Gulf of Mexico Alliance initiatives and furthering education and outreach activities through designation of coastal environmental learning centers in U.S. and Mexican Gulf states. The National Science Foundation has funded research activities in the Gulf of Mexico region.

The Gulf of Mexico coastal belt includes more than 140 counties and parishes and hundreds of municipalities and townships, some of which provide drinking water supply and wastewater management services. In addition, some states in the region have authorized the establishment of sub-state regional districts to provide these services. Other sub-state public organizations implementing programs that may impact on water resources management include shoreline and beach preservation districts and regional water management districts.

Other regional stakeholders represent agricultural interests, resource conservation and environmental advocacy organizations, local governments, business and commercial associations, academic and research interests and educational facilities (United States Environmental Protection Agency 2012).

Background

As noted elsewhere in this dissertation, regional identity is determined many times through a common cultural, historical, socioeconomic, and political heritage. This identity often serves as the basis for undertaking cooperative actions to address common threats or problems.

The Gulf coastal region was generally settled by Spanish and French pioneers beginning in the latter part of the 17th century (Weddle undated). New Orleans became the first significant population center due to its access to the Mississippi River and the Gulf of Mexico. Gulf coastal cities in Florida began to develop in the early 1800s and those in Texas after the state joined the Union in 1845. Urban areas have continued to grow due to the availability of economic opportunities (*e.g.*, access to international markets through ports), industrial development, the presence of a temperate climate promoting tourism and recreation, and more recently, relocation of retirees.

Early economies of Gulf coastal states were agriculturally based from citrus and vegetable production in Florida to cotton cultivation in Alabama and Mississippi to rice and sugar cane farms in Louisiana to beef cattle ranching in Texas. Many of these activities occurred further inland and affected coastal communities indirectly. Early coastal economies relied on seafood harvesting as a mainstay (Durrenberger 1992, Nuwer 2006). Until the early 1800s, most seafood products were consumed locally due to an inability to prevent spoilage (Nuwer 2006). However, from the mid-19th century to the first half of the 20th century, the Gulf coast seafood industry expanded rapidly as a result of (1) the construction of railroads and establishment of steamship service connecting coastal ports and inland markets, (2) the development of technologies for the commercial production of ice and pressure canning of oysters and shrimp, and (3) the use of gasoline-powered, metal-hulled boats which could trawl with larger nets (Durrenberger 1992, Nuwer 2006). Since the 1950s, landings have continued to increase as the result of use of improved fishing practices and better gear, advancements in processing and preservation of the catch, and greater effort due, in part, to the immigration of foreign fisherman (Durrenberger 1992).

In the 1930s, offshore oil exploration and production began to occur in the Gulf of Mexico, primarily off the coast of Louisiana, with efforts intensifying after World War II. Between 1954, when the federal government first began to lease offshore lands, and 1986, the federal government leased 41 million acres of outer continental shelf lands for oil and gas exploration and production. Within that area, 5,000 drilling sites were established, which ultimately led to the construction of about 26,000 wells by 1986 (Gore 1992). By 1992, production eclipsed 7 billion barrels of oil and 71 trillion cubic feet of natural gas, accounting for 95 percent of all U.S. offshore oil and gas production (Gore 1992). Significant production has also occurred in offshore waters near Mexico and Cuba.

The Gulf Coast is home to an industrial complex featuring petroleum refineries, natural gas processing plants, pulp and paper mills, agrochemical production facilities, ship building yards, chemical manufacturers, and food processing plants. In addition to using large volumes, many of these water-dependent industries discharge millions of gallons of treated wastewater to the Gulf of Mexico and its drainages.

Before moving to briefly discuss the causes and effects of human activities on the Gulf and its resources, it bears mention that not all impacts on coastal and marine resources are necessarily human-induced. An 1881 *Scientific American* article reported evidence of water quality problems resulting in fish kills as early as 1844. In that case, problems likely resulted from naturally occurring harmful algal blooms. Gulf waters have also been subject to oil pollution through naturally occurring seeps from areas on the continental shelf (Gore 1992). It is estimated that 980,000 barrels of crude oil enter the Gulf of Mexico through naturally occurring seeps annually (National Research Council 2003, Schmidt Etkin 2009). Because these seeps are aerially distributed and may have been discharging oil for long periods of time, impacts may be significantly less due to adaptations by potentially impacted aquatic organisms.

Campbell (1990) identified natural processes such as subsidence, and wind energy and other weather-related factors as significant contributors to coastal erosion. The impacts from storms and hurricanes have also significantly altered coastal habitats on a periodic basis.

Sea-level rise has the potential to cause significant impacts to marine ecosystems. Darnell (1990) estimated that sea level has risen by 426 feet in the past 18,000 years, converting most of the continental shelf to an open water habitat. In an assessment of the susceptibility of Gulf coast areas to adverse impacts from sea-level rise, Thieler and Hammar-Klose (2000) characterized 402 miles as having low vulnerability and 1844 miles as having moderate susceptibility. More than 650 miles were determined to be highly vulnerable with 2105 miles being designated as very highly susceptible to adverse impacts.

Man's activities have influenced conditions in the Gulf for more than 100 years and in some cases, have threatened and continue to threaten the natural beauty, ecological communities, and productivity of the Gulf. Threats have not only resulted from the rapid growth of coastal populations, but also from the economic and industrial development that has placed considerable demands and pressures on the Gulf's resources, particularly since World War II. Indicators of the degradation of coastal environmental quality included worsening of water quality, contamination of fisheries and shellfish beds, loss of wetlands and other coastal habitats, and closure of beaches and recreational areas (Kundell 1996).

In addition, degradation of coastal resources also contributed to serious conflicts among resource users (Lipka, Putt et al. 1989).

To provide a context for conditions and events leading to the establishment of the Gulf of Mexico Program, a brief discussion of the historical development of social and economic conditions and their impacts and then-prevailing environmental issues is presented in the following pages.

Since 1950, the population of the coastal counties in the Gulf states grew by more than 200 percent, as compared to a 64 percent rate of growth for the entire United States with Florida's coastal counties experiencing a 334 percent growth between 1950 and 1988 (Cato and Kumpf 1990). As a result shorelines have been developed and transportation infrastructure constructed impacts have led to losses of wetlands and other coastal habitats (Lewis 1989). Development of unsewered communities has contributed to fecal coliform pollution potentially closing near shore shellfish beds, while the increased impervious surface resulted in more stormwater runoff carrying toxic substances and nutrient pollution to Gulf Coast waterways. By 1990, almost 9,000 square miles of the Gulf of Mexico's shellfish harvesting waters had been classified with 48 percent approved for harvesting and 34 percent determined as off limits for harvesting. The remaining 18 percent were restricted, conditionally restricted, or conditionally approved generally based on freshwater inflows (United States Environmental Protection Agency 1993). Reported contamination of molluscan species usually arose from naturally occurring organisms (*Vibrio* species) or man-induced bacteria (associated with typhoid or cholera) or viruses (Hepatitis A virus and Norwalk viruses). Health impacts generally included varying degrees of gastroenteritis (United States Environmental Protection Agency 1993).

Other impacts have resulted from increased water and energy demand and discharges of treated wastewater into area rivers and streams. Providing some perspective to the impact of growth gulf-wide, Buff and Turner (1987) noted that by 1980 over 1,600 publicly owned treatment works were discharging more than 48 billion gallons of wastewater per day into coastal areas.

Challenges involving marine debris have been around as long as the maritime industry. However, with the increased use of plastics beginning in the 1950s, the nature of waste stream changed from food

materials, wood, metals and paper to include more synthetic substances. The increasing volume of synthetic materials was particularly troubling due to the extended degradation time and tendency to degrade into small pieces.

Based on a 1993 assessment, marine debris from ocean-based sources was characterized as galley wastes, recreational fishing and boat gear, commercial fishing and boat gear, and operational wastes from vessels and oil and gas platforms (United States Environmental Protection Agency 1993). As such, wastes included everything from trash bags and jugs to monofilament fishing line and lures to salt bags and rope to plastic sheeting and hard hats. In addition, marine debris also arose from near-shore stormwater outfalls, beach users, and marinas.

In the mid to late 1980s, marine debris and beach litter became a larger public policy concern due to the appearance of medical wastes and large quantities of trash washing up on public beaches. As a result, states adopted marine litter laws and policies and sponsored adopt-a-beach/beach cleanup programs. A 1988 beach cleanup in Texas yielded two tons per mile of debris (United States Environmental Protection Agency 1990). Reggio (1990) reported that 75 to 90 percent of that refuse came from offshore sources, such as ships and oil rigs on the continental shelf.

In addition to its unsightly nature on beaches, other adverse impacts attributed to marine debris included risks to human health and ecosystems from sunken debris. Death and injury to marine mammals, fish, sea turtles, and birds have been reported due to entanglement or ingestion of foreign substances perceived as food items, which choked, blocked digestive tracts and/or caused intestinal ulcers in animals (United States Environmental Protection Agency 1993).

Gulf of Mexico estuaries are dependent on freshwater inflows for efficient productivity and are sensitive to changes in quantity, timing, location and other disturbances in that inflow. These waters contribute nutrients and sediment, provide for circulation and flushing, and regulate water temperature and chemistry, including the establishment of a range of salinities (United States Environmental Protection Agency 1994). Decreased flows have been attributed to construction of dams and levees for hydropower generation, flood control and water supply impoundments, maintenance of channels for

navigation, and diversions for water supplies. Increased flows can result from flood control efforts, deforestation, urbanization, and agricultural development (United States Environmental Protection Agency 1994). Flow alterations, while not necessarily occurring in coastal areas, take place on waterways draining into the Gulf. Reduced flows can adversely impact habitats and aquatic resources due to increases in salinities and decreased flushing of estuaries, while increased flows may deliver too much sediment, nutrients and pollutants to these sensitive areas (United States Environmental Protection Agency 1994).

Toxic substances are discharged to the Gulf waters from both point sources and nonpoint sources. In 1994, approximately 3,700 point sources discharged wastewater into the Gulf and its drainages. More than 50 percent of those sources were industrial dischargers with approximately 350 outfalls discharging directly into the Gulf of Mexico (United States Environmental Protection Agency 1994). As required by law, wastewaters from point sources required treatment before discharge; however, treatment has not proven to be 100 percent efficient at removing pollutants. To provide some sense of the magnitude of industrial discharges in Gulf states, Lipka (1990) reported that based on the Environmental Protection Agency's 1988 Toxic Release Inventory data, four of the top five states nationally with routine and accidental industrial releases of reported toxic chemicals into surface water were located in Gulf states. Most reported discharges came from chemical and allied products industries.

In addition to the industrial sources, more than 100 municipalities along Gulf shorelines discharged over one billion gallons per day in treated effluent (Ferrario 1990, United States Environmental Protection Agency 1994).

Nonpoint sources of toxic substances and pesticides included accidental spills; urban, industrial, and agricultural runoff; failing septic systems; merchant shipping activities, disposal of dredged materials and sediments; and atmospheric deposition (Ferrario 1990, United States Environmental Protection Agency 1994). Gore (1992) provided numerous specific examples of the spills resulting from oil and gas activities, including the 1979 well blowout at the Ixtoc-1 platform in the Bay of Campeche that released as much as 1.7 million gallons, the 1985 blowout at the Ranger exploratory platform that discharged 6.3

million gallons, and the 1990 accident involving the Norwegian tanker *Mega Borg* which resulted in the release of an estimated 4 million gallons of oil into the Gulf. In addition, Rainey (1990) observed that transportation of oil and offshore production resulted in 91 spills over 1,000 barrels between 1974 and 1990.

Impacts of contamination from toxic substances and pesticides can result in lethal and sub-lethal impacts on aquatic organisms, contaminate estuaries and other sensitive habitats, and pose risks to human health through contact recreation and consumption of contaminated seafood. Substances of particular concern in the Gulf of Mexico included dioxins and furans, polychlorinated biphenyls, polyaromatic hydrocarbons, pesticides, and heavy metals due to the bioaccumulation potential of these contaminants, persistence in the environment, high toxicity, and common availability (United States Environmental Protection Agency 1993). By 1990, releases of toxic chemicals and improperly treated sewage resulted in the permanent or conditional closure of almost 3.5 million acres of shellfish beds in the Gulf (Lipka 1990).

Toxic substances in the food chain pose a risk to human health through seafood consumption. In its assessment, the Gulf of Mexico Program, Toxic Substances and Pesticides Subcommittee determined that exposure to hazardous wastes posed problems (United States Environmental Protection Agency 1993). Toxics were categorized as organics and inorganics with exposure to these contaminants causing a range of human health effects.

Coastal and shoreline erosion rates of 3 to 90 feet per year have been reported with few areas having attained any stability (Campbell 1990). Human-induced causes included hydrologic modifications such as channelization and levee and dam construction. In many cases, coastal erosion has resulted in loss of habitat, reduced fishery resources, saltwater intrusion, and degradation of recreational areas (Campbell 1990).

The availability of nutrients, particularly nitrogen and phosphorous, is vital to maintain healthy populations of aquatic organisms. Nutrient enrichment has caused and continues to cause significant problems such as hypoxic zones, harmful algal blooms, changes in trophic structures, and habitat

alterations in some areas of the Gulf. By way of example, the following paragraphs will further discuss the role of excessive concentrations of nutrients in the development of the hypoxic zone in the northern Gulf of Mexico and harmful algal blooms and the associated impacts.

One of the more publicized water quality issues facing the Gulf of Mexico involves the annual presence of a hypoxic zone in the northern Gulf. Hypoxic conditions exist when dissolved oxygen concentrations generally fall below two parts per million (Renaud 1986). This area, commonly referred to as the “dead zone,” derives that designation because commercial trawlers fail to capture fish, shrimp and crabs using bottom-dragging trawls (Renaud 1986).

The hypoxic zone in the northern Gulf of Mexico generally extends westward along the continental shelf off the Louisiana and Texas coasts from the mouth of the Mississippi River almost to Galveston Bay (Deslarzes 1998, Rabalais, Turner et al. 2002). The zone is the largest and most hypoxic area in the United States and the second largest human-caused hypoxic zone in the world (Rabalais 1999, Rabalais, Turner et al. 2002, Rabalais, Turner et al. 2002). Its extent varies considerably from year to year, reaching a minimum area of about 1,900 square miles in 2000 and a maximum extent of approximately 8,500 square miles in 2002 (Rabalais, Turner et al. 2007). Since the 1988 drought resulted in significantly reduced riverine discharges, no hypoxic zone formed (Justić, Bierman et al. 2007). Rabalais, Turner et al. (1996) observed that the single best predictor for the mid-summer extent, which explains 81 percent of the year-to-year variability, is the nitrate-nitrogen load delivered to the Gulf in the two months before the annual monitoring cruise typically held in July or August.

While hypoxic conditions in the northern Gulf of Mexico are typically associated with bottom waters, they can extend up into the water column (Rabalais, Turner et al. 2002). The generally observed depth distribution of those conditions is from 15 to 90 feet (Rabalais, Turner et al. 1995).

Conditions favorable to the development of the hypoxic zone may begin forming as early as February and end as late as October (Renaud 1986, Deslarzes 1998). However, the most extensive and persistent conditions occur from mid-May to mid-September (Rabalais, Turner et al. 1995).

Bianchi, DiMarco et al. (2010) explained that most scientists agree that the hypoxic zone in the northern Gulf of Mexico results primarily from two conditions. First, an overstimulation of algal growth results from excessive nutrient loads being discharged into the Gulf from the Mississippi and Atchafalaya rivers under favorable temperature and light conditions. The organic load on the continental shelf results from dead algae and fecal matter from zooplankton that consumed available algae. As the organic matter undergoes bacterial decomposition, oxygen is consumed which, in some cases, results in hypoxic or anoxic conditions (Rabalais, Turner et al. 1996).

Worsening the hypoxic conditions, vertical stratification of the water column near the continental shelf prevents oxygenation of waters, particularly bottom waters (Bianchi, DiMarco et al. 2010). Stratified conditions result from low velocity winds, calm seas, salinity differences, and temperature variations (Hanifen, Perret et al. 1995, Bianchi, DiMarco et al. 2010).

While the notoriety of the mid-summer hypoxic zone in the northern Gulf of Mexico has increased over the past 25 years, the presence of hypoxic conditions is not a recent phenomenon and is not confined to the Gulf of Mexico (Buck 2007, Diaz and Rosenberg 2008). Analyses of Gulf of Mexico sediments have confirmed the existence of low oxygen levels in Gulf of Mexico bottom waters before the late 1940s, when commercial fertilizer use began on a broader scale (Sen Gupta, Turner et al. 1996, Rabalais, Turner et al. 2002). However, more significant changes have occurred since the substantial increase in use of these chemicals began in the 1960s and 1970s (Diaz and Rosenberg 2008). Studies indicate that large-scale hypoxic events did not generally occur before the 1970s (Pokryfki and Randall 1987, Scavia, Justić et al. 2004, Justić, Bierman et al. 2007). Although hypoxic conditions had been studied and reported for years, issues associated with hypoxia began receiving significantly greater attention following Texas' closure of the shrimp fishery in 1982 (Renaud 1986). The first systematic assessment of oxygen levels in bottom waters began in 1985 (Rabalais, Turner et al. 1995, Rabalais, Turner et al. 2002).

While the zone in the Gulf of Mexico may be the largest in the U.S., Buck (2007) reported that hypoxic conditions have also existed historically in the Long Island Sound, Chesapeake Bay, and New

York Bight. In addition, these conditions have been known to exist in deeper ocean waters, including some deeper areas of the Gulf of Mexico.

Impacts associated with the hypoxic zone may be profound. Mobile organisms leave hypoxic waters and move to areas where dissolved oxygen concentrations can sustain life. Aquatic organisms that cannot move due to a life stage or habitat requirements may die (Hanifen, Perret et al. 1995). Other adverse effects may include decreased recruitment, increased incidences of red and brown tides, and changes in food webs, species composition, and ecological interactions (Hanifen, Perret et al. 1995, Committee on Environment and Natural Resources 2010). Commercial and recreational fishermen may also be negatively impacted due to overfishing resulting from increased harvests in areas where organisms have concentrated (Hanifen, Perret et al. 1995).

Another higher profile consequence potentially linked with the presence of excessive amounts of nutrients is the emergence of harmful algal blooms, sometimes inaccurately referred to as “red tide” since the presence of blooms is not directly associated with tidal cycles and blooms do not always produce a red hue on the water.

Algae, the most prevalent photosynthetic marine organisms, are essential elements of marine food webs and produce most of the oxygen in earth’s atmosphere. Most algae contain chlorophyll and require light, nutrients, and carbon dioxide for photosynthesis and are harmless to humans and aquatic organisms. Of the more than 5,000 species of marine phytoplankton, about two percent can adversely impact human health and/or marine organisms (Landsberg 2002). In many cases, these species are often present in marine waters; however, when blooms or higher-than-normal concentrations of harmful algal species occur, the phenomenon is commonly referred to as a harmful algal bloom.

As was the case with hypoxic conditions, harmful algal blooms are not new phenomena. Blooms have been reported in the southern Gulf of Mexico since the 1700s and off the coast of Florida since the 1840s (Texas Parks and Wildlife Department 2013). Magaña, Contreras et al. (2003) chronicled red tide events in the western Gulf of Mexico extending back more than 300 years, but most evidence is anecdotal. Some evidence suggests that harmful algal blooms are increasing in frequency, duration and

intensity (Boesch, Anderson et al. 1997, Magaña, Contreras et al. 2003, Lopez, Dortch et al. 2008). Some increase in frequency may be due to better technology and surveillance systems in detecting blooms (Van Dolah 2000).

Given the breadth of species causing harmful algal blooms, the causes behind such phenomena are not well understood. In some areas, harmful algal blooms are a natural occurrence that can be predicted on a seasonal basis, while in other areas, human activities may contribute to favorable conditions for the formation of blooms (Magaña, Contreras et al. 2003, Walsh, Jolliff et al. 2006). Natural conditions such as an increased seawater temperature (which may also have an anthropogenic component) and an influx of iron-rich dust from desert areas may also increase favorable conditions (Walsh, Jolliff et al. 2006).

Considering human-induced conditions favorable to the formation of blooms, a scientific consensus has emerged that coastal pollution, particularly nutrient pollution, promotes the development and persistence of harmful algal blooms (Boesch, Anderson et al. 1997, Heisler, Glibert et al. 2008). However, since “Florida red tides” occur 10 to 40 miles offshore, the Florida Fish and Wildlife Conservation Commission (2013) asserts the lack of a direct link between the frequency and duration of these events and nutrient pollution occurring in near-shore areas. Harmful algal bloom events may extend from weeks to months, depending on the species and environmental conditions (Darnell 1990).

Of the documented species that produce harmful algal blooms, 37 are present in Gulf of Mexico waters (United States Environmental Protection Agency 2010). These species can generally be categorized as flagellates, diatoms, or blue-green algae (cyanobacteria) (Florida Fish and Wildlife Conservation Commission 2013). Among the species of interest in Gulf of Mexico waters are the dinoflagellates, *Karenia brevis*, *Gambierdiscus toxicus*, *Karlodinium* spp., and *Dinophysis acuminata*; diatom, *Pseudo-nitzschia* spp.; and the marine cyanobacteria, *Lyngbya* spp. (Lopez, Dortch et al. 2008).

Depending on the causative species, harmful algal blooms can have a range of effects from illness or death caused by toxins to habitat loss and degradation caused by reduction of light penetration from

high biomass blooms (includes non-toxic algal species) to damage to fish gills (Lopez, Dortch et al. 2008).

Exposures to algal toxins primarily occur through consumption of food or water or through inhalation of sea spray. Some reports of irritation have occurred due to dermal contact (Magaña, Contreras et al. 2003). Human exposures typically produce symptoms ranging from neurological impairments to gastrointestinal distress to respiratory irritation to dermatitis. Impacts to marine fauna include mass mortality of marine mammals, fish, sea turtles, sea birds, or other organisms primarily due to ingestion of contaminated water or prey species (Lopez, Dortch et al. 2008). Some toxins produce sub-lethal effects, but tend to bioaccumulate thus resulting in enhanced impacts on higher trophic level animals (Lopez, Dortch et al. 2008). Harmful algal blooms may harm marine flora through the presence of accumulated biomass, which blocks sunlight and depletes the oxygen causing habitat impacts.

As noted in this discussion, habitat loss and degradation is a consequence of many human-related activities. Such loss and degradation also produces further impacts. Coastal wetland losses, whether from a decrease in acreage or quality of the wetlands, have reduced storm mitigation, a significant outcome in storm prone areas of the Gulf of Mexico. Declines in biological productivity, including reproduction and growth of fishery resources, have resulted from the loss of estuarine habitats. Impacts to habitats in the deeper regions of the Gulf of Mexico affect nutrient cycling and pollution attenuation (United States Environmental Protection Agency 1994).

Before continuing to discuss the events leading to the establishment of the Gulf of Mexico Program, those efforts should be placed in context of the marine resource-related environmental concerns and policy deliberations occurring during the 1980's.

In the early 1970s, Congress enacted several significant laws to protect natural resources and control pollution. Among those laws were the Coastal Zone Management Act of 1972, the 1972 amendments to the Federal Water Pollution Control Act, the Ocean Dumping Act, the Marine Mammal Protection Act, the Endangered Species Act of 1973, and the Magnuson Fishery Conservation and Management Act of 1976. Newly created agencies, the U.S. Environmental Protection Agency and the

National Oceanic and Atmospheric Administration, along with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers began the ambitious task of implementing these laws. Some laws were faced with implementation problems and were subject to amendment within 10 years of initial passage.

By 1980, much of the public support for environmental and natural resource protection programs had waned. To raise the public awareness of coastal resources and the threats faced by them, the Coast Alliance, a public advocacy group, promoted 1980 as the Year of the Coast and encouraged interested groups to undertake activities and programs fostering goals such as coastal conservation. While President Carter did not officially make the proclamation, the movement continued to build support.

Although ocean disposal of industrial waste had taken place in the Gulf of Mexico for more than 30 years and Congress had acted to restrict the practice, concerns continued across the Gulf region about the environmental effects. Those concerns were heightened in the early 1980s when proposals were submitted for ocean incineration of hazardous and toxic wastes in the Gulf of Mexico.

In retrospect, Giattina (1998) observed, as part of the motivation for the creation of the Gulf of Mexico Program, citizens were becoming more outspoken in raising concerns over habitat loss, endangered species, and water pollution. Supporting his assertion, he pointed to a Brownsville, Texas public hearing on ocean incineration in the Gulf of Mexico where almost 6,000 people attended to oppose the project. He further declared, “The ocean incineration issue galvanized public concern for the Gulf and served as a lightning rod for public frustration with what many saw as duplication and conflicting policies within and among agencies. Recognizing the need for coordinated policy development and implementation, as well as increased financial and technical assistance, citizens called for the formation of a program capable of addressing those concerns and responsible for taking a gulf-wide perspective on problems and their solutions” (Giattina 1998).

Congress also passed several noteworthy environmental laws in the late 1980s. In response to an incident releasing methylisocyanate in Bhopal, India, Congress enacted the Emergency Planning and Community Right-to-Know Act of 1986 to improve state and local emergency preparedness and response capabilities and to make government officials and citizens more aware of the types of chemical being

released locally. The Toxic Release Inventory requires manufacturing facilities meeting certain thresholds to report annually routine and accidental releases of 302 individual chemicals and 20 chemical categories to air, water, or land, as well as transfers offsite (United States Environmental Protection Agency 1990). This opportunity represented the first time citizens could readily obtain information on routine chemical releases.

In light of the public demand for action on marine litter, Congress ratified the International Convention for the Prevention of Pollution from Ships, more commonly known as MARPOL, in 1987. To implement the provisions of Annex V, Congress enacted the Marine Plastic Pollution Research and Control Act of 1987 to regulate the disposal of non-plastic wastes and prohibiting the dumping of plastics by any vessel in U.S. coastal, inland or offshore waters. The U.S. Coast Guard was charged with implementation of that law. Several Gulf coastal states also enacted complementary legislation prohibiting marine litter. However, these measures have not resolved marine debris issues, due to deposition of debris carried by ocean currents in near coastal waters and on beaches.

Perhaps, the most notable piece of environmental legislation enacted in the late 1980s was the Water Quality Act of 1987, a further revision of the nation's major water pollution control law. Provisions in the act emphasized the need for numeric water quality standards for toxic pollutants, management of stormwater runoff and its associated pollutants, and control of pollutants from nonpoint sources. In addition, Section 103 of the act authorized the continuance of the Chesapeake Bay Program and establishment of a Chesapeake Bay Program Office to collect and publish information on the environmental quality of the bay, coordinate federal and state management efforts, determine the impacts of sediment deposition as well as natural and anthropogenic changes to living resources in the bay, including pollutant loading impacts. The program's original authorization under the Chesapeake Bay Research Coordination Act of 1980 had expired on September 30, 1984.

In addition, Section 104 created the Great Lakes National Program Office within the Environmental Protection Agency to (1) implement action plans carrying out responsibilities under the Great Lakes Water Quality Agreement of 1978; (2) develop and implement a Great Lakes-wide water

quality monitoring network; (3) serve as a liaison to the International Joint Commission (4) coordinate internal Environmental Protection Agency programs and actions affecting the Great Lakes; and (5) cooperate with other federal and state agencies in implementing Great Lakes programs. The law specifically directed the program to develop a five-year program for reducing nutrient inputs and five-year study and demonstration projects regarding the removal of toxic pollutants.

The 1987 amendments also established a Great Lakes Research Office within the National Oceanic and Atmospheric Administration to identify issues related to Great Lakes resources that require further research, inventory current research programs regarding Great Lakes resources, and develop a comprehensive environmental research program and data base.

Section 317 of the Water Quality Act created the National Estuary Program to identify nationally significant estuaries threatened by pollution and development, foster comprehensive management planning to conserve and protect those estuaries, and improve coordination of estuarine research programs. The act authorized governors to nominate estuaries, but provided priority consideration for 11 areas identified in the law.

Seeking to end the practice of ocean dumping of sewage sludge and industrial wastes, the 1988 amendments to the Marine Protection, Research and Sanctuaries Act extended the deadline for implementation of a complete prohibition on the dumping of such wastes from December 31, 1981, to December 31, 1991. Furthermore, the act also prohibited the dumping of medical wastes from vessels and placed certain restrictions on the transportation of municipal or commercial waste within coastal waters.

Public concern continued to grow over coastal and ocean pollution throughout the 1980s. the sentiment may have best been captured a 1988 article in *Newsweek* that cautioned people about going near the water due to chemical and biological contamination caused by point and nonpoint sources of pollution (Morganthau, Hager et al. 1988). The article emphasized that problems have undoubtedly existed for long periods of time; however, innovations in detection and measurement technologies have allowed scientists and analysts to detect some sources.

To address growing public concerns over coastal water resource issues, the U.S. Environmental Protection Agency in 1985 began implementation of a new long-term strategic planning project, the Near Coastal Waters Initiative (United States Environmental Protection Agency 1989). In 1986, the agency identified environmental problems affecting near coastal waters nationwide that merited attention: (1) toxics contamination, (2) eutrophication/nutrient over-enrichment, (3) pathogens pollution, (4) habitat loss or alteration, and (5) changes in living resources (United States Environmental Protection Agency 1989). Through its 1986 strategic planning process, the Office of Marine and Estuarine Protection developed “a 10-15 year blueprint” for improving the Environmental Protection Agency’s coastal management programs and promoting integrated management through better coordination among federal, state and local resource management agencies (United States Environmental Protection Agency 1990).

Patterned on the National Estuaries Program and coastal water management programs in Chesapeake Bay and the Great Lakes, the Near Coastal Waters Initiative sought to address threats and concerns on a waterbody-wide basis. Although the Initiative was not implemented under specific legislative authority, it focused on coastal waters beyond estuaries (United States Environmental Protection Agency 1990).

Before the agency could implement its three-pronged approach, a national assessment was undertaken to determine the environmental status and trends of near coastal waters, which included an evaluation of waters impaired by nonpoint sources and toxic substances (United States Environmental Protection Agency 1989). The approach focused on identifying areas needing more attention, encouraging federal and state management and regulatory agencies to using existing authorities and programs to addresses issues and threats, and assisting with the implementation of new strategies, if necessary, to address remaining risks (United States Environmental Protection Agency 1990). Seven demonstration projects were initially funded under the Initiative to test management approaches. In the Gulf of Mexico region, a project in Perdido Bay utilized citizen monitoring teams in Florida and Alabama to create a multi-state management scheme to protect near coastal waters (United States Environmental Protection

Agency 1990). It was anticipated that this project could serve as a model for public-private cooperation in coastal environmental management.

Other activities conducted under the Near Coastal Waters Initiative included organization and presentation of materials regarding near coastal conditions in regional assessment reports, classification of selected estuaries according to their susceptibility to environmental damage from nutrients and toxic substances, completion of a coastal waters management case study in the northeastern United States, segmentation of coastal waters to allow greater focus in future studies, and development of an inventory of federal data to support near coastal waters assessments (United States Environmental Protection Agency 1989).

In response to the worsening conditions in the Gulf resulting from the impacts of population growth, commercial and industrial development, and the need to elevate the priority for protection of the Gulf of Mexico's valuable resources, Jack Ravan, U.S. Environmental Protection Agency Region 4 Administrator, proposed the creation of the Gulf Initiative, which sought to develop a comprehensive strategy to systematically assess conditions and sources of environmental challenges and to implement regionally-based solutions to challenges facing the Gulf of Mexico (Buff and Turner 1987, Thompson 1987, Herrington 1994, Larkin 1999). Ravan recognized that although numerous federal and state agencies held jurisdiction over various aspects of Gulf resources, no coordinated effort existed to address problems. The same situation was true for environmental advocacy groups, academic researchers and representatives of business and industry (Buff and Turner 1987).

In 1986, members of a Texas environmental coalition expressed their concerns over worsening conditions in the Gulf of Mexico to the Environmental Protection Agency Region 6 office in Dallas, Texas. In June, the Region 6 Administrator replied that his office was not prepared to commence any new initiatives regarding Gulf of Mexico resources (Whitson and Putt 1991).

To assess stakeholder interest and support for a Gulf of Mexico initiative, Region 4 officials convened a workshop in August 1986, in Gulf Shores, Alabama. Approximately 60 individuals attended the meeting representing federal agencies, state and local governments, research and academic

institutions, environmental advocacy organizations, and businesses and industries (Buff and Turner 1987, Thompson 1987, Lipka, Putt et al. 1989). Workshop sessions targeted characterization of problems and challenges, specific operational focus areas, and strategies and management approaches that may be used to address threats. Using the list of seven problem areas generated as part of the Near Coastal Waters Initiative (sewage and industrial effluent; urban and agricultural runoff; contaminated groundwater; pollution from toxics, pathogens, and nutrients; waterfront construction; dredging; and cumulative impacts), meeting attendees added six additional matters specific to the Gulf. Threats and concerns were ultimately categorized as follows: toxics contamination, eutrophication/nutrient pollution, pesticide contamination, habitat changes, and changes in living resources.

A discussion on the anticipated functional aspects for inclusion in any proposed institutional arrangements focused on needs for: (1) data, information and research; (2) public education and involvement; (3) land use controls; (4) permitting and enforcement; and (5) resource management. Workshop participants identified deficiencies in current operations, as well as proposed action steps to improving coordinated operations.

During the sessions considering strategies and management approaches, participants backed an organizational structure with a policy-level steering committee supported by task forces to address specific issues. To support that structure, attendees suggested the creation of task forces to address public and political education, data and information management and research, regulatory problems, and resource management activities. While committing his support to the effort, Ravan expressed concerns that the Environmental Protection Agency, because of its current resource constraints, could not lead an initiative (United States Environmental Protection Agency undated).

Based on the support and commitment received from the workshop participants, Region 4 officials proceeded with the development of a proposed initiative. An initial task force meeting was held in December 1986 in Atlanta, Georgia to put forward an organizational structure, identify pilot projects for commencing cooperative efforts, and begin development of a public information program (Buff and Turner 1987). The proposed organizational structure included a 12-member Policy Committee, co-chaired

by officials from the Environmental Protection Agency and the National Oceanic and Atmospheric Administration, to oversee and direct activities. To support the Policy Committee, the task force members recommended creation of a Steering Committee and a Citizens Advisory Committee. The Steering Committee would be charged with the development of proposed goals and programs, recommendation of management approaches to the Policy Committee, and coordination of issue-oriented working groups/subcommittees (Buff and Turner 1987). Details regarding the composition and mission of a Citizens Advisory Committee were deferred to the initial meeting of that committee.

To compile a list of proposed projects, states were asked to recommend proposals. Toward development of the public information program, task force members offered pictures, presentations, and supporting materials (Buff and Turner 1987).

At a February 1987 meeting, officials focused on articulating justification for establishment of an initiative. It was agreed that the primary purpose would be to “provide a regional perspective to addressing research and regulatory problems in the Gulf of Mexico and provide a mechanism for integrating local and regional initiatives and goals” (United States Environmental Protection Agency undated). Among the areas of concern that needed prompt attention were nutrient over-enrichment, toxics and pesticides contamination, habitat degradation, freshwater flow diversions, adverse public health impacts, loss of wetlands, accumulation of debris on beaches, and excessive erosion on barrier islands (United States Environmental Protection Agency undated).

The proposed initiative received official support from the new Region 6 Administrator and the governors of Texas and Louisiana in early 1987. During the early summer, Region 4 officials briefed state congressional delegations and southern governors on the proposed initiative (Whitson and Putt 1991).

Approval for the creation of the Gulf of Mexico Program was granted by U.S. Environmental Protection Agency Administrator Lee Thomas in August 1987 (Larkin 1999). In an *EPA Journal* story regarding the initiative, Thompson (1987) emphasized, “The ultimate goal of the Gulf Initiative is to provide a comprehensive strategy for managing and protecting this valuable resource [Gulf of Mexico].”

Establishment of the Gulf of Mexico Program

Following Administrator Thomas' approval, staff at both regional offices began the development of a memorandum of understanding specifying the roles and responsibilities of each regional office and the authority of the Gulf of Mexico Program office. In June 1988, the memorandum of understanding was signed by the respective regional administrators and in August, the Gulf of Mexico Program began operations at its offices in Stennis Space Center, Mississippi (Larkin 1999).

As provided in the agreement, the primary goal was to create a "regionally focused, institutional structure intended to facilitate consultative decision making between the Regional Offices and the Gulf of Mexico Program and to promote partnership building between the Regional Offices, Office of Water, and GMPO" (United States Environmental Protection Agency 1994). The specified objectives included: (1) provision of clear leadership and support; (2) consideration of all parties' concerns in decision-making process; (3) promotion of a consensus-views approach in developing and implementing plans of action; (4) enhancement of communication; and (5) promotion of national consistency among the Great Water Body Programs.

The Gulf of Mexico Program was responsible for program development, administration and implementation; interagency coordination; information management; and periodic assessments and progress reports. Regional offices committed to identifying significant issues and actions affecting the Gulf, ensuring participation by parties in decision-making processes, reaching consensus on program actions, maintaining effective communications, providing the regional perspective on issues, and providing administrative oversight and support for the Gulf of Mexico Program (United States Environmental Protection Agency 1994).

As discussed above, the Program's organizational structure provided for a Policy Review Board, Technical Steering Committees, issue-oriented subcommittees, and a Citizens Advisory Committee. To facilitate implementation, the agreement provided that the federal co-chair of the Policy Review Board would rotate biennially between regional administrators (United States Environmental Protection Agency 1994).

Other provisions in the Memorandum of Understanding provided for maintaining effective communications, dispute resolution, and revisions to the agreement (United States Environmental Protection Agency 1994).

Over the years, the memorandum of understanding has been revised to account for the changing role of the Environmental Protection Agency's Office of Water in Washington with respect to Gulf of Mexico Program and to include provisions specifying the role of a management committee in the Program's organizational structure.

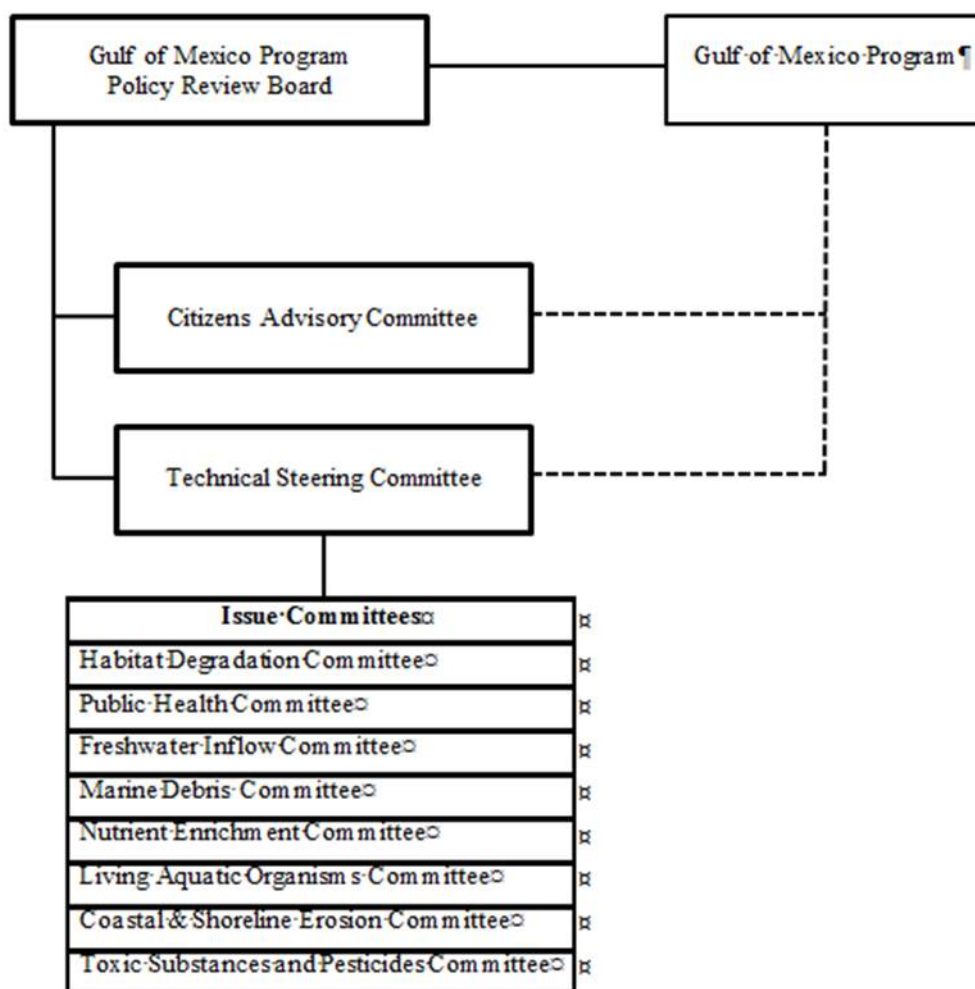


Figure 6. Gulf of Mexico Program Structure 1991

(Adapted from United States Environmental Protection Agency 1994)

Unlike the Great Lakes and Chesapeake Bay programs which have authority stemming from specific provisions of the Clean Water Act, the Administrator created the Gulf of Mexico Program pursuant to his/her general authority, provided in Section 104(b) of the Clean Water Act (1972). As discussed later in this text, numerous efforts have been undertaken over the past 25 years to provide federal statutory authorization for the Gulf of Program.

As a non-regulatory, intergovernmental partnership addressing major environmental threats facing the Gulf of Mexico and its resources, the Program fostered an ecosystem management approach relying on interjurisdictional implementation of voluntary, place-based solutions, similar to the means applied in the National Estuary Program (United States Environmental Protection Agency 1990). As a result, its activities (1) were oriented towards protecting and restoring uses; (2) treated site-specific problems and issues within the framework of regional priorities; (3) considered system-wide and cumulative effects of actions; and (4) managed problems through a focus on natural boundaries (Lipka, Putt et al. 1989). Interventions were applied at the earliest stage possible. In addition, Giattina (2007) highlighted the Program's emphasis on encouraging state leadership on actions and federal leadership on research, analysis, and funding. While the U.S. Environmental Protection Agency provided financial support and leadership to initiate the Gulf of Mexico Program, Lipka, Putt et al. (1989) pointed out that the long-term program goals cannot be reached without the active participation of all appropriate agencies.

Fundamental to achieving success, programmatic operations embraced the following tenets: (1) equal partnership among all participants in defining problems and implementing solutions, (2) use of the best available science and knowledge to guide decisions, (3) extensive use of public involvement to establish support for actions (United States Environmental Protection Agency 1997, Giattina 1998).

To address the complexity and breadth of challenges facing the Gulf, at least 14 federal departments and agencies and 37 state agencies committed to participation in the Gulf of Mexico Program (Lipka 1990). To facilitate a closer working relationship among partners, the Gulf of Mexico Program provided office space and support encouraging and allowing for the co-location of non-Environmental

Protection Agency staff. Federal participation included representatives from the departments of agriculture, commerce, interior, defense, energy, and health, education and welfare, and, as well as independent agencies, such as the National Aeronautics and Space Administration. State representatives from agencies responsible for resource management, environmental and business regulation, technical assistance, health protection, and research also contributed significantly. In addition, the partnership has included representation from local governments and concerned citizens from the five Gulf States, business and industry, and conservation and environmental advocacy organizations. As a result of the broad governmental commitment and citizen and interest group involvement, the initial program included participation by more than 400 people (Lipka 1990). The accommodation of a wide array of viewpoints and the extensive efforts at intergovernmental coordination have emerged among the Program's strengths in implementing its mission (Giattina and Altsman 1999).

Towards facilitating the most effective implementation of the program, it was vital that the organizational structure provide a mechanism to address complex problems crossing federal, state, and international jurisdictional lines; improved coordination among federal, state, and local programs to enhance long-term management efforts; a regional perspective to address research needs and the transfer of information; and a forum for affected user groups and the general public to participate in the solution process. (Lipka, Putt et al. 1989, Herrington 1994, United States Environmental Protection Agency 1994). As noted earlier in this discussion, the Gulf of Mexico, like organizations discussed in the other two case studies, extensively used a committee structure to facilitate its program implementation.

Committee Structure

Policy Review Board

To provide for program direction, the Environmental Protection Agency chartered the 20-member Gulf of Mexico Program Policy Review Board under the Federal Advisory Committee Act.

Passed by Congress in 1972, the Federal Advisory Committee Act governs the creation, operation, oversight and termination of advisory committees. Agencies are limited to the creation of advisory committees deemed in the public interest and that support the agency's responsibilities under

federal law. An advisory committee's scope and objectives and term are limited in its charter. Other provisions of a charter include identification of the federal official to whom advice is being provided, designation of a federal officer to coordinate committee activities, estimations of annual costs and meeting frequencies, specification of the committee's membership, identification of subgroups or subcommittees, and delineation of recordkeeping procedures. This final provision supports the act's focus on the openness of the advisory committee process, including the public availability of records. The act also places procedural requirements on the agency as to an advisory committee's activities.

In accordance with the act, notice of the establishment of the Gulf Of Mexico Program's Policy Review Board was published in the *Federal Register* on September 13, 1989. Besides providing the relevant information on the Board's membership and responsibilities, as discussed below, the notice established the connection between the Gulf Program and the agency's Near Coastal Waters Initiative (United States Environmental Protection Agency 1989).

Led by the administrators from Regions 4 and 6, who were designated as the chair and vice-chair, the charter provided a board membership consisting of executives of 15 other federal and state agencies with responsibilities for managing environmental regulatory and/or natural resource management programs in the region. The chair and vice-chair of the Citizens Advisory Committee and the chair of the Technical Steering Committee were also included as members (United States Environmental Protection Agency 1990).

Under the 1989 charter, the Gulf of Mexico Program Policy Review Board was charged to: (1) provide an executive forum for discussing the coordination of management plans, (2) evaluate the extent of coordination of federal and state plans to determine whether the combined effect will provide appropriate resource management, (3) assess the program's progress in implementing coordinated plans, (4) reach consensus on recommendations for the most appropriate use of federal funds, and (5) report to the Administrator on issues pertaining to implementation of Gulf of Mexico strategies (United States Environmental Protection Agency 1989). The charter further provided for at least two meetings annually `

and Revived Economies of the Gulf States Act of 2011] (United States General Services Administration 2013).

The membership of the newly chartered Citizen Advisory Committee included about 25 individuals appointed by the agency to represent non-federal interests from the five Gulf coastal states (United States Environmental Protection Agency 2011). To obtain a list of potential candidates for membership, the agency issued a notice in the *Federal Register* requesting nominations. The notice stated that members would be providing advice to the Administrator of the U.S. Environmental Protection Agency on issues affecting the Gulf and that members would be serving as representatives of the general citizenry and citizen interests (United States Environmental Protection Agency 2011). Terms were set at two to three years and the notice specified three criteria to be used in evaluating nominations (United States Environmental Protection Agency 2011).

The charter for the Gulf of Mexico Citizen Advisory Committee was renewed in 2012 without further changes (United States Environmental Protection Agency 2012). However, no indication currently exists that members have been appointed or that the committee is meeting.

Management Committee

In late 1991, the Policy Review Board determined that a 12-member Management Committee would improve the efficiency of the Board's business, including direction of the Program's activities; however, that committee was not formally established until September 1992. Members included the Board's federal co-chair (Environmental Protection Agency); officials representing the U.S. Army Corps of Engineers, Soil Conservation Service, U.S. Fish and Wildlife Service, and National Oceanic and Atmospheric Administration; representatives of the five state members serving on the Board; and two members of the Citizens Advisory Council.(United States Environmental Protection Agency 1993). Members were allowed to designate alternates to attend in their stead. The Committee reported directly to the Policy Review Board.

The Management Committee was charged with (1) defining and prioritizing issues and problems, (2) developing action agendas to protect or restore impacted resources, (3) designing coordinated multi-

agency implementation plans to carry out the action agendas, and (4) recommending work plans and budgets to the Policy Review Board (United States Environmental Protection Agency 1993).

Additionally, the Committee was directed to provide oversight of the issue-oriented subcommittees and to seek advice from the Technical Steering Committee and Citizens Advisory Committee on programmatic matters (United States Environmental Protection Agency 1993).

Management committee leadership included a federal co-chair and state co-chair. Support was provided by the Gulf of Mexico Program staff. As noted above, a deputy regional administrator served as the federal co-chair. A state co-chair was selected by the Committee's state members. The bylaws authorized co-chairs to serve one year terms and to succeed themselves (United States Environmental Protection Agency 1993).

The Committee was directed to hold regular meetings and authorized to conduct special meetings, upon request of a majority of Committee members. Meetings could be held by conference call, subject to certain restrictions, and the Director was authorized to poll members by telephone on matters pertaining to program development (United States Environmental Protection Agency 1993).

Management Committee meetings were subject to publication of a notice in the *Federal Register* and open to the general public. Items could be placed on the agenda by members upon submission of the relevant information to the Gulf of Mexico Program Director, who was charged with development of a proposed agenda. The bylaws required that agenda to be approved by the co-chairs (United States Environmental Protection Agency 1993).

The bylaws specified that a quorum consisted of two-thirds of all voting members. Although consensus would be sought on all business coming before the Committee, each member was allowed one vote, if voting were required. Approval by a majority vote of those members voting was required for action. Members could grant proxies. Any *ex officio* members could participate in discussions, but could not vote. Meeting minutes, which were subject to public inspection following approval at the next Committee meeting, were required to include all actions (United States Environmental Protection Agency 1993).

In its oversight of the issue-based committees, the Management Committee was charged with the appointment of co-chairs and members representing appropriate interests. The scope of the issue committees, as specified in the Management Committee Bylaws, included evaluating environmental issues and concerns affecting coastal resources; identifying protective and restorative approaches, including regulatory strategies, to address negative impacts to coastal resources and ecosystems; providing advice on scientific information and programs for data management, modeling, and monitoring resources and stressors, establishing processes of peer review of studies, reports and other documents; and alerting the Management Committee to any emerging trends (United States Environmental Protection Agency 1993). Furthermore, the bylaws specifically provided for the establishment of 10 committees, consistent with the issue-oriented subcommittees and operational committees discussed below.

With the establishment of the Management Committee, the Technical Advisory Committee was reorganized to report to that committee. Under the bylaws, the primary purpose of the Advisory Committee is to “provide expert advice to the MC [Management Committee] on the technical and scientific integrity of the issue characterizations and Action Agendas Prepared by the Issue Committees” (United States Environmental Protection Agency 1993). Leadership was provided by a member of the Gulf of Mexico Program staff and a non-federal official elected by the membership. The Technical Advisory Committee could meet annually to provide its assessment of the Program’s approach in meeting its environmental goals and objectives (United States Environmental Protection Agency 1993).

Other procedural provisions of the bylaws addressed rules of order, conflict of interest, and adoption and amendment of the bylaws requiring a three-fourths vote of the Management Committee membership and approval from the Policy Review Board (United States Environmental Protection Agency 1993).

To provide broader participation in the operational aspects of the program, the membership of the Management Committee was revised in 1996 to include representatives of key constituencies (Giattina 1998). The expanded membership provided for representatives of the Gulf of Mexico Business Coalition, Gulf of Mexico Committee of the American Farm Bureau Federation, Gulf Restoration Network,

Conference of Southern County Associations, coastal zone management programs, marine fisheries resource managers, and The Nature Conservancy. Because program activities affected specific agencies and programs within federal departments, the United States Navy, United States Air Force, United States Geological Survey, Department of Health and Human Services, National Aeronautic and Space Administration, National Estuary Programs were also provided representation.

Technical Steering/Advisory Committee and Issue-specific Committees

A Technical Steering Committee, initially involving 65 individuals appointed by the region's governors to represent a wide range of fields and disciplines, provided scientific and technical support to the Policy Review Board on evaluation of environmental threats and concerns and identification of management strategies and options. The committee also provided oversight for the issue-specific subcommittees and two other operational committees (Lipka 1990). To ensure appropriate coordination and continuity, the Director of the Gulf of Mexico Program served as chair of the Technical Steering Committee.

Co-chaired by a federal official and a state official, the issue-oriented subcommittees were charged to identify specific tasks needed to characterize risks, assess the availability and quality of information for corrective actions, develop predictive measures, and implement corrective actions regarding: (1) habitat loss; (2) marine debris; (3) nutrient enrichment; (4) public health threats; (5) toxic substances and pesticide contamination; and (6) freshwater diversions (Lipka 1990, United States Environmental Protection Agency 1990, Herrington 1994). Two operational committees were established to address the cross-cutting issues associated with public education and outreach and data and information transfer (Herrington 1994).

Over the next two years, the scope of subcommittee issues expanded. In 1989, the Technical Steering Committee established an ad hoc Coastal Erosion Task Force to evaluate options for best addressing coastal erosion issues in the Gulf of Mexico Program framework (United States Environmental Protection Agency 1990). Given the magnitude and complexity of issues surrounding coastal erosion, the task force recommended establishing a subcommittee reporting to the Technical

Steering Committee. Although the jurisdiction of the new subcommittee needed to be closely coordinated with the work of existing subcommittees, the Steering Committee agreed to establish a seventh subcommittee (United States Environmental Protection Agency 1990). In addition, the Policy Review Board approved the creation of a living aquatic resources subcommittee in December 1991.

As previously mentioned, the Technical Steering Committee was renamed in 1993 as the Technical Advisory Committee and directed to advise the newly created Management Committee on the implementation of action agendas and the Program's scientific and technical progress in addressing the challenges facing Gulf resources. The subcommittees, redesignated as issue committees, were also assigned to report to the Management Committee, instead of the Technical Advisory Committee, on the evaluation of environmental issues and the development of regional strategies and program options for addressing resource issues.

Two other organizational changes were made in 1996 affecting management of technical and scientific matters. First, a third operational committee was established to focus on modeling, monitoring and research. In coordination with this committee, nine panels of scientific experts from federal and state agencies identified scientific research critical to understanding and addressing regional environmental and public health issues. Additionally, a scientific review committee was created to ensure appropriate peer review of action plans, studies and other programmatic reports and documents (Giattina 1998).

Citizens Advisory Committee

A Citizens Advisory Committee was also initially established to assist the Policy Review Board in promoting (1) the development and implementation of a comprehensive Gulf management strategy; (2) the formation of an effective infrastructure for solving complex environmental problems; and (3) the establishment of a "framework-for-action" for implementing management strategies and controls (United States Environmental Protection Agency 1989).

More specifically, the Citizens Advisory Committee Bylaws provided that it would:

- develop organized local communication approaches needed by the Program in establishing a dialogue to provide information and receive concerns;

- review federal and state programs affecting Gulf resources to determine their consistency toward achieving the Program's goals;
- recommend federal, state and local governmental funding priorities relating to regional resources; and
- cooperate with the Policy Review Board in the development of an annual report; and
- assist with any public participation activities initiated by the Program (United States Environmental Protection Agency 1989).

Members of the 25-person committee were appointed by the governors of the five participating states with one appointment per state in each of the following areas of interest: fisheries, agriculture, tourism and development, industry, and environmental advocacy. To be eligible for membership, a candidate had to be: interested in water quality and resource management policy and have an awareness of the Environmental Protection Agency's programs; be interested in furthering the goals and objectives of the Program; be potentially affected by the Program's resource management activities; and be willing to communicate with stakeholders and resource users (United States Environmental Protection Agency 1989). Appointees served at the pleasure of the appointing governor without compensation and could designate alternates to attend meetings in their stead. However, travel expenses were subject to reimbursement by the Program (United States Environmental Protection Agency 1989).

Advisory committee leadership included a chair, vice-chair, and secretary/treasurer elected to a one-year term by Committee members. The chair was charged to coordinate activities, preside over meetings, participate on the Policy Review Board as a voting member, and sign official correspondence and documents on behalf of the Advisory Committee. The vice-chair assumed the duties of the chair in his/her absence and also served as a voting member on the Policy Review Board. The secretary/treasurer was designated to transcribe and distribute meeting minutes (United States Environmental Protection Agency 1989).

The bylaws also authorized the creation of an Executive Council consisting of the Advisory Committees officers and the chair of each state's delegation. These appointment provisions also included

a process to ensure that each interest group would be represented on the Executive Committee. In addition to any other powers vested by the Citizens Advisory Committee, the bylaws provided for the Executive Committee's inclusion in formulation of the annual Program budget, establishment of dates and agendas for meetings, and selection of alternate members to attend Policy Review Board meetings, if the chair or vice-chair was unable to attend (United States Environmental Protection Agency 1989). The Executive Committee was also required to name an executive secretary, who may be a member of the Program staff, to transmit meeting notices and agendas and prepare and disseminate meeting summaries.

The Citizens Advisory Committee was required to meet at least semi-annually, but was authorized to meet more often depending on the amount of pending business or at the discretion of the Gulf of Mexico Program Director. Members had to receive at least thirty days' notice of a meeting. If a member missed two consecutive meetings without extenuating circumstances, the Advisory Committee Chair was required to notify the appointing governor and request a new appointment. Meetings were required to be advertised and open to the public. Agenda items could be added by the Advisory Committee chair or any member, the Program Director, or the chair of the Policy Review Board (United States Environmental Protection Agency 1989).

The bylaws specified that a quorum consisted of 13 members, but attending alternate members could not be counted for purposes of a quorum. Each appointed member was allowed one vote. Approval of any motion required a majority vote of those present and voting. Members could grant proxies. Any *ex officio* members could participate in discussions, but could not vote. Meeting minutes, which were subject to public inspection following approval at the next Committee meeting, had to specify all actions taken by the Committee (United States Environmental Protection Agency 1993).

Other procedural provisions of the Citizens Advisory Committee Bylaws addressed rules of order, conflicts of interest, financial support from the Program, and amendment or repeal of the bylaws requiring a two-thirds vote of the Citizens Advisory Committee membership and approval from the Policy Review Board in accordance with the process specified in the bylaws (United States Environmental Protection Agency 1989).

In 1993, the bylaws were amended to specify semi-annual meeting times (United States Environmental Protection Agency undated). In addition, the changes to the program structure resulting from the establishment of the Management Committee allowed the Citizens Advisory Committee to influence decisions at an earlier point in the process by providing advice directly to the Management Committee.

As part of its efforts to revise the charter for the Policy Review Board, as discussed above, the agency departed from the traditional process of gubernatorial appointment of Citizens Advisory Committee members in 2009. It issued a notice in the *Federal Register* requesting nominations for membership on the Gulf of Mexico Citizen Advisory Committee (United States Environmental Protection Agency 2009). The notice specified the areas of interest and states from which nominations were being solicited and identified five criteria to be used in evaluating nominees. As discussed, further revisions were made in subsequent years.

Notwithstanding any challenges faced by the Program in its coordination with the Advisory Committee, Giattina (1998) noted that those members played an important role in maintaining momentum in the early stages of the Program.

Administration

Support through the U.S. Environmental Protection Agency to fund activities associated with the Gulf of Mexico Program has varied over its 25-year history. The Program began with a \$300,000 budget in 1988 to support a small professional and administrative staff. While the size of that staff has also varied, it has typically remained under 20 positions.

While a limited amount of appropriated funds has been used to cover personnel costs, the Program has used a substantial amount of its appropriations to directly fund projects, studies and other activities toward implementation of its mission. The grants and cooperative agreements to federal, state and local governmental agencies, non-profit groups, and academic institutions have allowed the Program to maximize the effective use of its funds through cost sharing mechanisms. Cost share provisions of funding provide a maximum of 95 percent federal funds for projects, while requiring the sponsor to

provide at least 5 percent in matching funds. By leveraging those resources from partnering organizations, Giattina (1998) reported that the Program achieved an 80 percent match on funds invested by the Environmental Protection Agency. More specifically, by Fiscal Year 1998, the Program had funded more than 200 projects in the five coastal states for more than \$12 million. Approximately one-third of the funding went to public education and outreach projects, while the remaining funds supported demonstration projects such as wetlands restoration in Galveston Bay; erosion control in Louisiana; reduction of fecal coliform contamination from failing septic systems in Mississippi; installation of biofiltration systems on failing septic systems in Alabama; and education of health professionals in Florida on the diagnosis and treatment of illness resulting from the consumption of contaminated shellfish (United States Environmental Protection Agency 1997).

Given the efficient use of its funds, the Program has received support for significantly larger appropriations. For example, in Fiscal Year 1992, agency leaders committed to increase funding to \$6 million, a substantial increase over the Fiscal Year 1991 level of \$1.4 million (United States Environmental Protection Agency undated). However, the Program only received \$2.5 million, which included \$1 million specified for leveraging project funding. As the result of the extensive activity associated with programmatic activities, the President's budget requested a Fiscal Year 1993 appropriation of \$21 million (United States Environmental Protection Agency 1992). The Program received just over \$4 million (Larkin 1999).

In his 2009 testimony before the U.S. Senate Subcommittee on Water and Wildlife, Bryon Griffith, the Director of the Gulf of Mexico Program stated that the Gulf of Mexico Program had issued \$42 million in grants over its 21-year history to support projects ranging from the development of state nutrient management strategies in Mississippi, to support for environmental education and outreach for underserved students. The Program has also supported the development and deployment of an early warning system for harmful algal blooms, and integration of federal and state information on Gulf habitats.

For more than 20 years, supporters of efforts to protect the resources of the Gulf of Mexico have expressed serious concerns regarding financial support to the Gulf of Mexico Program. Notwithstanding the aerial extent of the Gulf of Mexico is almost three times larger than the Great Lakes and ten times larger than Chesapeake Bay, the Gulf of Mexico Program has seen a small fraction of the financial support provided to those regional geographic initiatives. In a comparison of funding levels spanning almost 20 years, annual funding for the Gulf of Mexico Program remained around \$5 million, while annual financial support for the Great Lakes Program generally ranged from about \$20 million to almost \$70 million and support for the Chesapeake Bay Program averaged \$20 million to \$30 million annually (Bass 2009). In its report to the 1989 Presidential Transition Team, the agency acknowledged that its funding commitments for the Gulf of Mexico Program were “not in proportion relative to the Gulf’s productivity and value to the nation” (United States Environmental Protection Agency 1989).

Activities Program

Under the newly formed program, the first committee meetings were being held in 1988—the Technical Steering Committee in October and the Citizens Advisory Committee and Policy Review Board in December (Whitson and Putt 1991). Meetings were generally organizational in nature.

The Program immediately began work on the list of identified issues. An environmental concern receiving significant media attention was the increasing incidence of marine litter in near coastal waters and on beaches. As noted previously, Congress passed the Marine Plastic Pollution Research and Control Act of 1987 in its efforts to ratify the MARPOL treaty. It was decided that a “special area designation” would be sought from the International Maritime Organization under Annex V of MARPOL for the Gulf of Mexico (Reggio 1990, United States Environmental Protection Agency 1990). During the last months of 1988, the Gulf of Mexico Program developed the technical information required to support such designation. The special area designation for the Gulf of Mexico was accepted as of July 1991 (United States Environmental Protection Agency 1993). As a result, ships were prohibited from dumping garbage or plastics anywhere in the Gulf. Additionally, ports and marinas were required to provide suitable facilities for the disposal of vessel-generated wastes.

To better focus its activities, the Program developed and adopted its five-year program strategy (1988 – 1992), which included two principal goals and eight objectives (United States Environmental Protection Agency 1990). Initial efforts under the strategy targeted the establishment of an effective programmatic infrastructure for addressing complex environmental problems associated with man's use of Gulf of Mexico resources. Objectives identified to meet this goal included establishment of the Program office, development of the Program's committee structure, and creation of a public outreach network (Lipka, Putt et al. 1989, United States Environmental Protection Agency 1990). A second goal involved the establishment of a "framework-for-action" for implementing management strategies and controls. Meeting this goal required: (1) preparation of environmental characterization reports to identify actual problems and relevant trends; (2) development of environmental assessments to determine baselines and the extent of current damage; (3) creation of an interactive data management system to improve information management in development of technical solutions; (4) preparation of predictive assessments to determine the potential effects of management approaches; and (5) development of an environmental monitoring plan to support scientific assessments and decision-making (Lipka, Putt et al. 1989, United States Environmental Protection Agency 1990).

Since an initial focus was placed on reaching a consensus regarding the most serious threats facing Gulf coastal resources and characterizing the nature and extent of those problems toward development of agendas for integrated and coordinated interagency actions to address them, the issue-oriented subcommittees held their initial meetings in February 1989 to begin the study and evaluation process (United States Environmental Protection Agency 1990, Whitson and Putt 1991). Studies to characterize threats in those issue areas were initiated in 1990 and preliminary reports regarding habitat loss, freshwater inflow, and nutrient enrichment were submitted for public consideration and comment in June 1991 (Whitson and Putt 1991).

Furthering what would become a long-term central component of enhancing public outreach, other early program activities focused on coordination and dissemination of information through the establishment of an electronic bulletin board and production of a bimonthly newsletter, *Gulf Watch*. The

Gulf of Mexico Program also participated in (1) a multi-agency Mobile Bay wetlands mapping project; (2) formation of the Alabama Coastal Initiative; (3) initiation of Adopt-a-Beach and other beach cleanup programs to properly collect and dispose of marine debris; (4) commencement of the boater's pledge program to reduce marine debris; and (5) organization of workshops on coastal preservation issues (Lipka 1990, United States Environmental Protection Agency undated).

In November 1990, the action plan development process began based on the problems being characterized and studied by the issue-oriented subcommittees (Whitson and Putt 1991). Funding was initially requested for the development of plans addressing marine debris, habitat degradation, coastal and shoreline erosion, and public health concerns (United States Environmental Protection Agency undated).

In the late 1980s and early 1990s, two aspects of public administration were receiving greater attention, development of priorities to better target use of scarce financial resources and measurement of programmatic performance to ensure that public funds were being used most effectively. Although state and federal agencies had been determining priorities and evaluating programs, to some extent, for several years through strategic planning processes, increased attention spurred agencies to treat these matters more systematically.

The Environmental Protection Agency completed a comparative risk analysis in 1987 evaluating 31 problem areas based upon their potential to pose cancer and non-cancer risks to humans, ecological impacts, and welfare effects (United States Environmental Protection Agency 1987). Among Environmental Protection Agency staff and management, problem areas ranking high for potential ecological impacts and thus likely posing adverse effects to aquatic resources such as the Gulf of Mexico, included physical alteration of aquatic habitats and point and nonpoint source surface water pollution. Habitat alteration was identified as high risk because alterations, specifically to wetlands, estuaries, coastal waters and oceans, can degrade or destroy habitats, impacts can occur on a regional basis, and in many cases, effects may be irreversible. Direct and indirect point source discharges and nonpoint source discharges were included due to a higher tendency to affect ecological function and, in some cases, ecological structure on a regional scale; however, effects have a greater potential for reversibility.

Inclusion of both of these problem areas tended to substantiate the issue-specific work being carried out through the Program.

The study team also assessed public opinion on environmental risks and water pollution was also identified as posing a high risk to environmental resources. The project report, *Unfinished Business: A Comparative Assessment of Environmental Problems*, observed that the agency's priorities and current effort did not match well agency-determined risks, but corresponded well to public opinion.

Also shaping the agency's approach to characterizing and prioritizing environmental problems was the Science Advisory Board's response to the comparative risk analysis. In its 1990 report, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection*, the Board agreed with the agency about the uncertainties involved in determining some environmental risks and its concerns in using risk as a sole determinant of priorities. From an ecological risk standpoint, the Board's report confirmed the high risk posed by habitat loss, but also identified loss of biodiversity as having a high risk of potentially adverse impacts (United States Environmental Protection Agency 1990). Among the 10 recommendations included in the report, advice most salient to the Gulf of Mexico Program involved targeting future activities towards the greatest opportunities for risk reduction; attaching as much importance to reducing ecological risks as to human health risks; better reflecting more recent risk assessments in strategic planning and budget proposals; and increasing efforts to integrate environmental considerations in public policy decision-making to that same extent as economic considerations (United States Environmental Protection Agency 1990).

To accommodate the emphasis on performance evaluation, early measurement of the Program's success focused on whether (1) programmatic efforts were leading to management decisions and corrective actions addressing a deteriorating environment, (2) existing data and projects were being effectively utilized, (3) the public was being informed of the value of Gulf resources, threats to those resources, and options for addressing those threats, and (4) the public had an effective role in resource management decisions (Lipka, Putt et al. 1989). Within those parameters, early efforts fared well.

A primary objective of the Program and its partnering agencies was to provide greater visibility to the value of the Gulf of Mexico and its resources and the threats and challenges being faced by those resources. To that end, the Policy Review Board and the Program strongly supported the designation of 1992 as the Year of the Gulf. In December 1991, Congress adopted House Joint Resolution No. 327, designating 1992 as the Year of the Gulf. The resolution recognized the sensitive ecosystems present in the Gulf and the economic importance associated with Gulf-based activities. It further emphasized the apparent deterioration of environmental quality due to adverse impacts of pollution, coastal development, dredging activities, and changes in freshwater inflow. In making the designation, Congress concluded that it was in the national interest to preserve and enhance the Gulf's natural and economic resources (1992).

As requested by the resolution, that action was supported by Presidential Proclamation No. 6399, which emphasized the ecological treasures and economic importance of the Gulf of Mexico and reiterated a national commitment to protecting and preserving those values (Bush 1992).

As part of the Year of the Gulf celebration, federal and state agencies, and other interested parties, participating through the Citizens Advisory Committee, jointly signed an agreement endorsing the Gulf of Mexico Program's Partnership for Action. The agreement included a common vision among the 17 signatory parties recognizing the Gulf's natural beauty and richness, ecological significance, cultural meaning, value for human uses, and economic importance (United States Environmental Protection Agency 1992). Reconfirming the goal of the Gulf of Mexico Program, the document principally set forth nine environmental challenges for the signatory parties to meet over the succeeding five-year period. These challenges included: reducing coastal wetland losses, increasing the aerial extent of seagrass beds, enhancing the sustainability of fisheries, decreasing nutrient, toxic substance and pathogen inputs, increasing harvestable shellfish beds by 10 percent, lessening trash on beaches by 10 percent, providing beaches that were safe for swimming and recreational activities, improving coastal habitats, and expanding public education and outreach activities (United States Environmental Protection Agency 1992). A tenth challenge, reduction of coastal and shoreline erosion, was later incorporated (Larkin 1999). In addition to providing a means to measure program benefits, the challenges allowed the partners to

focus on achieving common characterizations of problems, educating the public on the need to address those problems, collecting baseline data through which progress can be assessed, and implementing demonstration projects to address problems (Giattina and Altsman 1999).

The Gulf of Mexico symposium titled, *America's Sea, Keep It Shining*, was held in December. Attracting more than 1600 participants, the conference largely focused on environmental education. Technical sessions provided updates on the work of the Technical Steering Committee's issue-based subcommittees (Jacobson 1992).

Consistent with the 1989 Five-Year Plan, each subcommittee issued a report in 1993 or 1994 characterizing environmental conditions and issues and proposing an action agenda that reflected the public's comments and concerns. The action agendas set forth management options, identified and communicated planned activities, and established baseline information from which to measure progress (Herrington 1994).

Collectively, the reports identified over 400 different action items to achieve 91 objectives. Action items called for the development of assessment techniques and monitoring strategies for a variety of parameters; integration of existing data management systems and development of new databases; inventories of sources of contamination and existing management and regulatory programs and strategies; assessments of the severity of conditions and status and trends of impacted resources; evaluation of ecological impacts of human activities and the identification of indicator species; development of regulatory standards and criteria for sediment, water quality and land management; expansion of current regulatory and management programs; improvements in resource management planning; increased and targeted enforcement activities; implementation of technology transfer and technical assistance programs and demonstration projects; development of comprehensive and coordinated research plans; and enhancement of outreach and education programs to include citizen handbooks, videos, slide presentations, and an awards program recognizing outstanding accomplishments.

Some recommended action items were very specific (*e.g.*, determine the ecological role of pine flatwoods in coastal communities; assess the impact of nutrients in the New Orleans canal system on Lake

Pontchartrain; and develop a nutrient nonpoint source control strategy for Weeks Bay, Alabama), while other actions were more aspirational (*e.g.*, recommend appropriate new legislation authorizing regulatory action, enforcement authority, and funding for living aquatic resources, where inadequacies exist and propose policy alternatives for allocation of freshwater among estuaries) (United States Environmental Protection Agency 1994, United States Environmental Protection Agency 1994, United States Environmental Protection Agency 1994, United States Environmental Protection Agency 1994).

Many recommendations served as the basis for future programmatic activities. However, among the more noteworthy cases were calls to identify land based sources of nutrients, determine the relative contribution of atmospheric deposition, municipal and industrial point sources, and urban and nonurban runoff to nutrient pollution in the Gulf; implement demonstration projects to reduce nutrient inputs from priority sources; improve methods of detecting and managing marine biotoxins; reduce concentrations of fecal wastes in coastal waters; report periodically on the status and trends of living aquatic resources; and monitor the impacts of non-indigenous species (United States Environmental Protection Agency 1993, United States Environmental Protection Agency 1994, United States Environmental Protection Agency 1994).

In 1994, the Program completed development of its second Five-Year Plan, endorsed by participating state governors and environmental agency heads. The Plan incorporated the 10 challenges identified through the 1992 Partnership for Action, discussed above. In addition, it recommended funding for demonstration projects using constructed wetlands for wastewater treatment to reduce pathogen contamination in shellfish growing areas and restoring coastal habitat in Tampa Bay area. (United States Environmental Protection Agency 1994).

To reduce habitat degradation, the Program began implementation of the Gulf Ecological Management Sites initiative in 1994 to identify unique or ecologically valuable areas around the Gulf that need particular management attention to enhance a site's value or ensure its protection. Working with appropriate federal and state agencies and The Nature Conservancy, through the Natural Heritage Program, nominations of candidate sites were sought. Following an evaluation of those sites, designations

were made for the implementation of special management approaches (United States Environmental Protection Agency 1994). Today, almost 125 sites across the five Gulf states are part of this initiative. Among those sites are national wildlife refuges and wildlife management areas, state parks, coastal and aquatic preserves, state parks, and national seashores.

In 1995, the federal partners reconfirmed their commitment to and participation in the Gulf of Mexico Program by endorsing an agreement describing a shared leadership approach to program management. This agreement was designed to further the prevention of duplication, improvement of coordination, and provision of a comprehensive network for data and information sharing (United States Environmental Protection Agency 1995). The agreement provided for a program directorate composed of the Director of the Gulf of Mexico Program and associate directors representing other participating agencies with personnel co-located at the program offices. The directorate coordinated day-to-day program activities, assisted in the formulation of program budget requests, participated in discussions on policy matters, and collaborated with the program's committees. While the United States Environmental Protection Agency continued to serve as the administrative lead for program activities, other agencies committed to shared leadership in coordination on technical and scientific issues and regional management, as well as policy oversight (United States Environmental Protection Agency 1995). Participating agencies also agreed to create individual agency plans to support the Program's strategic assessment activities, a regional communications network, and a comprehensive inventory of relevant agency activities in the Gulf region. Other priorities included the joint development of a program strategy to complete the regional assessment and to "identify and prioritize feasible solutions to address issues" (United States Environmental Protection Agency 1995). Other provisions of the agreement addressed commitments for the establishment of ecological measures and baselines and joint pursuit of appropriations to fund identified actions.

Over the years, individuals and organizations supporting the Gulf of Mexico Program have attempted to improve the program's perceived lack of standing and political legitimacy. As noted earlier in this section, specific authorizations for the Chesapeake Bay Program and the Great Lakes Program

were enacted into federal law as part of the 1987 amendments to the Clean Water Act. Since then, the Clean Water Act has been amended to provide for an office to administer the Long Island Sound management conference and study (1990), authorize the Administrator to coordinate the Lake Champlain management conference (1990), and establish the Lake Pontchartrain Basin Restoration Program (2000).

Beginning in 1991, several bills were filed to create the Gulf of Mexico Program. The Gulf of Mexico Preservation Act of 1991 (S. 1715) called for the establishment of a Gulf of Mexico Program within the Environmental Protection Agency with a program director appointed by the Administrator. The bill specified the duties of the director and required the director to conduct a study to characterize the quality of the Gulf of Mexico environment and identify the effects of human activities on that environment. In addition, the Administrator was directed to study regional environmental problems in the Gulf, including those existing outside the United States, and if determined necessary, to propose cooperative agreements with foreign governments to address problems. The legislation also mandated the Administrator to develop and implement a management plan and required the agency to provide grants to states to assist in implementing plan provisions.

Another proposal, the Gulf of Mexico Protection and Restoration Act of 1991 (H.R. 3777) directed the Administrator to develop and implement a comprehensive plan for improving the water quality of the Gulf of Mexico and required the award research grants for development of baseline scientific data and implementation grants to those states assisting in execution of the plan. For purposes of the bill, Puerto Rico and the Virgin Islands were also considered Gulf states.

The provisions of the Gulf of Mexico Preservation Act of 1992 (H.R. 5249) were similar to language contained in S. 1715 (1991). In addition, the legislation required a report to Congress on the status of activities in the Gulf of Mexico and the development of a strategy for monitoring the environmental quality of the Gulf. Like S. 1715, this bill required the Administrator to make any budget proposal as a separate line item. A counterpart Senate bill (S. 2627) was also introduced in 1992.

Using a slightly different approach, the Gulf of Mexico Environmental and Economic Restoration and Protection Act of 1992 (H.R. 5441) required the establishment of a Gulf of Mexico Program within

the Environmental Protection Agency and the creation of the Gulf of Mexico Executive Board to prepare a plan for resource development and protection of Gulf ecosystems, set schedules for completion of projects, and fund studies of resource problems. The Administrator was also mandated to award grants for the development of baseline scientific data and information regarding the environmental quality of the Gulf.

Senate Bill No. 3122, the Gulf of Mexico Commission Act of 1992, required the President to establish a Gulf Coast Commission, upon consent of each Gulf state governor, to promote the environmental and economic interests of the Gulf of Mexico. In turn, the Commission was required to prepare a plan guiding the development, use, management, and conservation of resources and to recommend improvements in resource management systems, agreements with foreign governments to further resource management and protection, and improvements to the transportation infrastructure and productivity of industries doing business in the Gulf.

Although the previously discussed bills were introduced, the only Gulf of Mexico Program-related legislation to receive consideration during the 102nd Congress was House Joint Resolution 327, which designated 1992 as the Year of the Gulf of Mexico. This resolution was adopted in October 1991.

The 103rd Congress also saw the introduction of several bills regarding the Gulf of Mexico Program. The provisions of the Gulf of Mexico Preservation Act of 1993 (S. 83) are similar to those of S. 2627 (1992); however, under the 1993 bill, the Secretary of State was charged with entering into any appropriate international agreements.

Like S. 3122 (1992), the Gulf of Mexico Act of 1993 (S. 686) called for the appointment of a Gulf of Mexico Commission to promote the environmental and economic interests of the Gulf. In addition, the bill established the Gulf of Mexico Program Office within the Environmental Protection Agency and required the director to undertake certain studies and activities. Furthermore, the bill directed the Environmental Protection Agency Administrator to publish a Gulf of Mexico Management Plan and authorized grants to states to defray the costs of implementing programmatic activities. H.R. 1566 is the counterpart bill to S. 686, but the House version requires the Department of Agriculture to develop and

submit to Congress an inventory of federal and state laws and regulations on the use of wetlands for agricultural purposes along with recommendations for simplifying such laws or regulations.

The Gulf of Mexico Economic and Environmental Protection Act of 1993 (H.R. 1899) authorized the establishment of the Gulf of Mexico Program, an interagency program for the protection of the economic and environmental resources of the Gulf of Mexico, under the leadership of the Gulf of Mexico Program Office within the Environmental Protection Agency. The bill also requires the President to create a Gulf of Mexico Executive Board and mandates the Board to establish a Gulf Citizens Advisory Committee. Similar to H.R. 5441 (1992), the Board was mandated to develop a preliminary plan recommending a mechanism for balancing actions to address Gulf economic and environmental problems and submit to Congress on the impact of environmental quality on the economic viability of the Gulf. Based on the Board's plan, the Administrator was charged to complete a final plan and affected parties were required to implement the plan.

Provisions establishing a Gulf of Mexico Commission to make recommendations to the President on program goals were included in the Water Pollution Prevention and Control Act of 1994 (S. 2093). Section 1001 further provided for the development of a management and restoration plan and a report to Congress assessing the environmental quality of the Gulf and the impact of environmental problems on economic conditions. Grants were authorized for Gulf states to defray the costs of plan implementation. This Gulf-related legislation received the most extensive consideration in the 103rd Congress, but died on the Senate calendar.

No legislation providing for the statutory establishment of the Gulf of Mexico Program was introduced for more than 10 years. However, an executive order calling for the Program's establishment was drafted in 2004, but was not subsequently issued.

In 2006, the Gulf of Mexico Restoration and Protection Act (S. 2783) proposed to amend the Clean Water Act to reestablish the Gulf of Mexico Program as an office in the Environmental Protection Agency. The legislation specified certain duties of the Program, including service as a liaison to Mexico on Gulf matters. The Administrator was authorized to provide financial assistance to defray the costs of

water quality monitoring, research on the impacts of environmental changes on Gulf resources, development of locally-based watershed restoration projects, and reduction of pollutants from point sources that contaminate the Gulf. Similar legislation was introduced in 2007 (S. 1126), 2008 (S. 3558), and 2009 (S. 1311). In 2010, the U.S. Senate Environment and Public Works Committee reported S. 1311 to the Senate calendar. In its report on the bill, the committee acknowledged the Gulf of Mexico Program's status among the "flagships of the nation's efforts to apply an adaptive management approach to large coastal freshwater and marine ecosystems" (United States Senate Committee on Environment and Public Works 2010). The report went further recognizing that the Gulf of Mexico Program, unlike the Chesapeake Bay and Great Lakes programs, operates under no specific statutory authority. The Congressional Budget Office estimated the budgetary outlay for S. 1311 at \$87 million for FY 2011-2015 (United States Senate Committee on Environment and Public Works 2010). The legislation died on the Senate calendar. A 2007 Global Environment Facility report identified this apparent lack of support at the federal level as a major barrier to the Program's effectiveness. As a result, federal and regional agencies have seen little incentive to use the Gulf of Mexico's approach to "step outside traditional 'stove pipe' lines of authority to develop and pursue coordinated objectives" (Global Environment Facility International Waters Learning Exchange and Resource Network 2007).

In 1996, concerns peaked that the Program was becoming "federally intrusive" and was "potentially fostering a regulatory agenda" (Giattina 1998). The same Global Environment Facility report discussed above observed that this fear of additional regulation resulted directly from the Environmental Protection Agency's leadership role in the Program. Supporting its contention, the report referred to the heightened sense of concern that followed the release of the Great Lakes water quality regulations and guidance in the mid-1990s. This trepidation "has curtailed and discouraged any effort to utilize the Gulf Program as a venue for addressing policy or regulatory inconsistencies at the federal or state level, or for developing new approaches, including incentive-based approaches that may involve future regulation" (Global Environment Facility International Waters Learning Exchange and Resource Network 2007).

To address these concerns, management and organizational changes increased the involvement of nonfederal interests, provided opportunities for more state leadership and direction, and focused on a narrower range of issues (Giattina 1998). The organizational and management changes to the Policy Review Board and Management Committee are reflected in the specific discussion regarding the evolution of these bodies.

In narrowing the program's objectives, the Policy Review Board decided to focus on: (1) public health impacts; (2) excessive nutrient enrichment; (3) habitat loss and degradation; and (4) introduction of invasive species and four focus teams were formed to address those issues (Giattina 1998).

The new public health objective targeted the program's work toward reducing human illnesses resulting from consumption of contaminated shellfish and contact recreation. It also provided a basis for initiatives to address harmful algal blooms. Since 1994, Program partners had been working to meet the 1992 challenge of increasing beds approved for harvest by 10 percent (United States Environmental Protection Agency 1997). Through that process, a regional assessment provided for the development of 32 potential restoration strategies and identification of candidate watersheds where implementation might be successful (United States Environmental Protection Agency 1997, Giattina and Altsman 1999). Initial projects focused on reducing fecal coliform inputs in the Barataria-Terrebonne watershed (United States Environmental Protection Agency 1997).

Protection and restoration of coastal wetlands and seagrass beds remained a priority for projects and programs on habitat loss and degradation. The new team continued to develop strategies for habitat protection and restoration on a gulf-wide basis (Giattina and Altsman 1999).

The invasive species team sought to reduce mortality caused by pollution and the prevalence of shrimp viruses resulting from commercial vessel ballast water releases (Giattina 1998, Giattina and Altsman 1999). Increased attention was placed on non-indigenous species concerns after the introduction of cholera into Mobile Bay in 1992 through the discharge of ballast water (Giattina and Altsman 1999). A priority was placed on bringing regional attention to invasive/exotic species introductions and developing approaches to prevent the introduction of such species and/or control the spread of introduced species

(United States Environmental Protection Agency 1997, Giattina and Altsman 1999). The new focus also provided the basis for assisting the Gulf states in the development of non-indigenous species management plans, as authorized under the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990.

Nutrient enrichment efforts continued to be directed towards reducing the extent of the mid-summer hypoxic zone in the northern Gulf, as well as eutrophication in six Gulf coastal estuaries in the National Estuary Program (Giattina and Altsman 1999). To achieve its goal of protecting the Gulf of Mexico waters from the adverse effects of nutrient enrichment from all sources, the team pursued a process leading to selection of priority geographic areas for greater management attention and the identification of measurable objectives that could be met in those areas (Giattina and Altsman 1999). This approach, which focused on improving land management practices, was consistent with the national movement to reduce nutrient inputs (United States Environmental Protection Agency 1997). The Program's attention to the hypoxic zone came primarily through participation in the Mississippi River/Gulf of Mexico Nutrient Task Force chartered in 1998 to develop a better understanding of the causes and effects of eutrophication in the Gulf of Mexico and reduce the size and mitigate the effects of the hypoxic zone in the northern Gulf of Mexico. Over the years, management and staff of the Gulf of Mexico Program have remained involved in varying capacities with the work of the group.

As required by the Harmful Algal Bloom and Hypoxia Research Control Act of 1998, the Task Force released an initial plan in 2001 calling for implementation of 11 short-term actions through use of voluntary, practical, and cost-effective approaches through existing programs applying an adaptive management approach. Among the 2001 goals was a reduction in the five-year running average areal extent of the Gulf of Mexico hypoxic zone to less than about 1,900 square miles by 2015, subject to the availability of additional resources. This extent has not been seen in more than 20 years (Rabalais and Turner 2013). It was estimated that a reduction of at least 40 to 45 percent in riverine nitrogen inputs would be required to meet this goal (Scavia, Justić et al. 2004, Justić, Bierman et al. 2007). In a 2007 reassessment of this goal, it was determined that the goal remained "reasonable" despite the

acknowledgement that achievement is unlikely (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2008). The conclusion that the goal will not be attained is confirmed in the 2013 reassessment (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2013).

As recommended in the 1994 Nutrient Enrichment Action Agenda, subsequent studies have determined that significant nitrogen and phosphorous loads originate from watersheds in the central Mississippi River and Ohio River basins. Cultivated croplands reportedly contribute about two-thirds of the nitrogen, while the remaining load is added by atmospheric deposition, animal agricultural activities, urban runoff, and other incidental sources (Alexander, Smith et al. 2008). In contrast, about 80 percent of the phosphorous loads derive from croplands and animal manure with most of the remain load resulting from urban runoff (Alexander, Smith et al. 2008). Further studies refining understanding about the sources of excess nutrients have identified 150 watersheds in nine states as potentially providing the largest contributions of nitrogen and phosphorous to the Gulf of Mexico dead zone (Robertson, Schwarz et al. 2009).

As mentioned in the background information, another environmental threat commonly associated with nutrient enrichment is the presence of harmful algal blooms. The Gulf of Mexico Program has worked extensively with regional states, other federal agencies, and Mexico to establish an early warning system.

Given the potential for economic and ecological harm and remaining uncertainties regarding harmful algal blooms, Congress responded in 1998 by enacting the Harmful Algal Bloom and Hypoxia Research and Control Act, which called for an interagency committee to complete and submit to Congress an assessment examining the ecological and economic consequences of harmful algal blooms, including alternatives for reducing, mitigating, and controlling blooms. A 2004 reauthorization of the law required the Secretary of Commerce to provide for regional scientific assessments of harmful algal blooms and hypoxia, as may be requested by states, and directs the interagency task force to complete scientific assessments of harmful algal blooms in freshwater and hypoxia and harmful algal blooms in coastal waters (2004).

In 2000, the U.S. Environmental Protection Agency began development of an integrated system to detect and forecast the potential for development and movement of harmful algal blooms. The agency's Office of Research and Development's National Health and Environmental Effects Research Laboratory, Gulf Ecology Division took the lead in this effort (United States Environmental Protection Agency 2002). A pilot project for a Harmful Algal Blooms Observing System, a near real-time application that integrates weather data, observations, and model predictions of sea surface conditions to assist in providing early detection and forecasting where harmful algal blooms might form, was proposed in 2002 to provide timely data and information on *Karenia brevis* blooms (Fisher, Malone et al. 2003, United States Environmental Protection Agency 2008). Facilitating implementation of this project, the Gulf of Mexico Program served as the administrative lead and coordinated activities, including the establishment of a steering committee, signature of appropriate memoranda of understanding, and development of an action plan with milestones and a funding strategy (United States Environmental Protection Agency 2002). Partners in this initiative included the National Oceanic and Atmospheric Administration, National Aeronautic and Space Administration, United States Navy, National Association of Marine Laboratories, and various academic institutions and state agencies (Fisher, Malone et al. 2003). By 2008, the early detection and forecasting system was operational in South Florida and South Texas (United States Environmental Protection Agency 2008).

In addition to its role as lead administrative unit on the Harmful Algal Blooms Observing System, the Gulf of Mexico Program worked to coordinate and secure the signature of a US/Mexico bi-national agreement between the United States and Mexico in 2004 that supported monitoring of red tide using consistent sampling and reporting protocols. A 2009 Memorandum of Understanding between the Gulf of Mexico Program and the state of Veracruz (Mexico) provided for the implementation of the Harmful Algal Blooms Observing System in Mexican waters. In 2010, these efforts were expanded to include other Mexican states and institutions with the integrated assessment and management of the Gulf of Mexico Large Marine Ecosystem (Soto, Hu et al. 2012).

The Gulf of Mexico Program expanded its education and outreach program in 2000 with the establishment of the Gulf Guardian Awards. This recognition was developed to honor the extraordinary work or innovative actions of individuals, businesses, or organizations in acting to protect and preserve the Gulf and its resources. Given annually, the awards recognize first, second and third place winners in seven categories.

In 2001, a working group of the Management Committee assessed the performance of the Gulf Program focusing on four aspects: the Program's scope, the nature of the Program, participation by senior leaders, and the role of focus teams. Considering the Program's scope, the working group identified the pros and cons of implementing a scope as a regional forum, a locally focused watershed-based financial assistance program, or both. In addition, organizational structures for comparable programs, such as the Chesapeake Bay Program, South Florida Geographic Initiative, and several Great Lakes programs (United States Environmental Protection Agency 2001). No significant organizational changes resulted from the review.

In Fiscal Year 2002, the Program revised its focus slightly to target the following five areas: building state capacity to address impaired waterbodies (designated under Section 303 of the Clean Water Act), reducing public exposure to contaminated seafood, protecting and restoring coastal habitat, assisting in efforts to address Gulf hypoxia, and restoring impaired waterbodies. Among its 2002 accomplishments were participation in and/or coordination of bacterial source tracking research, development of a coastal assessment framework, implementation of consumer awareness efforts to reduce deaths from *Vibrio vulnificus* contamination, monitoring of mercury contamination in Gulf marine organisms, development of a coastal wetlands restoration partnership, and implementation of a framework for monitoring and modeling of hypoxic conditions (Griffith 2002).

In 2004, the Gulf of Mexico Program saw another turning point in its efforts to protect, maintain, and restore the health and productivity of the Gulf of Mexico. As the result of the leadership of governors Jeb Bush of Florida and Haley Barbour of Mississippi, the Gulf States Governors' Alliance, now the Gulf of Mexico Alliance was established to significantly increase regional collaboration in enhancing the

environmental and economic health of the Gulf of Mexico (Gulf of Mexico Alliance 2008). Support for the creation of the Alliance came from the U.S. Commission on Ocean Policy's evaluation of ocean and coastal resource management policies (Gulf of Mexico Alliance 2008). Other factors that may have provided further motivation for the Alliance's creation involved the recommendations of the Pew Oceans Commission, significant increases in storms in the Gulf of Mexico during 2004, a perceived lack of support among national leaders for the Gulf of Mexico Program, and decreasing federal budgets. While the Gulf of Mexico Program had, since its inception, strong state leadership through the Policy Review Board and a significant commitment to characterize and address state priorities, the establishment of the Gulf of Mexico Alliance provided for clear state direction on priorities supplemented by federal agencies in supporting roles. State leadership of the process signified a commitment of state resources to address issues on a collaborative basis. Formally becoming a nonprofit organization under Section 501(c)(3) of the Internal Revenue Act in 2010, the Gulf of Mexico Alliance has expanded its options for funding activities and projects. The Gulf of Mexico Alliance has been called a "regional model for ocean governance" (McKinney 2011).

To support the activities of the Alliance, a Gulf of Mexico Regional Partnership Federal Workgroup, representing 13 federal agencies including the White House Council on Environmental Quality and the National Science Foundation, is coordinated by the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration. Workgroup members committed to supplement coastal recovery and rebuilding efforts undertaken in response to the damage from the 2005 storms and hurricanes and build upon partnerships and initiatives established under existing programs, like the Environmental Protection Agency's Gulf of Mexico Program (Gulf of Mexico Alliance 2006). In addition, the Gulf of Mexico Program served as the foundation for the Alliance's technical and financial assistance (Griffith 2009).

In March 2006, the Alliance released the first *Governors' Action Plan for Healthy and Resilient Coasts*, identifying regional priority issues and states to assume leadership responsibilities for priority issue teams. Focusing on a three-year horizon, the plan identified 73 actions to be undertaken toward

achievement of 11 objectives categorized under five priorities, including: ecosystem integration and assessment; environmental education; habitat conservation and restoration; nutrients; and water quality (Gulf of Mexico Alliance 2006). By way of example, the plan included activities to: (1) improve the harmful algal bloom detection and forecasting system off the coast of Florida; (2) develop a resource management tool integrating data on storm surge, localized sea level rise and subsidence and creating a pilot community resiliency index for coastal communities; (3) initiate an environmental education pilot program targeted to underrepresented and underserved communities; (4) create an Internet portal that allows public access to habitat maps for sensitive coastal habitats; and (5) advance opportunities to implement nutrient reduction strategies in the rebuilding of coastal infrastructure (Gulf of Mexico Alliance 2006). The core goals of this plan were “to build partnerships and lay a foundation for a true regional approach” (Gulf of Mexico Alliance 2009).

The *Governors’ Action Plan II for Healthy and Resilient Coasts* was released in June 2009. This five-year plan identified four major challenges facing coastal states: sustaining the economies of the U.S. and Gulf states, improving ecosystem health, mitigating the impacts of and adapting to climate changes, and reducing the adverse effects of poor coastal water quality (Gulf of Mexico Alliance 2009). The 2009-2014 Action Plan set forth a strategy, including 97 actions designed to accomplish tangible results, toward improving the health of Gulf coastal ecosystems and economies in ways not achievable by a single entity (Gulf of Mexico Alliance 2009). Those actions will address concerns and challenges in the following areas: improving water quality for healthy beaches and seafood; restoring and conserving coastal habitat; ensuring ecosystems integration and assessment; reducing nutrient impacts to coastal ecosystems; enhancing coastal community resilience; and fostering environmental education (Gulf of Mexico Alliance 2009).

Actions under the water quality priority focused on pathogens, harmful algal blooms, and mercury in seafood, while activities addressing habitat conservation and restoration centered on expanding partnerships, technology development, sediment management, and restoring ecosystem services. Efforts on ecosystem integration and assessment included a master mapping plan and acquisition

of data, evaluation of the status and trends of emergent wetlands, and valuation of ecosystem services. In addition to assisting states in the development of nutrient criteria for state waters, nutrient reduction activities continued to concentrate on lessening the extent of the hypoxic zone and nutrient reduction strategies. Environmental education efforts focused on improving public awareness and environmental literacy, and communication of economic values associated with Gulf resources. Coastal community resilience actions were directed towards risk assessment, risk management, and risk communication (Gulf of Mexico Alliance 2009). The 2009 Action Plan also supports the establishment of a parallel regional collaborative organization among Mexican states, the Mexican Gulf of Mexico Alliance, for the purpose of enhancing cooperative relationships in the management of the Gulf of Mexico large marine ecosystem (Gulf of Mexico Alliance 2009).

As it worked to support the initial efforts of the Gulf of Mexico Alliance, the Gulf of Mexico Program experienced a setback in 2005 as the result of the devastating effects of Hurricane Katrina. Although not completely destroyed, the Program office at Stennis Space Center, Mississippi was located in an area hardest hit by the hurricane. Homes of many of the Program's staff were either damaged or completely destroyed. Through the diligent efforts of the Program's Director, Bryon Griffith and his staff, the Gulf of Mexico Program resumed some operational capacity within 30 days of the storm's passage.

In a 2007 presentation on the history of the Gulf of Mexico Program, Jim Giattina, the Program's Director from 1996 to 2004, provided an overview of accomplishments from a gulf-wide perspective and place-based viewpoint. Among the regional accomplishments, he included the establishment of a Gulf states resource monitoring program; development of the first marine-based ecoregion plan for the northern Gulf of Mexico in partnership with The Nature Conservancy; completion of the first area-wide survey of mercury contamination in Gulf fisheries and first area-wide survey of invasive species in the Gulf; cooperation with the National Oceanic and Atmospheric Administration to leverage \$2.2 million in funding for the Gulf Ecological Management Sites initiative; and initiation of the harmful algal bloom forecasting pilot project. Place-based accomplishments included assisting states with restoring impaired

waters and marine habitat, developing a hydrodynamic model for the Navy, and aiding local governments in developing projects under the coastal impact assistance program.

Supporting the Gulf of Mexico Alliance's goals and achievement of its annual commitments under the agency's performance management system, the Program has continued to work with its partners, primarily the U.S. Department of Agriculture, to reduce nutrient enrichment in the Mississippi and Atchafalaya River Basins. However, as discussed previously, the Program will not likely achieve its 2015 target. Significant success has been achieved in cooperative efforts to restore coastal habitats—by 2009, more than 29,000 acres had been restored, enhanced or protected since 2006 (United States Environmental Protection Agency 2010). Efforts to restore impaired waterbody segments in 13 priority watersheds have also proven successful with habitat or water quality being restored in 131 segments in Fiscal Year 2009, exceeding the commitment for 96 segments (United States Environmental Protection Agency 2010). The program has not achieved its target to raise the Gulf of Mexico's rating on the *National Coastal Condition Report*.

Additional challenges and changes resulted from the British Petroleum Deepwater Horizon oil spill in 2010, which caused the discharge of an estimated 4.9 million barrels of crude oil into Gulf waters (McKinney 2011). While the ecological effects are still subject to assessment, the spill resulted in additional organizational changes. President Obama appointed the Gulf Coast Ecological Restoration Task Force to coordinate intergovernmental efforts on restoration actions; support the natural resource damage assessment process; to develop and submit to the President a Gulf of Mexico Regional Ecosystem Restoration Strategy; engage and communicate with local stakeholders, the general public, and government officials throughout the region on its efforts; and periodically report on progress toward meeting the Strategy's goals (Obama 2010). The Gulf of Mexico Program has worked closely with the Task Force in implementing its charge.

Outside the activity associated with oil spill response and restoration, the Gulf of Mexico Program saw a significant organizational change in 2010 with a transition from the Policy Review Board to a new Environmental Protection Agency-appointed, 20-member Gulf of Mexico Executive Council.

The Program also revised its priorities and the focus of its six alliance teams to mirror those issue areas being addressed by the Gulf of Mexico Alliance's priority issue teams (United States Environmental Protection Agency 2010, United States Environmental Protection Agency 2012). The new organizational structure retained the Citizens Advisory Committee and the Monitoring Modeling and Research Committee. However, a new organization unit, the Underserved Communities Committee, was also created.

Closing

In a 1975 *EPA Journal* article, Environmental Protection Agency Administrator Russell Train lamented the public's attitude that seas, like the Gulf of Mexico, were places to put waste and other unwanted things. He referred to the dumping of untreated pollutants into the air and water as a policy of "plunder now and pay later." Administrator Train expressed concern over the impacts of ocean dumping and spills, potential detrimental outcomes from transportation of petroleum, and adverse effects associated with deep water mineral exploration and mining, and oil and gas exploration and production on the Outer Continental Shelf. In closing his remarks, he emphasized, "Before we degrade the seas with our pollutants, before we lay down any more new carcinogens or wipe out any more species, we should remember that we are connected to all life. Man is also a fragile, endangered species still dependent ultimately after millions of years for the very air he breathes on simple cellular plant life in the sea" (Train 1975).

In reflecting on the Gulf of Mexico, Bill Reilly, Administrator of the Environmental Protection Agency under President George Herbert Walker Bush noted, "These challenges [threats imperiling Gulf resources] call upon us as never before to look beyond isolated pollution problems to chart a course of action broadly based on the health of the entire ecosystem, a course drawing together the creative energies of all levels of government, academia, business, environmental groups, and private citizens" (Weber, Townsend et al. 1992). The Gulf of Mexico Program has pursued that course for 25 years.

Earlier in this text, two factors, lack of support at the federal level and fear of additional regulation, were mentioned by a 2007 Global Environment Facility report as potential barriers to the

achievement of the original vision for the Gulf of Mexico Program. The same report also included three additional noteworthy factors. Although the Gulf of Mexico Program has emphasized state leadership in program and project identification, development and implementation, such leadership has been “uneven,” because the states have not recognized the shared interdependencies existing in the Gulf in a manner that translates into “coordinated political positions on actions”(Global Environment Facility International Waters Learning Exchange and Resource Network 2007). Furthermore, while “a strong, vocal and well-coordinated public interest” existed for the establishment and during the early years of the Gulf Program, that support, particularly for broad, large scale actions, waned significantly and evolved to include predominantly single issues or local concerns. Finally, the report also observed that the vision has been impeded by “an inability to articulate, based on scientific information, the inter-relationships and interdependences of important ... resources that cross political boundaries and form the foundation for many of our coastal economies. And as a result, we run the risk at the very worst of destroying that which we fail to understand and at the very best of missing opportunities for improved management and economic development of our coastal resources” (Global Environment Facility International Waters Learning Exchange and Resource Network 2007).

Over its 25-year history, the institutional arrangements configuring the Gulf of Mexico Program have allowed it to adapt to numerous influences, including changing resource management issues, new national priorities, lackluster participation and support by governmental officials and interested parties, political pressures, perceived insecurities and conflicts among stakeholders, and insufficient funding. The Program’s institutional arrangements have relied heavily on voluntary participation and the Environmental Protection Agency’s ability to financially incentivize cooperation. At times, the Program has been seen less as a partnership and more as an initiative of the Environmental Protection Agency. As with the Delaware River Basin Commission, the Gulf of Mexico Program has not always been able to meet the expectation of widespread intergovernmental cooperation to focus on integrated action toward addressing environmental threats facing a large marine ecosystem.

Despite the barriers outlined in the Global Environment Facility report, the Program leadership and staff have diligently strived to continue implementing the mission and, as a result, programmatic efforts have achieved incremental success. The Program’s reputation has also suffered due to the imposition of unreasonable expectations to address relatively intractable problems. In recent years, the Gulf of Mexico Program has yielded primacy to a new partnership, the Gulf of Mexico Alliance, based upon different institutional arrangements.

At the 1992 Gulf of Mexico Symposium, the Environmental Protection Agency’s Deputy Administrator, Hank Habicht, portrayed the Gulf of Mexico Program as “a window on the future of environmental protection” because of its unique approach to bring together divergent, often opposing, interests to define and address complex, multi-faceted problems for the greater good (Jacobson 1992).

Given its unique approach and notwithstanding its challenges, the Gulf of Mexico Program has demonstrated success. Table 3 identifies selected accomplishments during the tenure of the Program. An argument may be made that such accomplishments would not have occurred or would not have occurred in a timely manner without coordination, participation, or funding by the Gulf of Mexico Program.

Table 3. Selected Accomplishments – Gulf of Mexico Program

Selected Accomplishments
Characterize resource conditions/identify action items (1993/1994)
Gulf Ecological Management Sites initiative (1994)
First area-wide survey of mercury contamination in Gulf fisheries (2000)
First area-wide survey of invasive species in the Gulf (2000)
Harmful algal bloom forecasting pilot project (2000/2009)

In its 2010 report, the Committee on Environment and Natural Resources of the White House Office of Science and Technology Policy’s Joint Subcommittee on Ocean Science and Technology observed that the Gulf of Mexico Program had made “significant progress in identifying the

environmental issues in the Gulf ecosystem and in organizing a program to address those issues” (Committee on Environment and Natural Resources 2010).

WESTERN STATES WATER COUNCIL

Introduction

In 1965, the governors of the eleven western states shown in Figure 8, commonly referred to as American West, became founding members of the Western States Water Council pursuant to a resolution of the Western Governors’ Conference. As discussed later in this section, the Council has added seven additional regional states to reach its current membership of 18. During the 1980s, Minnesota became an associate member state, but subsequently decided to discontinue its participation. Hawaii became a Western States Water Council member in 1991 and subsequently discontinued its participation in 1999. With the transition to the Western Governors’ Conference to the Western Governors’ Association, the Western States Water Council became a fully recognized affiliate member of the association in 1996.

Resource Characteristics

As colonial holdings of other countries, many lands west of the Mississippi River were acquired by the United States through treaties with Spain/Mexico and Great Britain or through the Louisiana, Gadsden, and Alaska purchases. As a result, ownership of those lands initially vested in the United States and notwithstanding land grants and settlement policies of the late 1800s, the federal government remains a large landowner in those states. As settlement progressed westward, the population of these territorial areas became sufficient to allow the territories to apply for statehood. Most states shown in Figure 8 joined the Union between 1850 and 1912. Their boundaries, established by Congress, were largely based upon surveys involving lines of longitude and latitude, instead of watershed units, as advocated by John Wesley Powell. However, in looking at any map, it should be noted that large rivers such as the Colorado, Columbia, Rio Grande, and Snake rivers are boundary waters.

The aerial extent of the 11 founding states encompassed approximately 1.2 million square miles. With the addition of the seven remaining states, that area more than doubled to 2.5 million square miles. Despite the vast land area covered by the founding states, water covered about 23,000 square miles,

including 13,000 square miles of inland waters. Bingham (1969) further described the hydrology of this area as including all or portions of eight major drainage basins with 39 river basins containing 190 transboundary streams. Forty-two streams cross an international boundary.

With the expansion of the Council's membership, including Alaska, the total area covered by water increased to 107,000 square miles with 31,000 miles of inland waters. The 18-state region also contains the headwaters of many of America's largest rivers, including the Missouri, Rio Grande, Colorado, Arkansas, and Snake rivers.

Average annual precipitation across the states of the Western States Water Council varies considerably. Lying on and westward of the 100th Meridian, the climate is generally characterized as arid or semi-arid as some areas typically average less than 20 inches of precipitation annually. However, data show that half of the states actually receive more than 20 inches yearly with Washington and Oklahoma averaging 38.4 and 36.5 inches, respectively. The driest states are Nevada with 9.5 inches and Utah with 12.2 inches per year (National Oceanic and Atmospheric Administration 2013).

Socioeconomic Characteristics

Patterns of settlement have played a significant role in the regional identity of western states. As mentioned previously, before 1850, the American West had been settled predominantly by Spanish colonists and American Indians. During the mid-1800s movement emigration westward was spurred by the discovery of gold in California and the rise of urban centers along the Pacific coast. Between 1850 and 1860, the population of California almost quadrupled. Other areas of the West, such as Oregon, Washington and Utah also witnessed similar increases.

During the late 1800s, federal government public lands' policies such as the Homestead Act of 1862, the Mining Act of 1866, and the Desert Land Act of 1877 not only led to increased settlement of western states and territories, but also legitimized water rights particularly to support mining and agriculture, as will be discussed later in this text. By 1900, the population of California, Kansas, and Nebraska exceeded 1 million people, while Texas had more than 3 million residents (Forstall 1996). Between 1880 and 1900, the population of now-member states doubled (Forstall 1996).



Figure 7. Members of the Western States Water Council (Evans 2014)

Bingham (1969) reported that the population continued to significantly increase after 1900 with growth exceeding more than 10 percent per decade in some cases. Overall, many members of the Western States Water Council continued to see significant population increases throughout the 20th century. By 1965, the population of the 11 founding states of the Western States Water Council exceeded 27 million and in 2000, the total population of member states surpassed 95 million (STATS Indiana 2013).

Population growth in many western states continues to transcend the national average with North Dakota, Texas, Utah, Colorado and Alaska among the fastest growing states nationally.

Western states have and continue to see increased demands for water to meet public supply needs and other requirements associated with population expansion. The rapid increase in population combined with greater urbanization has intensified the competition for water resources. In some cases, expanding urban demands are leading to reallocation and transfers of water from traditional uses such as agriculture and other rural uses to meet the pending needs.

Economies of western states have also undergone significant changes. Where early economies relied heavily on agriculture and mining, Case and Alward (1997) observed that a significant transformation of those economies by the late 1970s toward service and trade industries. Based upon earnings by industrial category, mining ranked seventh and agriculture ranked ninth in 1977. By 1993, the agriculture sector had fallen to eleventh (Case and Alward 1997).

Although transfers are occurring from agricultural uses to other uses, agricultural water uses, primarily irrigation, remain largely consumptive. Kenny, Barber et al. (2009) estimated that irrigators in member states use almost 70 billion gallons per day of fresh surface water. In addition, aquaculture, the second most prominent use, accounts for another 4 billion gallons per day. Facilities in Texas are responsible for most of the 2 billion gallon per day industrial use, as well as the majority of fresh surface water used for mining. The total freshwater withdrawals across the region account for slightly over 13 billion gallons per day.

In summing the western states' sense of regional identity, Bingham (1969) observed that common bonds exist between these states as a result of similar climates, topography, and the competition for development, despite the size of the area.

Selected Water Management Institutions

In allocating surface waters, western states largely rely on the appropriative rights doctrine; however, vestiges of the riparian rights doctrine still exist in some states. Permits are the most common administrative mechanism for authorizing water use. While most states also follow some form of the

appropriative rights doctrine for groundwater allocation, such doctrine is not exclusive. See discussion of Texas groundwater law in the Gulf of Mexico Program case study.

Almost all western states have comprehensive state water resource management plans that address water availability and supply as well as water quality matters. Plans also typically include surface water resources and groundwater. In some cases, plans are developed through a process that specifically includes sub-state areas. Those states that do not have comprehensive state plans either address water resource issues through an agency strategic planning process or provide for the development of plans at a sub-state level. Those states delegated the authority to administer the federal Clean Water Act programs implement the continuing planning process described in Section 303 of the Clean Water Act.

Water Management Agencies and Organizations

Numerous organizations are responsible for management of water and its related resources across the western states. Federal agencies such as the Army Corps of Engineers, Environmental Protection Agency, Fish and Wildlife Service, Department of Agriculture, Federal Energy Regulatory Commission and Geological Survey implement programs (1) ensuring navigation, (2) operating reservoirs for water supply and flood control, (3) preventing and controlling water pollution, (4) protecting threatened and endangered species, (5) assisting farmer and ranchers and funding rural water supply and wastewater projects, (6) hydropower licensing, and (7) collecting data on water levels and stream flows. However, for more than 100 years, the Bureau of Reclamation has played and continues to play a crucial role in the settlement and development of the western states through its programs for the construction of dams, power plants and canals, and wholesaling water and hydropower. Given the extensive ownership of lands in this area, the Bureau of Land Management, National Park Service, and Forest Service also play important roles in the framework for water management.

At the regional scale, 15 compact commissions oversee allocations of rivers. Other interstate compacts are administered by federal and state officials.

Regional organizations, such as the Missouri River Association of States and Tribes (MoRAST) and the Western States Water Council, also serve as forums for discussion on interstate water issues.

MoRAST was created in 2006 through agreement among the governors of Iowa, Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming and a coalition representing 28 American Indian nations (Missouri River Association of States and Tribes 2012). The organization serves “as a forum for the identification, discussion, and resolution of issues of concern to the basin states and tribes, including matters of interstate comity and matters of common concern ... [to facilitate the] management of the natural resources of the Missouri River Basin including water resources, fish and wildlife, and consideration of the impacts to the economic, historical, cultural, and social resources among the basin states, tribes, and the federal government” (Missouri River Association of States and Tribes 2012).

Management of water resources in the West has been historically influenced by other regional organizations. These include the Pacific Southwest Federal Inter-Agency Technical Committee, the Columbia Basin Inter-Agency River Basin Committee (and its successor, the Pacific Northwest River Basins Commission), and the Missouri River Basin Commission. As discussed in Chapter 2, these federal inter-agency technical committees included representatives of the Bureau of Reclamation, Army Corps of Engineers, Federal Power Commission, and Department of Agriculture and were established to facilitate interdepartmental communication on issues affecting the basins with the committee’s jurisdiction. The two commissions were established in the 1960s under the Water Resources Planning Act in efforts to move toward integrated water resources planning.

In 2008, nine federal agencies signed a declaration of cooperation to form the Western States Federal Agency Support Team, commonly referred to as WestFAST, to work with officials from the western states in promoting the benefits of sustainable use of water resources (Western States Federal Agency Support Team 2008). In seeking “proactive, voluntary, participatory and incentive-based approaches to water resources management and conservation,” the agencies pledge collaboration with the Western States Water Council in the development of an action plan (Western States Federal Agency Support Team 2008). To facilitate coordination, the federal agencies support a liaison position with the Council. Since its inception, the support team has expanded its membership to include 12 agencies.

Within the 18 member states, numerous state agencies administer various aspects of water resources management programs. Water rights are usually administered by state engineers or officials associated with a department of water resources. Implementation of pollution control programs generally fall under the jurisdiction of departments of environmental quality or state health departments. Other state agencies may be responsible for the development of water projects, promotion of agriculture, protection of fish and wildlife, conservation of water resources, soil conservation, and regulation of natural resources extraction.

Due to the evolution of water resources policy in the western states, many substate water management organizations have been created. Some remain active, while others have become inactive over the years. These organizations, including irrigation districts, drainage districts, water authorities, and water conservation districts, were usually created by property owners for the single purpose specified in their title. Irrigation districts have played a critical role in water deliveries in some areas, while drainage districts were created for the construction of canals, ditches and other works.

Local government agencies operate utilities for providing potable water and wastewater management services, particularly in urban or suburban areas. As populations increase, these organizations often face challenges to increase available supplies through conservation efforts or acquisition of additional sources.

Given the water heritage of western states, landowner interest in water resource management issues has historically been high. Over the past few decades, concerns over water resources management among a broader cross-section of the population has led to the creation of watershed management organizations across the American West. Development of such organizations has been encouraged in some states to provide a forum for local input and decision-making on issues affecting water supplies and quality.

Background

While it is beyond the scope of this dissertation to provide a comprehensive historical account of the challenges and conflicts associated with the use of scarce surface water resources in the western

United States and the numerous approaches, determinations, and institutional arrangements employed addressing those matters, this section provides a discussion of some illustrative examples that contributed to the formation of the Western States Water Council. Further information on the evolution of western water policy is provided by Samuel Wiel, *Water Rights in the Western States* (1911); Wells Hutchins, *Water Rights Laws in the Nineteen Western States* (1971, revised in 2004); Joseph Sax, Robert Abrams, and Barton Thompson, *Legal Control of Water Resources: Cases and Materials* (1991, revised in 2006); and Robert E. Beck, *Waters and Water Rights* (1991, revised 2007).

Thorson, Kropf et al. (2005) observed that conflicts over the availability of scarce water resources in western states have historically been common for more than 150 years. As a result, institutional arrangements have developed to resolve these conflicts, which to a large extent codified social customs and practices used to allocate the water resources initially for mining and agricultural uses. These institutions, which provided for the use and management of a common pool resource, water in streams and rivers, established the basis of the appropriative rights doctrine.

Experts generally agree that institutional arrangements encompassed in the appropriative rights doctrine originated from three sources. These original institutions were modified in each state, thereby leaving each state with slight variations in the appropriative rights doctrine.

Like the Hohokam farmers and the Anasazi Indians, Spanish settlements in the southwestern United States relied on irrigation for subsistence agriculture (Willardson 1989). As a result, farmers diverted water from rivers and streams to irrigation ditches to water their crops on non-riparian lands. While considerable debate exists whether only appropriations from the sovereign had to be honored, all appropriations of water were generally honored as a matter of custom. Under the Spanish institutions, diverted water was seen more as private property. Ultimately, these customs became codified in Arizona and New Mexico and upheld by courts in those states.

Water use conventions were also developing in other parts of the America West. Moving west to Utah in the mid-1800s, Mormons settlers also used irrigation extensively for food production (Willardson 1989). Communities surrounded by cultivated fields developed across the intermountain West. Like uses

in most places in the American West, irrigation in Utah predated the establishment of formal governance and territorial authority. As a result, the Mormon Church decreed that water resources were communal in nature and established institutional arrangements to allocate land and administer water use through water masters, water codes, and water courts (a function of church courts) (Willardson 1989, Thorson, Kropf et al. 2005).

However, the most widely recognized influence on the evolution of western water policy and the subsequent development of the appropriative rights doctrine derived from the customs and practices of miners in California and other western states. In many cases, waters needed to be diverted from rivers and streams to remote locations for use. Since mines were generally located on public lands, but no federal or territorial control was initially exerted to establish rights, miners established institutions for determining water rights similar to those used in filing mining claims. As a result, a first-in-time-first-in-right system was implemented so long as the water was being put to beneficial use (analogous to the “working the claim requirement” under mining rules).

Similar in practice to eastern settlements, towns and cities were initially located near significant surface water sources, and as these areas grew, surface water demands for domestic use, mill power, and other offstream uses increased. Initially, sufficient water was available to meet all needs, even in the most arid areas. However, as flows became subject to increasing diversions and water availability became more limited, particular in times of drought, courts were called on to resolve disagreements between disputing parties. In addressing differences, courts applied local customs and principles in most cases. As the body of common law grew, state legislatures also adopted these institutions by statute. In most western states, constitutions or statutes provide that the state owns all of the water in the state. Statutory schemes set forth institutional arrangements for the establishment and regulation of usufructuary rights, in these cases through the appropriative rights doctrine. While all western states have institutions based upon appropriative rights, some states, commonly referred to as California doctrine states, did not completely provide for the extinguishment of all riparian rights. As a result, some landowners still hold riparian rights, which are senior to appropriative rights’ holders. States completely abandoning the riparian rights

doctrine and adopting the appropriative rights doctrine for surface water allocation are referred as Colorado doctrine states. In those states, allocations adhere strictly to the priority system.

While institutional arrangements created through state constitutions, statutes, and common law generally addressed the allocation of waters among users within states, significant conflicts existed and continue to exist over the availability and use of water from interstate streams. Spending significant time and resources, western states have generally sought to resolve disputes through litigation or negotiation of interstate compacts, or both.

The United States Supreme Court has frequently opined, reluctantly in some cases, on allocation of flows in interstate rivers and the need to control water pollution in those rivers. Most cases involving western states have centered on the allocation of flows. In an early 20th century dispute over diversion of waters from the Arkansas River, the Court affirmed its jurisdiction to hear and decide cases involving interstate water disputes and set forth its doctrine of equitable apportionment in deciding transboundary waters cases (*Kansas v. Colorado* 206 U.S. 46 (1907)). Addressing Wyoming's contention that a diversion in Colorado would interfere with its superior right under the appropriative rights doctrine, the Court held that the appropriative rights doctrine applies to interstate stream diversions, if both litigating states also employ that doctrine for water allocation. As a result, Colorado was granted a diversion from the Laramie River for a reduced amount of water so long as the diversion did not interfere with Wyoming's right (*Wyoming v. Colorado* 259 U.S. 419 (1922)).

Because users in the Upper Colorado River Basin recognized that appropriators in the Lower Basin held senior rights, this decision and its ramifications reportedly incentivized efforts to negotiate the Colorado River Compact.

Interstate waters in western states are also subject to management through more than 20 interstate compacts, mostly addressing apportionment of flows. The following discussion will focus briefly on the Colorado River Compact of 1922. Lee (1976) observed that in the early 1900s, tensions among states in the Colorado River Basin continued to rise due to increasing demands to support population growth and the expansion of irrigated agriculture. As noted earlier, the Supreme Court's decision in *Wyoming v.*

Colorado raised concerns over the potential loss of flows to lower basin states. Interests in California sought more water for irrigated agriculture in the Imperial Valley and for domestic supply and energy generation in the Los Angeles area. Additionally, the Reclamation Service was requesting authority to build a large dam in Boulder Canyon.

Seeking to provide systematic development in the Colorado River Basin, representatives of area states, civic and business groups, and other interested parties formed the League of the Southwest in 1919. This organization largely focused its efforts on ensuring authorizations for the construction of a dam on the Colorado River at Boulder Canyon. Besides providing water to irrigate millions of acres of agricultural lands, the dam could also generate power and protect river communities from spring flooding (Kruckman 1921). In 1920, Congress directed the Secretary of the Interior to study possible diversions from the Colorado River and their uses. Following adoption of legislation creating a Colorado River Commission by each basin state, Congress authorized the states to begin negotiations in 1921 and enter into an interstate compact providing for the equitable division of waters of the Colorado River (Wyoming Water Development Office undated).

By November 1922, state delegates and Secretary of Commerce Herbert Hoover, on behalf of the United States, had reached agreement on compact terms. Of the anticipated 15 million acre-feet of flow annually, the upper basin states agreed to provide a minimum of 7.5 million acre-feet annually for use in the lower basin. Provision was also made for water to flow through to Mexico. Six of the member states ratified the compact in 1923; however, the compact was not ratified by Arizona, the seventh state (Wyoming Water Development Office undated). In 1925, four member states successfully revised the compact's authorizing provisions to allow the agreement to take effect upon ratification by six states and the United States. With the passage of the Boulder Canyon Project Act of 1928, Congress granted its consent. Legislatures in Utah and California subsequently conformed their compact law, and the compact took effect in 1929 (Wyoming Water Development Office undated).

In addition to granting consent, the Boulder Canyon Project Act appropriated \$165 million to defer costs associated with the construction of Hoover Dam, the Imperial Diversion Dam, and All-American Canal (to provide irrigation water for operations in the Imperial Valley).

While considerable attention in the 1920s was drawn to the Colorado River and the efforts to provide an equitable distribution of water through the first-of-its-kind interstate compact, compacts were also negotiated to apportion waters of the La Plata River (Colorado and New Mexico) and the South Platte River (Colorado and Nebraska) during that decade.

Given the complex issues surrounding the apportionment of waters of the Colorado River, the Colorado River Compact did not resolve all allocation issues. A significant line of cases involves continuing disputes between Arizona and California. In 1930, Arizona requested the Supreme Court to enjoin the implementation of the Boulder Canyon Project Act claiming injury due to an inability to divert unappropriated flows, if the project is built. The Court denied Arizona's request (*Arizona v. California* 283 U.S. 423 (1931)). In 1936, the Court again denied Arizona's request to provide title to its share of water and for a decree declaring that use of Arizona's share of the river flow would not constitute a prior appropriation (*Arizona v. California* 298 U.S. 558 (1936)).

In the meantime, water utilities in California had contracted with the Secretary of Interior for their share of California's allotment of Colorado River flows. Competition for and conflict over waters in western interstate rivers continued. Four additional compacts apportioning flows were negotiated between 1935 and 1945. Three of those compacts included Colorado as a party state.

In 1944, Nevada contracted for its allotment of Colorado River water. In addition, the United States entered a treaty with Mexico requiring delivery of 1.5 million acre-feet of water from the Colorado River in an average flow year (Central Arizona Project undated). Less than one month later, Arizona entered its contract with the Secretary of Interior for delivery of its allotment of 2.8 million acre-feet annually and ratified the Colorado River Compact becoming the seventh and final member of the compact.

Arizona continued to address its water needs by seeking authority from Congress in 1947 for construction of the Central Arizona Project to divert water from the Colorado River for municipal and agricultural uses in central and southern Arizona. Although California opposed the legislation for years, the project was authorized in 1968 (Central Arizona Project undated).

In 1948, negotiation of the Upper Colorado River Compact was completed between Arizona, Colorado, New Mexico, Utah and Wyoming. The compact allocates Arizona 50,000 acre-feet per year and distributes the remaining water by the percentage of flow among the other member states.

Arizona and California again became engaged in a dispute over waters from the Lower Colorado River Basin. Arizona filed suit against California in 1952. Other basin states and the United States were joined as parties. The United States' interest involved federal reserved rights, particularly water rights for five tribes. In a 1963 decision, the U.S. Supreme Court determined that the Colorado River Compact had apportioned waters between the upper and lower basins, but it did not further allocate waters among lower basin states. Congress, through enactment of the Boulder Canyon Project Act, had set forth a comprehensive scheme for apportionment of waters in the Lower Colorado River Basin and had authorized the Secretary of the Interior to implement that scheme through water delivery contracts. The Congressional apportionment, which provides California, Arizona, and Nevada with 4.4 million acre-feet, 2.8 million acre-feet, and 300,000 acre-feet on an annual basis, respectively, only applies to water in the main stem of the river. Surplus flows were also allocated. Each state was entitled to use tributary waters within its jurisdiction. Pursuant to the water delivery contracts, the Secretary of Interior was obligated to satisfy the present perfected rights in times of shortage, as provided in the Boulder Canyon Project Act. However, the Secretary's discretion was not limited by state appropriative rights systems in delivering any remaining waters. In its decision, the Court also approved the Special Master's recommendations as to claims for waters from the main stem and some tributaries for use on tribal lands, national forests, wildlife refuges and other government lands (*Arizona v. California* 373 U.S. 546 (1963)). Since issuing a 1964 decree consistent with the 1963 opinion, the Court has revised that decree at least five times.

Bingham (1969) asserted that the potential implications of the 1963 U.S. Supreme Court decision in *Arizona v. California* served as a stimulus for the creation of the Western States Water Council. While Arizona emerged as the apparent winner, it still had to negotiate with states for congressional support for development of its Central Arizona Project.

In addition to the cases discussed above, the U.S. Supreme Court has heard cases regarding numerous other controversies over allocation of interstate waters between states including Washington and Oregon, Kansas and Colorado, Nebraska and Wyoming, and Colorado and New Mexico (Sherk 1984). Despite its jurisdiction, the court has attempted to deter states from filing actions that may better be settled through negotiation or Congressional action. In a dispute over waters from the Pecos River, the Court continued to emphasize, “time and again we have counseled States engaged in litigation with one another before this Court that their dispute is one more likely to be wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceedings in any court, however constituted” (*Texas v. New Mexico* 462 U.S. 554 (1983)).

Two other motivations have also been identified as promoting the creation of the Western States Water Council. Given the scarcity of water in the West, significant conflict has been associated with inter-regional and interbasin transfers. Transferred water is used in another river basin or watershed, and no water returns to the basin of origin following use. Noted Yale University Professor James Fesler (1957) summarized the quest for water in the West by stating, “Water, partly because of its fluid gold quality for agricultural development in the arid West, and partly because of its white coal quality as a yielder of hydroelectric power for industrial development in underdeveloped regions, acquires a strategic significance as a convenient lever with which to plan and affect economic growth.”

Willardson (1989) identified 14 proposals for inter-regional water transfers set forth between 1951 and 1968 and another 10 proposals for international water transfers during that period. The vast majority of proposals were offered after 1963. William Gianelli, a former Director of the California Water Resources Board and subsequently past-chairman of the Western States Water Council, criticized the proposals as providing inadequate attention to political, legal, institutional and social factors.

Increased focus on water transfers grew as the result of projected increases in population and commercial and industrial growth (Willardson 1989). In some cases, projected growth never materialized during the anticipated timeframe.

Concerning state motivations to participate in regional collaboration, Western States Water Council Vice-Chairman William Holden stated, “I am only half joking ... by stating that five states joined the Council to try to get additional water, five states joined the Council to try to retain the water they presently have, and the eleventh state joined to protect its interests in both directions” (quoted in (Willardson 1989)).

A final driver for the creation of the Western States Water Council lay in the increasing role of the federal government in water resources management. The federal role initially expanded from maintaining navigation to flood control. As previously mentioned, the Bureau of Reclamation became involved in western states through the construction of large public works projects and contracting for the delivery of water and hydropower. While Congress had originally left regulation of hydroelectric power facilities to the states, the enactment of the Federal Power Act in 1920 redirected that authority to the Federal Power Commission (now, the Federal Energy Regulatory Commission). Additionally, in 1948, Congress assumed an initial role in controlling water pollution through enactment of the Federal Water Pollution Control Act. As amendments were adopted in 1956, 1961 and 1965, federal jurisdiction expanded from interstate waters to navigable intrastate waters. Among the 1961 amendments were expansion of federal jurisdiction for enforcement against water pollution and a requirement that federal agencies consider needs for streamflows to address water quality control in planning any reservoir or storage facility. In addition, the 1965 revisions required states to establish water quality standards for interstate waters and authorized the Federal Water Pollution Control Administration to set those standards, if the states failed to act.

Considerations were also being given to modifying federal involvement in water resources planning. While federal water resources planning had been undertaken for decades by the U.S. Army Corps of Engineers, it was primarily development-oriented or project-based. Attempts had been made in

the 1940s to initiate river basin planning, but few, if any, efforts achieved success. In general, federally led planning efforts had left some aspects, particularly planning and policies regarding water allocation and use, to state authorities.

As discussed in Chapter 2, efforts were made in the early- and mid-20th century to centralize federal water resources planning. By July 1961, bills were finally introduced to enact the Water Resources Planning Act. The legislation proposed the establishment of a Water Resources Council and river basin commissions involving federal and state officials, and provided financial assistance to states to support state participation in planning. The act became law in 1965. Willardson (1989) emphasized, “Western states found themselves in an era of rapid federal water resources planning and development without a unified, direct voice in the use of their own water resources.” In light of these developments, western governors moved to “put their own house in order;” therefore, consideration and passage of the Water Resources Planning Act contributed to the decision of the western governors to form the Western States Water Council (Getches 1988, Willardson 1989).

Recognizing the importance of water resources to their states, the governors of Arizona, California, Nevada and Utah met in 1960 and designated a committee to find a means of improving interstate affairs regarding water resources planning and project development. From the work of this committee, the Southwest Water Council, composed of representatives from seven Colorado River Basin states, was formally created in 1961 (Willardson 1989). The council was charged to (1) promote a mutual understanding of the states’ water resource management challenges and develop a forum for information exchange on those challenges and related issues in order to assist participating states in water resources planning; (2) cooperate with federal, state and local agencies, and other parties interested in water resource conservation, development and use issues; and (3) assist in the compilation of hydrologic and other scientific and technical data. Bingham (1969) added that an expectation existed that activities of the council could also reduce tensions regarding water allocations between upper basin and lower basin states. Furthermore, the establishment of the council also served as the beginning of cooperative state efforts to address aspects of water resource management. Success in implementing the council’s mission

was hampered because states were slow in filling vacancies and members held other significant full-time job responsibilities leaving them little time to participate in the council's work (Willardson 1989).

However, members opposed dissolution of the Southwest Water Council pending the establishment of another organization to assist in guiding water resource development on a regional basis.

Given the on-going federal and state interests, water resource management issues continued to occupy a priority position in western state governors' policy agendas. The May 1964 meeting of the Western Governors' Conference saw the introduction of two resolutions on water resources policy. Additionally, meeting attendees heard a presentation from Wesley Steiner, California's Coordinator of Interagency Planning, on the need for long-range water resources planning (Willardson 1989). Mr. Steiner questioned the authority of any single state to undertake water resources planning that relied on use of interstate water sources in the absence of a mechanism for interstate cooperation. He further maintained that no state should be developed at the expense of another.

Individual regional governors were also supporting action. Oregon Governor Mark Hatfield faced a unique conundrum in his stance on regional water development. Despite being concerned about large-scale transfers from the Columbia River Basin to support water use in California, he declared, "the states of the west should focus attention on our water needs from a regional perspective...that our water concerns could not be properly considered on a basin-by-basin basis, and that there was grave weakness in the concentration on single project proposals, even though carefully designed" (Hatfield 1965). To meet these ends, he directed the Director of the Oregon Department of Finance and Administration to work with officials in other western states to create a council to study western water needs and alternatives for addressing those needs (Western States Water Council 2006).

Combining proposals offered by Governor Pat Brown of California and Governor Hatfield, the governors adopted a resolution calling for a comprehensive study of western states' water resources to be conducted by the Council of State Governments. The study was to examine the viability of inter-regional water use, alternative means for meeting need in water-deficient areas, and reasonable measures for maintaining a state's right to its water (Willardson 1989).

At a September 1964 meeting of the Western Interstate Water Conference, representatives of water resource research institutes in the western states adopted a resolution requesting the governors to establish a task force to work with the Council of State Governments to develop a proposal for a permanent regional water commission (Bingham 1969, Willardson 1989). In November, the Western Conference of the Council of State Governments endorsed the need for a task force to develop a proposal for a regional water commission, including its role, structure and authority (Western States Water Council 2006).

As a result of these requests, the Western Water Resources Task Force was formed in March 1965 to determine if a new organization was needed and the nature of its scope and function. In addition, another serious issue identified by the task force was consideration of the need for formal policies to protect areas of origin in water transfer transactions. To meet the charge, the task force formed two committees, the Organization Committee and the Areas of Origin Committee (Willardson 1989). The Organization Committee determined that no existing organization could fulfill the governors' request for a study. As a result, it began deliberations on the creation of a suitable organization.

The committee work session involved a discussion of numerous concerns, including membership for Alaska and Hawaii, the need for an executive committee, specific prohibitions on actions affecting the authorization of projects pending before Congress, and perceptions created of state dissociation from federal water resources development activities (Willardson 1989, Western States Water Council 2006). The resulting proposal allowed Alaska and Hawaii to become members upon the governor's request, deleted the provision for an executive committee, and strictly limited any involvement in the Congressional authorization process. Responding to concerns over lack of federal participation, the intent of the proposal was clarified to focus on developing a unifying western state position on issues. Significant debate also occurred regarding the need and financial support for a full-time staff and agreement emerged that a small, appropriately funded staff was needed. The committee adopted a resolution proposing the creation of the organization and, after adding a minor amendment, the task force

concurred and forwarded the resolution to the Western Governors' Conference for its consideration (Willardson 1989).

At the August 1965 Western Governors' Conference meeting, Nevada Governor Grant Sawyer proclaimed, "Today we stand on the threshold of an expanding economy, greater than could possibly have been foreseen as late as ten years ago. However, ...one grave danger lies in the path...water. There is an abundance of water available in this part of the country now wasting to the sea. It needs only storage and transportation facilities to move it from areas of surplus to areas of deficiency" (Western States Water Council 2006). In emphasizing the urgency of the Council's mission, he further stated, "we must act as fast as we can, for I guarantee, if we cannot get this moving among the states, it is going to be done, and it may be done at a level which may not take into account public interest as we see it. If we cannot work together as combined states, we certainly cannot complain if someone else, specifically the federal government, resolves our problems for us. We cannot complain about federal control when it is invited by our own inaction" (Willardson 1989).

Formation of the Western States Water Council

In approving the resolution of the Western Water Resources Task Force for the creation of the Western States Water Council, the governors emphasized the vital role of water resources in future growth and economic prosperity. It is also noteworthy that the resolution, included in its entirety below, also called for a staff, central office, and initial funding of \$150,000. Rather than sharing the funding obligation based upon representation in the United States House of Representatives, as recommended by the task force, the governors supported an equal sharing of expenses (Willardson 1989).

Resolution by Western Governors' Conference Concerning the Creation of the Western States Water Council

June 13, 1965

WHEREAS, the future growth and prosperity of the western states depend upon the availability of adequate quantities of water of suitable quality; and

WHEREAS, the need for accurate and unbiased appraisal of present and future requirements of each area of the West and for the most equitable means of providing for the meeting of such requirements demands a regional effort;

NOW THEREFORE, BE IT RESOLVED by the Western Governors' Conference that it approves the creation of a Western States Water Council to be established in general conformity with the organizational pattern of the attached SUGGESTED RULES OF ORGANIZATION developed by the Western Water Resources Task Force appointed by the members of this Conference; and

BE IT FURTHER RESOLVED, that the members of this Conference will take all feasible steps to provide the support to give effective meaning to the creation of such a Council including the establishment, upon recommendation of the Council, of a staff and central office to be financed in an amount not to exceed the sum of \$150,000 for the first year from appropriations by each of the member states equally.

Rules of Organization

The rules of organization provided the organizational structure and institutional arrangements, and articulated the purpose, principles and functions of the Council. Commenting on the organization of the Council, Bingham (1969) summarized the rules of organization and operating principles as providing for one vote per state and equal sharing of Council expenses, as well as requiring unanimous consent in the adoption of external positions or recommendations. He further emphasized that the rules prohibit surprises, power plays, or domination by federal interests.

The rules of organization specifically charged the Council to provide a forum for effective cooperation among western states in planning for programs that lead to intergovernmental cooperation in the integrated development of western water resources (Western States Water Council 1968). More specifically, the Council was directed to maintain state rights, while identifying ways to accommodate legitimate federal interests; provide a forum for the exchange of views and perspectives among member states; and analyze water resource issues to assist member states in evaluating impacts of federal laws and

programs and the effectiveness of state laws and policies (Clark 1965; Western States Water Council 2005).

The rules went further by setting forth the following three principles upon which planning must be based: all water-related needs of states of origin must be considered; rights of receiving states are subordinate to the needs of the areas of origin; and any costs of water development in the states of origin must not be any greater as the result of a transfer (Western States Water Council 1968).

At the time that the Council was created, the governors envisioned two functions for the Council. The first function involved the preparation of assumptions and criteria to be used in the evaluation of water resources development projects. The other involved a continuing review of all large-scale plans and projects involving interstate and interbasin transfers in western water states and a submission of recommendations to the governors regarding the compatibility of those plans or projects with the optimal development of western water resources (Western States Water Council 1968). Consistent with the evolution of the Council's mission, the rules of organization were amended in 1985 to remove references to the preparation of criteria for regional water resources development plans and to add duties on developing and articulating policy positions, serving as a forum for information exchange, promoting dialogue about western water resource issues, and authorizing the preparation of *amicus curiae* (friend of the court) briefs (Western States Water Council 1986). Regarding the Council's function and mission, Willardson (1989) emphasized that the Western States Water Council was not envisioned as a programmatic operating agency nor was it given any authority to implement programs. Its role was strictly limited to providing advice and consultation on western water resource issues.

The rules of organization also provided that the Council's membership would consist of not more than three gubernatorially appointed representatives from each member state. In addition, each governor was designated to serve as an *ex officio* member. Appointed members were authorized to name alternates to serve in their stead. The 1965 rules of organization limited the Council's membership to the eleven states, but provided that Alaska and Hawaii could join membership upon submission of a letter by the governor requesting membership. The rules were subsequently amended on several occasions to add the

names of additional states that may become members upon request by the governor. Now, all states having membership in the Western Governors' Association can become members of the Western States Water Council, upon request. A state could withdraw from membership upon submission of a letter from its governor.

While most states had no direct statutory authorization for participation in the Western States Water Council, some states obtained legislative authorization by statute or appropriation (Willardson 1989). California statutes specifically authorize participation in the Western States Water Council by providing that members will be appointed by the governor with the advice and consent of the Senate. Appointed members are authorized to receive a per diem rate and expenses to defer the costs of their service .

Although the original membership included eleven states highlighted in Figure 8, Texas petitioned for membership in 1966. As a result of concerns regarding sharing of water with other states in the Southwest, Texas was not approved as a member until 1978. However, representatives of the state were allowed to attend Council meetings and activities and participate as non-voting observers. The following other states became members in the respective years: Alaska (1984); North Dakota and South Dakota (1988); Hawaii (1991); Oklahoma (1999), and Kansas and Nebraska (2000) (Western States Water Council 2006).

In 1983, the Council amended its rules of organization to allow the Executive Committee to confer associate member status to non-member states requesting such standing. Associate member states were allowed to appoint two observers and two alternates to participate in Council meetings and those representatives received materials distributed by the Council. However, observers were prohibited from voting on any matter before the Council. The Executive Committee also established dues for associate members and fees for other non-members to participate in Council activities (Western States Water Council 1984). In 1989, the rules were further amended to limit the term of associate member status to three years (Western States Water Council 1990). States may seek associate to explore the benefits of membership or to temporarily reduce participation due to financial hardship or any other reason not

allowing participation as a full member. Over the years, North Dakota, South Dakota, Alaska, and Minnesota have held associate member status. Oklahoma joined as an associate member in 1990 and withdrew in 1994; however, it continued to seek funding to support its membership and joined as a full member in 1999. Furthermore, issues associated with membership dues have resulted in Montana, Alaska, Washington, and Texas reducing their participation to associate member status at various points in time (Western States Water Council 1996, Western States Water Council 1997). As previously mentioned, Hawaii discontinued its membership in 1999, and as of 2010, Nevada participates as an associate member (Western States Water Council 2010).

Likewise, the rules of organization provided for the annual election of officers, a chairman and vice-chairman and the appointment of a secretary-treasurer by the chairman. The rules did not require the secretary-treasurer to be a Council member. Officers were limited to serving two consecutive one-year terms (Western States Water Council 1968). A 1989 revision provided for the annual election of a secretary-treasurer, but did not limit the number of terms that such person may serve (Western States Water Council 1990).

Given the potentially contentious nature of issues appearing before the Council, the rules of organization clearly established decision rules and a process of notifying members of items being considered at upcoming meetings. Each state was authorized a single vote and representation by a majority of the member states was needed to achieve a quorum. Council members must receive 30-days prior notice on agenda items, but items may be added on the day of the meeting without objection. A 1989 modification to the rules specifically required advance notice regarding proposed external policy positions (Western States Water Council 1990). Any state could request and receive one postponement on an agenda item and additional postponements could be granted by majority vote. (Western States Water Council 1968, Willardson 1989). An affirmative vote by all member states was required to authorize a recommendation or external position. That provision was subsequently revised in 1974 to require an affirmative vote of at least two-thirds of all member states. However, a recommendation or external position concerning out-of-basin transfers continues to require a unanimous vote of all member states.

Approval of internal matters requires an affirmative vote of the majority of members (Western States Water Council 1968, Willardson 1989). The 1974 changes to the voting provisions were initiated by the Western Governors' Conference (Western States Water Council 1975).

Other provisions in the rules of organization provide for an annual meeting each July, special meetings called by the chairman or a majority of the members, and a specific prohibition on any work of the Council deferring or delaying authorization or construction of projects before Congress. The rules of organization may be further amended upon a unanimous vote (Western States Water Council 1968, Willardson 1989). The rules were amended in 2011 to clarify certain provisions.

Committee Structure

In lieu of a larger staff or significant reliance on state or federal agency staff to provide support, the Western States Water Council opted to conduct its operations primarily through a committee structure coordinated and assisted by a small staff. In addition to the Executive Committee which has provided oversight of day-to-day operations and decisions to act on policy matters between meetings, the Council's programmatic work and policy consideration and development have primarily been undertaken through three working committees, the Water Policy and Legislative Committee (retitled in 1976 as the Legal Committee), the Water Resources Committee, and the Water Quality Committee (created in 1976). A diagram depicting the 2010 committee structure is provided in Figure 8.

Executive Committee

Since the rules of organization, as originally adopted by the governors, did not provide for the creation of an executive committee, the Council initially created the Budget and Administrative Planning Committee, consisting of the chairmen of the state delegations to guide its efforts in establishing its structure and operation (Senator Moss (UT) 1965). In addition, a Personnel Selection Committee, also composed of council members, was established to recommend candidates for the executive director and other personnel positions. Notwithstanding the lack of authority, the Budget and Administrative Planning Committee was redesignated as the Executive Committee in November 1965, and authorized to act as the Personnel Committee in hiring staff. In 1966, the Council formally amended its rules of organization

creating an executive committee composed of one member from each state. The new article also authorized standing and special committees to report to the Council through the Executive Committee (Willardson 1989).

However, it was not until 1970 that the Executive Committee received its initial charter. Noting that the committee derives its authority from the Council, it was authorized the following duties: (1) to act upon administrative matters between meetings of the Council; (2) to establish working groups and ad hoc groups, as needed; (3) to make committee assignments and specify the scope of services of other committees; (4) to receive committee reports; and (5) to ensure effective implementation of actions and programs approved by the Council. Moreover, the committee was charged to serve as the Council's liaison with federal, regional, and state agencies and organizations, and to maintain a working knowledge of actions and developments by those agencies as they relate to Council programs.

Each state was authorized one appointment to the Executive Committee with the Council's chair and vice-chair both representing their respective state and serving as officers of the Executive Committee. In 1989, the Council revised its rules to allow a state's governor to designate the Executive Committee member, but if the governor does not provide a designation, the member is chosen by the gubernatorial appointees (Western States Water Council 1990). The Council staff was designated to provide support services for the Executive Committee.

In conducting business, each Executive Committee member was authorized one vote with a quorum consisting of six members. Committee actions on internal matters required an affirmative vote of a simple majority of those present and voting. Approval by unanimous vote was needed to act on external matters and such action was authorized only if the committee determined that an emergency situation existed.

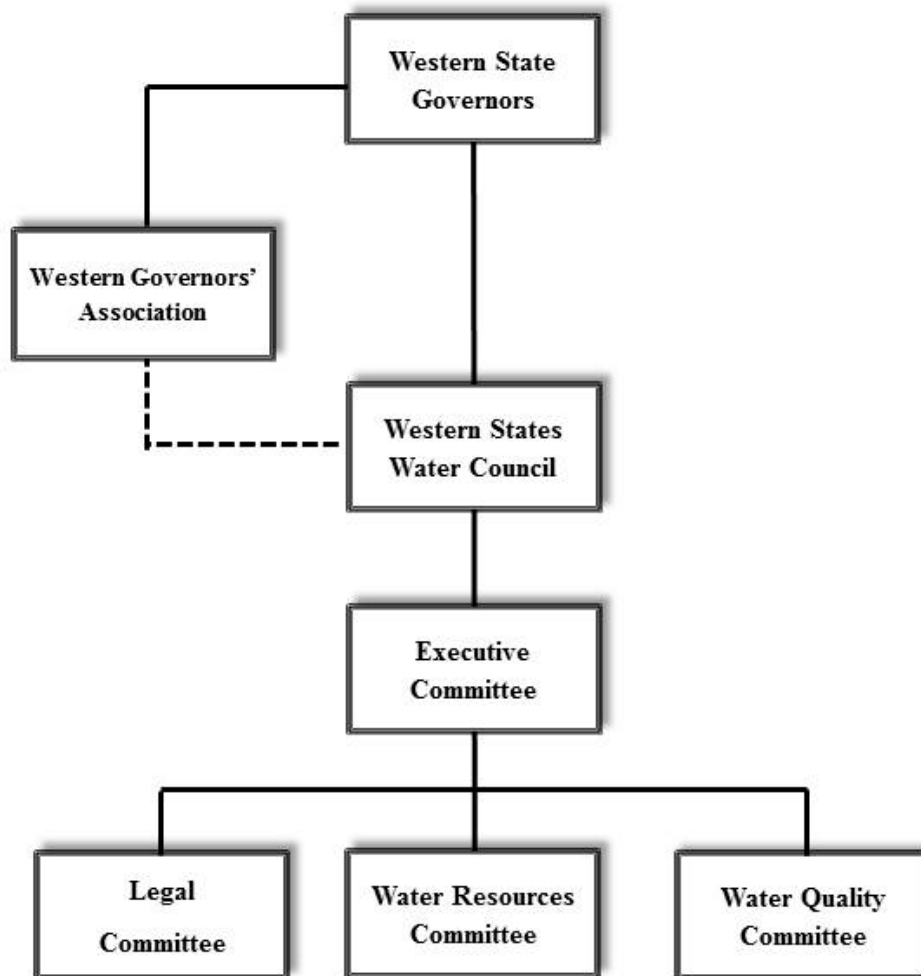


Figure 8. Western States Water Council Committee Structure

To further facilitate oversight of Council operations, a five-member Management Subcommittee was created in 1976. The subcommittee membership included the three Council officers, the immediate-past chair, and the executive director. Participation by three members constituted a quorum with each member having a single vote and actions taken by a simple majority vote (Western States Water Council 1976).

Water Policy and Legislative Committee (retitled in 1976 as the Legal Committee)

Pursuant to its charter, this committee was charged to provide guidance on the social, ethical, legal, and political aspects of the Council's programs, including protection of areas of origin. To this end, the charter directed the committee to study the above-identified aspects associated with interstate water resources development and to recommend appropriate policies. Furthermore, the committee was charged to provide advice on the proper role of the Council relating to federal, regional, and state agencies and organizations affecting development. Other responsibilities included recommendations on the need for new legislation, actions for area of origin protection, and termination of existing committees, councils, or groups addressing western water resource issues (Western States Water Council 1971).

Each member state was allowed to appoint one committee member; however, that member was not required to be a Council member or alternate. Committee members could designate an alternate member. Requiring a quorum of six members (later changed to a majority of members), each state had a single vote and actions required support from a majority of committee members present and voting (Western States Water Council 1971). Through the years, subcommittees addressed issues associated with land use planning; state-federal water rights; water quality, including the effects of the 1972 amendments to the Federal Water Pollution Control Act; and the Reservation Doctrine (reservation of water rights for activities on federal lands and for tribal nations).

Following its 1976 transition to become the Legal Committee, the scope was broadened to include water resources generally and water quality and to eliminate the reference to areas of origin protection. Programmatic responsibilities were redefined to include developing and recommending positions on "current legislation, laws, administrative rules and activities relating to water resources, water rights, related land use and Indian issues" and reviewing "ongoing pertinent court cases" (Western States Water Council 1977). Rules regarding membership and decision-making remained the same. Through the years, the committee has assisted the Council on issues involving reserved water rights, groundwater management, Clean Water Act Section 404 jurisdiction, federal hydropower licensing, preparation of *amicus* briefs, and threats to and refuges for migratory birds.

Water Resources Committee

The committee was originally charged with assisting the Council in implementing the functions and objectives identified in the rules of organization. To that end, the committee pursued a program to develop the principles and standards to assist in formulation of regional water development plans, recommend guidelines and procedures for exchange of data and information, propose mechanisms for the correlation of plans and schedules of water resource development, and advise the Council on physical and economic factors associated with a staged regional water development program (Western States Water Council 1971). Charter provisions regarding membership and voting were the same as the provisions previously discussed for the Water Policy and Legislative Committee.

In 1976, the committee's charter was significantly revised to refocus its efforts on providing guidance on water resources planning and conservation and other developments of common interest. The chartered program was also broadened to emphasize study and recommendations on legislation, regulations, criteria, plans and problems relating to water planning and management, as well as conservation and utilization of water (Western States Water Council 1977). During its tenure, the Water Resources Committee has addressed issues associated with water resources planning and conservation, drought, project financing and cost sharing on federal projects, endangered species protection, dam safety, water use fees, use of western water resources in energy development and production, and state funding under federal water resource management programs.

Water Quality Committee

Created in 1976, the Water Quality Committee was directed to make recommendations for positions on water quality problems and environmental aspects of programs associated with western water resources. Charter provisions regarding membership and voting mirrored the same provisions under the other committee charters. Matters addressed under the guise of this committee have included groundwater management, federal water pollution control and wetlands protection programs, endangered species protection, safe drinking water, federal/state program relations, and implications associated with the National Environmental Policy Act.

Administration

The resolution creating the Western States Water Council contemplated the employment of a small staff, three positions at that time, to support the Council's work. In the late 1960s, a decision was made to conduct business without staff support. However, that approach failed and since then staff resource levels have remained between three and eight positions. Of those positions, three to five people provided programmatic services (engineers, attorneys, economists, and other technical specialists) with the remaining staff providing clerical, administrative and logistical services.

The seminal resolution also provided for a total annual budget not to exceed \$150,000; however, given the delay start in hiring staff, that amount was reduced to \$55,000 for the final six months in Fiscal Year 1966. The Fiscal Year 1967 funding level, similar to the 1966 level, relied on a per-state contribution of approximately \$11,000 (Western States Water Council 1968). For Fiscal Year 1976, the budget was \$144,000 requiring a \$13,000 assessment rising to about \$216,000 with a per-state contribution of \$16,500 for Fiscal Year 1980. By Fiscal Years 1985/1986, the total budget approached \$290,000 requiring a per-state payment of \$19,500. By Fiscal Year 1993, the budget had risen to \$378,000 with the annual state dues set at \$21,000 (Western States Water Council 1994). The proposed Fiscal Year 2014 budget is approximately \$650,000 with \$480,000 in proposed funding from membership dues, \$125,000 from contracts, and small amounts from newsletter subscriptions and corporate sponsorships (Western States Water Council 2013). Based on the proposed budget, the annual membership dues are set at \$30,000 per state.

Activities Program

At the initial meeting of the Western States Water Council, Nevada Governor Grant Sawyer set the tone for the Council's work by emphasizing the rise of a significant agricultural, industrial and recreational economy and observing how that economy is now being maintained through groundwater depletion in some areas. In lieu of building projects that have been traditionally locally focused, he stressed that the region's future potential demanded a western regional approach to water development (Willardson 1989). Governor Sawyer further observed that water-poor states (generally, the Pacific

Southwest) promoted water planning to obtain desperately needed supplies, while states having an abundance of water resources (referring to the Pacific Northwest) are highly skeptical of plans developed by outsiders. Sawyer called upon professionals engaged in water planning to work in meeting the needs of the entire West (Willardson 1989). The governor also strongly endorsed requirements for protection of the areas of origin of any transfers to avoid any resulting water shortages. In conclusion, Sawyer emphasized the governors' expectations for a "stable, long-lasting" organization that provides "vigorous action." (Willardson 2005)

To implement the two functions identified in the rules of organization, the Council's initial activities program focused on three primary tasks (Hiatt 1967, Willardson 1989, Western States Water Council 2006). First, the Council would develop draft criteria and assumptions for examining the feasibility of water resource development projects and to be used in making recommendations to the governors. Secondly, it would review state and federal plans and activities to identify current and projected long-term water needs and the availability of water resources. The Council would concentrate on the scope and anticipated completion dates for studies, informational gaps, and means to address any data inadequacies. Finally, it would review large-scale water resource development projects requiring interbasin or interstate transfers and make recommendations to the governors regarding the compatibility of those projects with orderly water resources development.

Moving rapidly to complete its first task, draft assumptions and criteria for evaluating regional development plans were provided to members and discussed extensively at the July 1966 annual meeting. In an initial vote, members adopted none of the 34 criteria statements. Non-affiliated California officials criticized the Council's efforts. Critics suggested that the established program of action contained elements that were premature and recommended that the Council's work be focused on a task where consensus could more likely be obtained (Willardson 1989). An allegation was made that this original task was creating significant and unneeded tension among members. A resolution was subsequently adopted at the same meeting redirecting the Council to focus on developing principles and criteria for comprehensive western state water planning (Willardson 1989).

In October 1966, an attempt was made to adopt a supplement to the activities program, but the Council failed to adopt the proposal. Although the members failed to adopt the supplement, they did provide the staff with comments on several study proposals, including water importation from the Lower Mississippi River to the Colorado River Basin, diversions of water from James Bay in Canada, trends and costs associated with desalination, the costs associated with the long-range conveyance of water, and an efficiency study of state water resources organizations (Willardson 1989).

Concerns regarding the Council's progress, general direction, and operations continued. In December 1966, the Council staff was directed to produce a self-evaluation of its performance in meeting its mission and to make recommendations for possible improvements (Willardson 1989). Based on the results of that analysis, completed by January 1967, the staff recommended several changes, including revisions to the rules of organization to establish a three-fourths majority rule, in lieu of the unanimity rule for approval of external positions and inclusion of new provisions regarding staffing. Furthermore, despite challenges with appointments, it was recommended that the per-state representation remain at three individuals with the anticipation of appointees being an executive agency head, a legislator, and a private citizen. It was also suggested that minimum qualifications be established for appointees. The results also identified several potential new roles for staff including, emphasis on legal and legislative aspects of water development and preparation of framework planning studies. The self-evaluation also considered elimination of the staff; however, it was determined that justification remained for a permanent staff (Willardson 1989). Supporting even greater use of the committee process to conduct business, the Council, in March 1967, opted to reduce the staff to an executive director and a secretary (Willardson 1989).

Moving to reach closure on some Council initiatives, a consolidated report of the two working committees was approved to defer action on the planning principles and to approve documents providing guidance in the formulation of concepts for staged regional water resources development and procedures for correlating development plans and schedules. The principles were subsequently adopted at the September 1967 meeting; however, no agreement was ever reached on more detailed assumptions and

criteria for evaluating regional development plans (Willardson 1989). In retrospect, Willardson (1989) observed that 1967 was a “year of introspection for the Western States Water Council.” Despite the ever contentious issues associated with water transfers, Willardson (2005) noted that the Council’s initial assignment showed a “preoccupation with proposed inter-basin and interstate transfers.”

In his remarks before the 1967 annual conference of the American Water Works Association, Wright Hiatt (1967), the Council’s first executive director, commented on the prospects of the organization meeting its mission by declaring,

The success of the Council will probably depend, to a large extent, upon the foresight, forbearance, fortitude, forthrightness, forwardness, and forethought of its members. Progress in water resources activities is, and must be, so rapid, aggressive and constructive that an organization which does not advance, develop new ideas, meet changing needs, and take advantage of new opportunities for service will have difficulty surviving. The western states have certainly not solved their serious water problems by the formation of the Western States Water Council...The establishment and continuance of a body where honest men with different views can freely express their thoughts is not easy. Those without water will be impatient with those who have water; those who have water are fearful of those who lack water. By the very existence of a forum where differences can be aired, the possibility of an eventual accommodation exists.

In March, 1968, the Council adopted a new activities program reflecting common areas of agreement (Willardson 1989). The basis for the revised activities program was best summarized by its introduction which states, “The Council’s obligation and duty to the western states is such that it should assume an active role in many areas in the field of water and related land resource development that have not heretofore been undertaken by the western states collectively (Western States Water Council 1968).” The revised program identified nine specific activities and subject areas where the council would focus its efforts, including the development of a checklist for the evaluation of plans and projects including large-scale interstate and interbasin transfers, exploration of methods of financing water development projects,

recommendations on consideration of wild and scenic rivers, water quality and economic aspects of various water uses in water resources planning, analysis of the consistency of criteria used in federal and state water resources planning, review of the water resources-related activities and documents of other regional and national organizations, assistance to member states in drafting position papers on matters of mutual interest, and review and comment on plans and policies for western water development (Western States Water Council 1968).

The previous discussion provided a more detailed examination of the Council's activities during its first three years to illustrate the challenges faced by such an organization attempting to harness broad support and obtain unanimous consent in dealing with highly complicated issues. Approaching its 50th anniversary, the Council remains a dynamic and influential organization in western water resources management. On the occasion of its 40th anniversary, the Council's annual report reviewed the its activities over its tenure and identified numerous accomplishments consistent with its mission (Western States Water Council 2006). Providing an overview of the Council's activities, the following pages highlight some of those activities and accomplishments.

A fundamental purpose of the Council involved its efforts to serve as a forum for the exchange and discussion of ideas, information and perspectives on water resources management. Achievements highlighted under this aspect of its mission include the development of principles, standards and guidelines for regional water development plans and the Council's extensive endeavors to ensure appropriate development of and funding for water data collection and management programs. The Council has been a strong supporter of U.S. Geological Survey and National Oceanic and Atmospheric Administration programs to collect and manage data on stream flows and meteorological/climatic conditions. Consistent with that support, the Council has also backed water resources research programs at federal agencies and state academic institutions. Other matters and concerns addressed through these forums include adaptation of water rights programs to improve implementation of the Endangered Species Act and to recognize and protect resources to meet ecological needs and environmental flows.

The Council has also heard significant discussion regarding groundwater management issues. As water demands have increased, states have sought better approaches to manage groundwater, more specifically to develop conjunctive use strategies to optimize efficiencies. To supplement supplies, extensive consideration has been given to the technical feasibility and legal issues associated with artificial groundwater recharge. Given the arid climate and the significant evapotranspiration potential from reservoirs, some areas have found substantial promise in groundwater storage projects.

Other water resource management issues receiving notable attention in Council forums involve drought conditions and responses, water conservation, water quality and its relationship to water allocation challenges in the West, and appropriate identification and quantification of federal reserved rights. Drought conditions have presented and persisted several times over the past 40 years and in 1986, the Council staff published a report presenting details on drought management programs in western states, including state emergency powers; the effect of drought on implementation of the appropriative rights doctrine; and a compilation of federal drought assistance programs (Western States Water Council 1987). In the following year, the staff produced and the Council approved a model state drought response planning document.

While most of western water policy and the Council's activities have focused on the availability of water (or lack thereof), water quality concerns have received attention since the 1980s. States have faced challenges in maintaining minimum flows, particularly in over-allocated waterways. Council discussions and a publication focused on the relationship between the U.S. Environmental Protection Agency's water pollution control programs and western state water resources management programs. Before 1985, some states had not received delegation to implement federal water quality protection programs, and even today, some western states are still not fully delegated implementation of Clean Water Act programs.

The Council also plays a substantial role in providing water resource-related information to states. Crucial to its informational efforts is the publication and distribution of a weekly newsletter. Published since 1974, the newsletter provides information on Council meetings, events and business as well as news

on water resource management issues. The newsletter is intended to improve water resources management, enhance intergovernmental relations, promote the water-related interests of western states, and identify and briefly explain policy issues (Western States Water Council 1994).

The other aspect of the Council's service involves the preparation and dissemination of policy reports and staff papers. The 2005 annual report chronicles almost 30 documents prepared by the Council staff in conjunction with its programmatic committees. Reports, which address issues discussed in Council meetings and forums, include *Groundwater Management in the West (2005)*, *State Tools to Provide Water for Endangered Species (2003)*, *Intrastate Water Transfers in the West: Approaches, Problems and Related Issues (1995)*, *Water Conservation and Western Water Resource Management (1983)*, and *The Reservation Doctrine (1975)* (Western States Water Council 2006).

In fulfilling its mission to provide a western perspective on water resource management issues, the staff of the Western States Water Council also assists member states by reviewing policies proposed before Congress and federal agencies and preparing proposed positions outlining the interests of western states and recommended approaches or options to address those issues. Council officials have testified before Congress on a range of issues. Council representatives reviewed and commented on information and proposals from the Public Land Law Review Commission, the National Water Commission, the U.S. Environmental Protection Agency, the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service.

Council representatives were also extensively involved in the work of the Western Water Policy Review Advisory Commission, a 1992 presidential advisory commission given a broad charge by Congress to conduct a comprehensive review of western water resources issues. Within its scope, the Commission was directed to review present and anticipated water resource problems, including the need for additional storage or other water augmentation methods; examine current and proposed federal programs and recommend continuance or adoption; assess federal agency water-related authorities and activities; evaluate the problems of rural communities; and review legal regimes and institutional arrangements and assess their effectiveness in addressing water resource issues (1992).

The Council has also been heavily involved in working with the federal government in addressing reserved water rights. While asserting a strong states' rights position, the organization has endorsed the appropriate settlement of Indian water rights (Western States Water Council 2006).

Closely related to its assistance function is the Council's charge to serve as an advocate of state positions in water rights litigation. Over the years, the staff, in conjunction with the Legal Committee, has prepared numerous *amicus curiae* briefs. Discussing its accomplishments, Western States Water Council (2006) highlights participation in the following four landmark cases: *United States v. District Court of Eagle County* (1971) on federal participation in state general stream adjudication; *Cappaert v. United States* (1976) on the scope of the reserved rights doctrine; *United States v. New Mexico* (1978) on reserved water for national forest purposes; and *United States v. California* (1978) regarding conditions placed on a Bureau of Reclamation permit to appropriate water (Western States Water Council 2006).

More recently, the Western States Water Council has been working closely with the Western Governors' Association in determining the current and future water needs and setting forth strategies to achieve a sustainable water future. A 2006 report provided general recommendations in six major policy areas. Proposals to address water policies and growth focused on identifying water requirements and based on anticipated growth, the development of water supply options for consideration by local decision-makers. Other recommendations urged states to facilitate watershed-focused planning and to consider local, tribal and watershed plans and decisions regarding growth management in evaluating applications for new uses, transfers and changes in use. Due to potential adverse effects on rural economies, states were also asked to identify feasible alternatives to transfers of water from agriculture and rural areas (Western Governors' Association 2006).

To meet demands, recognition was given to the need for increased funding for state and federal basic water data collection and management to serve as the basis for sound decision making. It was also recommended that states work with university-based research programs to focus research on practical applications of new technologies. Governors were asked to support enactment of the National Integrated Drought Information System Act of 2006, which was approved in December 2006, to develop a drought

warning system. More specifically, the Council was directed to encourage the development and implementation of strong water plans by states and to compile and evaluate trends in existing uses, available supplies, future demands, and state water resource planning programs and activities. Furthermore, the Council was charged to evaluate the merits and obstacles related to using the various approaches and technologies, as well as the legal and institutional means to augment existing water supplies (Western Governors' Association 2006).

The report made numerous recommendations related to infrastructure needs. Governors were urged to support increased funding through the Clean Water State Revolving Fund, Drinking Water State Revolving Fund, and the Reclamation Fund, as well as funding for projects important to the West through the Water Resources Development Act. Support was also sought for the Rural Water Supply Act of 2006, which authorized the Bureau of Reclamation to work with rural communities in conducting water supply assessments and to examine the feasibility of options to meet those needs. All levels of government were encouraged to maximize opportunities for use of a coordinated regional and/or watershed approach to controlling water pollution. Specific tasks for the Western States Water Council included better identification of the beneficiaries of existing water resources assistance programs to support the establishment of a broader collation for future program support and the identification and evaluation of successful partnership arrangements for providing infrastructure (Western Governors' Association 2006).

Governors were also asked to reconfirm their policy on settlement of Indian water right claims, engage Congress to establish a federal policy and funding mechanism for such settlements, and request the Secretary of Interior to open a dialog on trust responsibilities for Indian water rights (Western Governors' Association 2006).

Recognition was also given to the need for addressing climate change impacts. It was recommended that governors urge Congress and the Administration to fund research for improving predictive capabilities and impact assessment and mitigation through the Climate Change Science Program. States should direct the state climatologist and other cognizant officials to assess historical, current, and projected climate trends and relate these trends to potential changes in water supply and

water quality to support development of impact mitigation strategies (Western Governors' Association 2006).

The final set of recommendations directed the Council to develop a protocol supporting consultation between federal and state agencies to resolve water resource issues in species conservation. It was further recommended that policy tools be identified to provide water for endangered species protection (Western Governors' Association 2006).

Reports apprising the governors of progress on meeting these recommendations have been published on a biennial basis. The 2008 report identified 42 more specific steps that should be taken to address the general recommendations (Western Governors' Association 2008).

Closing

Willardson (1989) observed that when the Western States Water Council was created, western state governors did not generally perceive western water challenges as national problems. Although the Council has maintained a strong states' rights focus and opposed outright federal authority over water resources management, it has come to recognize the federal government's interests in many aspects of management. To achieve its mission, it has coordinated with numerous federal agencies over the years to provide a unified perspective on water-related policy matters.

During its tenure, the Council has also remained a dynamic organization changing its emphasis and focus as the range of water policy issues has evolved. However, the organization has retained its commitment to reaching a regional consensus on issues of mutual concern. In hindsight, Willardson (1989) reflects that the likelihood of the Council's success was enhanced because (1) it was created in the spirit of making decisions at the lowest practical level of government; (2) discussions leading to the Council's creation exhibited sincerity in establishing a cooperative working relationship; and (3) a realization was achieved that regional statesmanship must prevail over intraregional politics.

Table 4 identifies selected accomplishments during the tenure of the Western States Water Council. An argument may be made that such accomplishments would not have occurred or would not have occurred in a timely manner without coordination, participation, or funding by the Council.

Table 4. Selected Accomplishments – Western States Water Council

Selected Accomplishments
Long-term planning
Policy reports on endangered species, conservation, federal reserved rights (1983-2003)
Model state drought response planning document (1987)
Evaluation of implications of inter-regional and interstate water transfers (1991/1995)
Assessment of groundwater management options/strategies (2005)
Work with WGA on current and future water needs and strategies to meet those needs (1997/2006-2013)

To summarize the value of involvement in the Western States Water Council, Sue Lowry, Interstate Streams Administrator in the Wyoming State Engineer’s Office, stated, “Participation in the Western States Water Council reaps rewards far surpassing the resources invested in the organization. Since water resource and water quality agency heads, as well as water attorneys for the states, participate personally at the Council meetings, water policy issues important to all of us in the West can be debated and positions taken. Coming from a state with a single representative in the Congress, the ability to join forces with the other western states on water issues is critical to our success. The Council staff members keep us abreast of germinating issues, and take the load off of us individually at the state level. The Council meetings afford the opportunity to get better acquainted with our counterparts in the other states and with the federal resource agencies. The networking and increased communications as a result of the Council activities are an added bonus” (Willardson 2005).

SUMMARY

The case studies presented in this chapter illuminate some commonalities and some differences regarding organizational structures, the circumstances under which they were created, selected institutional arrangements, and collaborative activities. In each case, regional identity—that is, a shared understanding of the nature of the resources and challenges and threats facing them, provided significant motivation to engage in collective action to address problems. Other common factors contributing to the establishment of collective action bodies involved external institutional triggers and state or federal

leadership. A history of interactions among the members played a significant role in the case of the Delaware River Basin Commission and to a lesser extent for the Western States Water Council.

From an operational standpoint, the Delaware River Basin Commission provides comprehensive water resources management that controls development and water use, while working to provide recreational opportunities and flood damage reduction. The Gulf of Mexico Program and the Western States Water Council serve advisory roles with regard to policy and program issues and coordinate program implementation through their membership. All organizations employ a nested structure involving committees, subcommittees or working groups thus providing significant opportunities for participation in the policy process by scientific and technical experts, potentially affected citizens, and other interested parties. This structure also allows for bottom-up development of policy proposals to enhance support for overall adoption. The endurance of these organizations speaks to an ability to adaptively manage to consideration of new issues as they are presented, particularly in the politically charged environment in which water resource management programs have found themselves in recent years.

CHAPTER 4
SURVEY RESULTS
INTRODUCTION

A survey instrument was developed and administered, in accordance with the methodology described in Chapter 2, to assess the perceptions, attitudes, and opinions of current and/or former senior executive environmental protection officials representing the eight states in the study area on: (1) general perceptions of the nature of current challenges and the potential causes of any dilemmas; (2) perceptions on the importance being placed by state policymakers on water resource management issues and the importance of those issues to future prosperity; (3) knowledge of actions taken by states in the past 10 years to address water resource management issues; (4) attitudes and opinions on the need for and aspects of institutional arrangements associated with multi-state regional surface water resources planning and coordination; and (5) impediments to enacting institutional arrangements for regional planning, as well as strategies to overcome those impediments.

Letters were sent to 11 current and/or former state environmental commissioners requesting their participation in the study. Six respondents representing six states participated. Surveys were administered by telephone, primarily in December 2012. Based upon knowledge of invited participants, no discernible nonresponse bias exists based upon participation and non-participation.

This purposive sample was selected because these officials have direct experience with water resources policy issues and concerns at the highest levels of state government. This experience creates a beneficial perspective on the development and implementation of public policies affecting water resources management. Their perspectives on the aspects and attributes of regional surface water coordination and planning provided important insights that should be considered, if a proposal for creation of a mechanism is to be developed.

CURRENT WATER RESOURCE MANAGEMENT CHALLENGES

The initial questions in the survey were posed to establish a baseline regarding respondents' perceptions of the nature and seriousness of water resource management challenges, potential causes and impacts, and state policy responses. Survey respondents were asked to characterize their perceptions on the seriousness of water resources management challenges facing their states as increasing, decreasing or remaining about the same over the past 10 years. All respondents agreed that states are facing more challenges. As the perception of greater challenges grows, a shared sense of adverse resource impacts may emerge leading to collective action, in this case potential regional surface water resources planning and coordination.

In considering factors causing or contributing to greater water resource management challenges, the survey focused on difficulties associated with water availability. Respondents unanimously agreed that water shortages resulting from reduced precipitation were significant. Other prominent causes involved interstate water disputes, and conflicts between instate users. Two respondents agreed that flooding contributed to problems. In elaborating on their responses, participants further identified groundwater withdrawals and interbasin transfer laws and requirements as contributing factors.

Overall, responses to this question are empirically supported. Water shortages across the Southeast have resulted from drought conditions occurring between 2000 and 2008. Over a longer horizon, rapid growth and development have fueled transboundary water disputes and concerns in Alabama-Coosa-Tallapoosa basins; Apalachicola-Chattahoochee-Flint basins; Catawba and Yadkin basins in North Carolina and South Carolina; Savannah basin in Georgia and South Carolina, and Tennessee basin in Georgia and Tennessee. In addition, controversy between Mississippi and the City of Memphis has involved groundwater withdrawals. Furthermore, the responses elicited here share consistency with a 2003 Government Accountability Office survey that asked state officials about the potential for freshwater shortages over the next decade. Water managers in 36 states, including most states in the Southeast, perceived possibilities of state, regional or local shortages (United States Government Accountability Office 2003).

Respondents were also questioned about their awareness of difficulties being faced by water users in obtaining sufficient supplies of good-quality surface water. All respondents agreed that users had faced difficulties over the past decade. One respondent emphasized that users were facing significantly more difficulties. The brief discussion of Professor Glennon's concerns in Chapter 1 supports the increasing difficulties, at times, in obtaining needed resources.

IMPORTANCE OF WATER RESOURCE MANAGEMENT ISSUES

Given the challenges and difficulties noted above, participants were asked about their attitudes on the importance of water resource issues. In illustrating the significance of water resources management issues to the future economic development, quality of life and environmental protection in their state, respondents were asked to rate the importance on a five-point scale, where a rating of 5 indicated "very important" and rating of 1 represented "not important at all." A mean of 4.7 was calculated with five respondents asserting that water resources are very important and the remaining participant observing that resources are of average importance. To be sure, the availability of good quality water is only one factor promoting improved future social and environmental conditions, many decision-makers consider it essential.

Using the same five-point scale, respondents were asked to provide their perspectives on the importance currently placed on water resource management issues by state policymakers. Among the five participants responding, the calculated mean was 4.0. Examining the distribution, two respondents selected an average importance, and one rated the current priority as somewhat important. Two participants observed that state policy makers place very high importance on water management issues. One participant provided no response. Responses to this question may have been influenced by the timing of the survey implementation—that is, with near normal precipitation conditions across the region. Since the importance of water resource concerns on the public policy agenda is often driven by crisis or catastrophe, those concerns may simply not be receiving greater attention due to the lack of crisis.

STATE ACTIONS ADDRESSING WATER RESOURCE MANAGEMENT ISSUES

In response to the occurrence, general impact, and importance of water resource management problems, states have acted to improve conditions. Participants were requested to respond yes or no as to whether their state had taken 14 identified actions over the past 10 years. All respondents agreed that three actions had been taken in their states: impaneling an executive or legislative committee to study water resource management; completing a study on the maintenance of environmental flows; and adopting significant changes to the state's water quality management program (striped blue bars on figure below). Five of six respondents *reported that state officials had participated in discussions regarding strategies for improving water resources management on a multi-state regional basis* (dotted blue bar on figure below). The distribution of the remaining responses is shown in Figure 9.

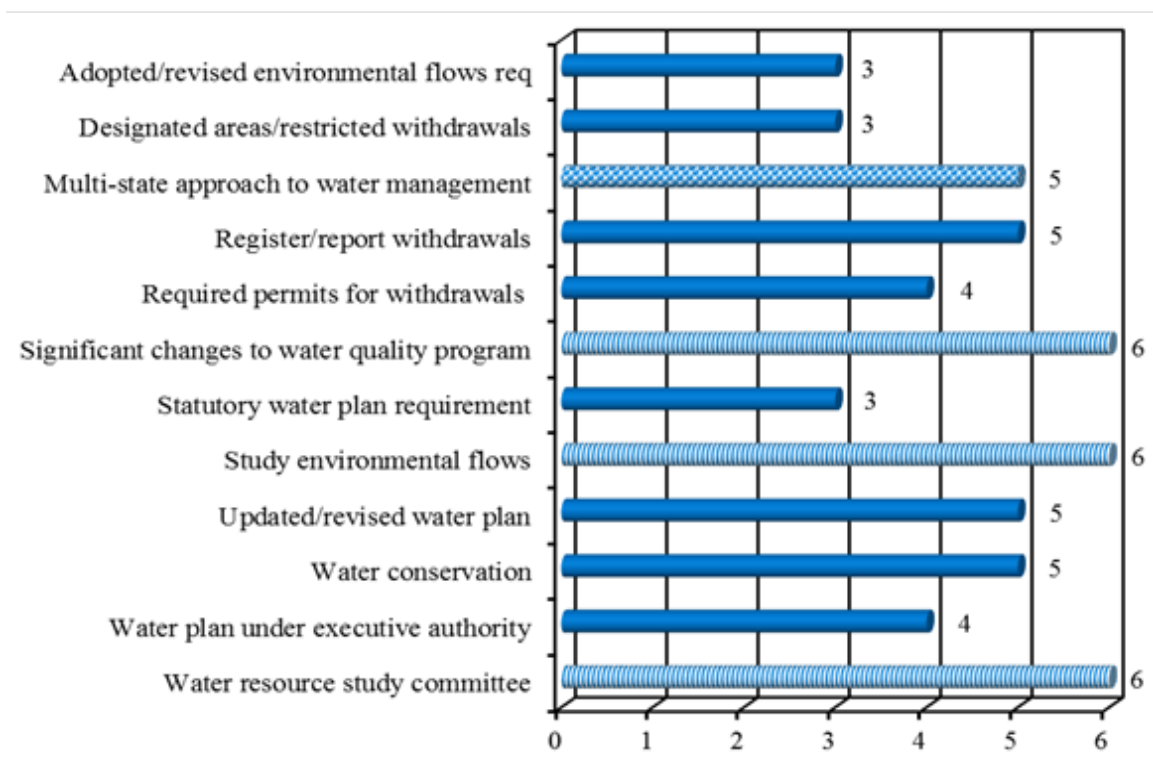


Figure 9. State Actions Addressing Water Resource Management Issues

Further elaborating on their responses, participants added the following actions: improved data management and access, enhanced cooperation with federal agencies, managed water resources in the

state using a basin-oriented approach, authorized funds for development of water supplies, and increased interest in the impacts of drought on municipal supplies and drought planning.

Looking more specifically at water resources management planning, questions were posed about the nature and scope of planning. All respondents reported planning activities included surface water supplies and availability, while only three indicated the incorporation of surface water quality. Groundwater supplies and availability are reported included in two-thirds of states. Groundwater quality matters and water supply and wastewater management infrastructure projects were reportedly being addressed in five of six states. Recognizing the interconnection between surface water and groundwater resources, states, in some cases, have attempted to apply a comprehensive, integrated approach to water resources planning.

MULTI-STATE REGIONAL COLLABORATION ON **SURFACE WATER MANAGEMENT**

Creation of a Mechanism

In the responses above, five of six respondents acknowledged that state officials have participated in discussions regarding strategies for improving water resources management on a multi-state regional basis in the past 10 years. Furthering the research objectives under this dissertation, survey participants were asked about attitudes and opinions regarding multi-state (regional) surface water resources coordination and planning among states in the Southeast.

All respondents agreed that a mechanism should be developed and that interstate coordination could improve water resources management in their state.

However, when asked about which states should be included in a regional coordination mechanism, responses varied considerably. One respondent proposed the inclusion of only 3 states, while another increased extended participation to 4 states. Other responses called for a five-state area (n=1), a seven-state region (n=1), and an eight-state district (n=2).

Considerable variability also existed in responses to which states should be included. Figure 10 provides a graphical representation of the responses. Other states posited for inclusion in a southeastern regional coordinating and planning initiative were Louisiana and Missouri.

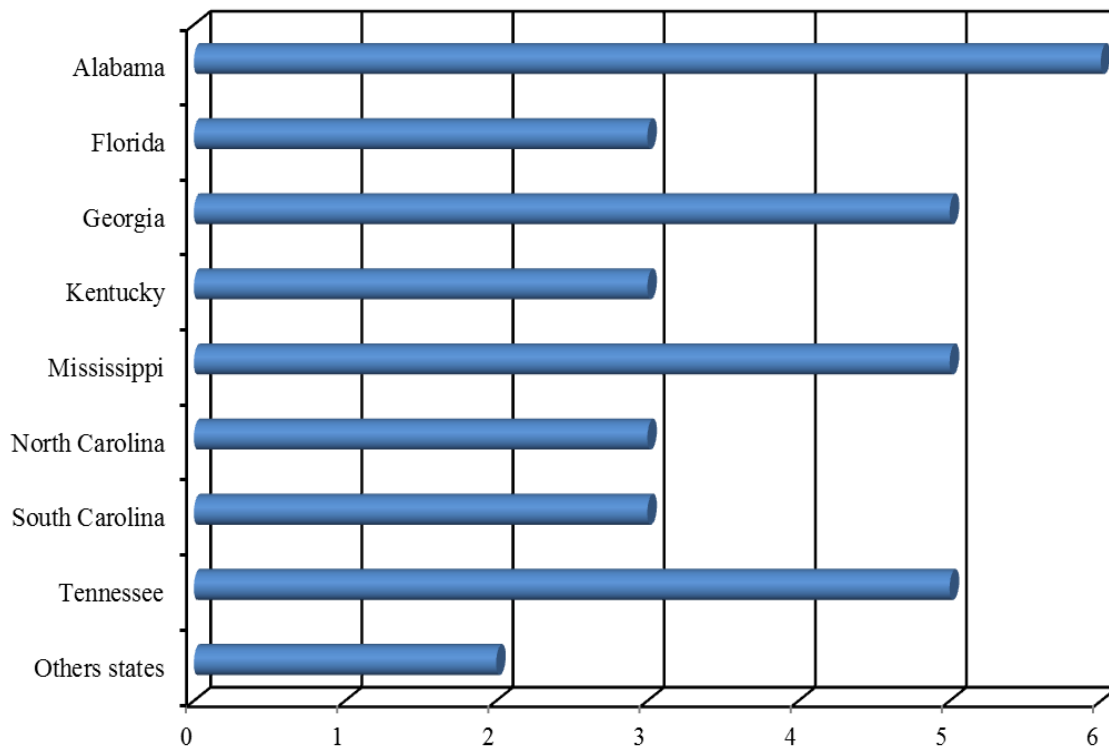


Figure 10. Potential State Participation in Regional Surface Water Coordination and Planning

In identifying which states would be appropriate participants in a regional surface water planning and collaborative effort, each respondent, at a minimum, identified his/her state and the neighboring states as part of a potential region.

This divergence of responses has potentially significant implications for regional planning and coordination in the Southeast. The study area for this dissertation was derived using the eight-state U.S. Environmental Protection Agency Region 4 boundaries. As noted earlier, that area was designated nationally, not by agreement among the participating states. Discussions over the years have questioned whether Virginia would be better suited for inclusion in Region 4, or whether Kentucky might find more common concerns with its neighbors, Illinois, Indiana, and Ohio, or whether Mississippi might be better placed in Region 6 with Louisiana and Texas.

As discussed in the explanations of the case studies, regional identity is a crucial consideration to the success of a cooperative regional initiative. States that have common historical, cultural, economic, political, and even, environmental tend to have a greater likelihood of finding a basis for lasting cooperation and coordination in addressing many public policy issues. As mentioned earlier, regional identity facilitates collective action because actors share an understanding of the resources, and the nature and severity of any problems, as well as a shared sense of stewardship.

Institutional Arrangements

Respondents were also asked to consider which institutional arrangements could be appropriate for interstate surface water resources coordination and planning for the Southeast. One participant did not respond to this question. Of the remaining five individuals, four supported creation of a federal-state interagency council (dotted blue bar on figure below). Figure 11 shows the distribution of responses. Upon further elaboration, specific suggestions included working with the Southern Governors' Association to establish an organization similar to the Western States Water Council and consideration of arrangements such as those used for the Tennessee-Tombigbee Waterway Commission (discussed in Chapter 1).

Functional Goals and Responsibilities

If institutional arrangements were adopted, they must clearly specify the functions and responsibilities of any implementing organization. Respondents were asked to respond yes or no to five pre-determined functions. As shown in Figure 12, participants unanimously agreed that creation of a forum for sharing ideas and information, and developing an understanding on present and potential future issues of mutual interest should be part of the mission. Support also exists for other "soft management" functions. In follow-up, one participant commented that any regional organization should strive to improve consistency among state water management frameworks, while another respondent proposed the inclusion of hydrologic modeling as a function.

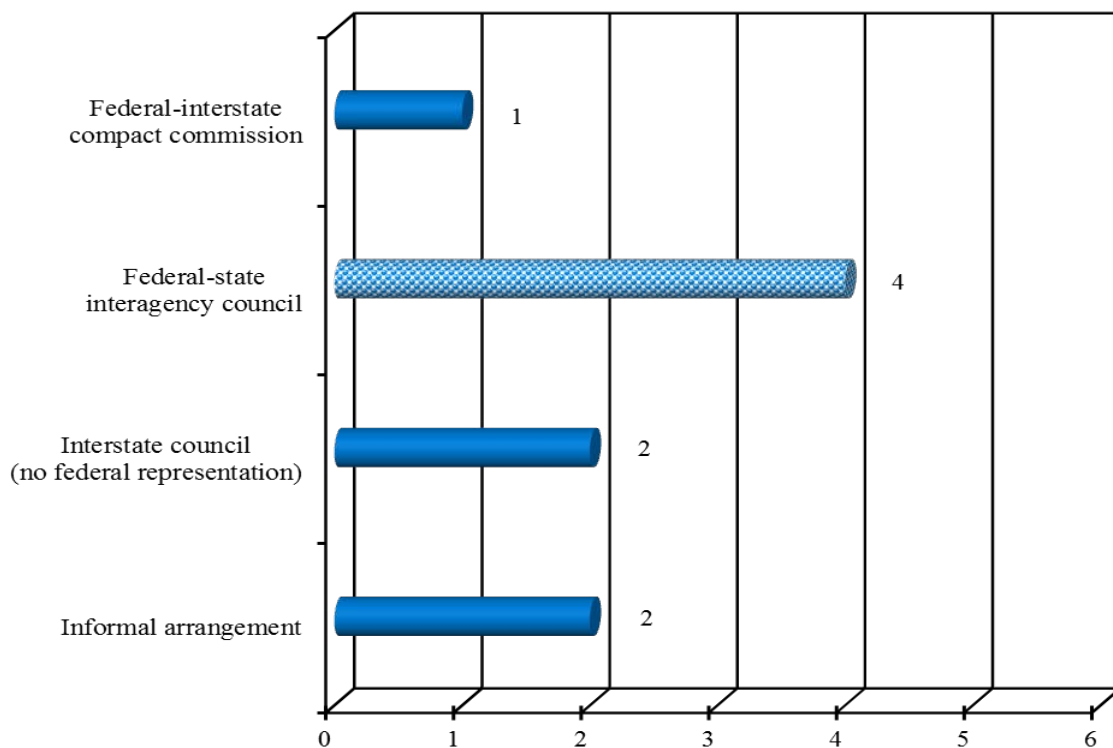


Figure 11. Mechanisms for Regional Surface Water Coordination and Planning

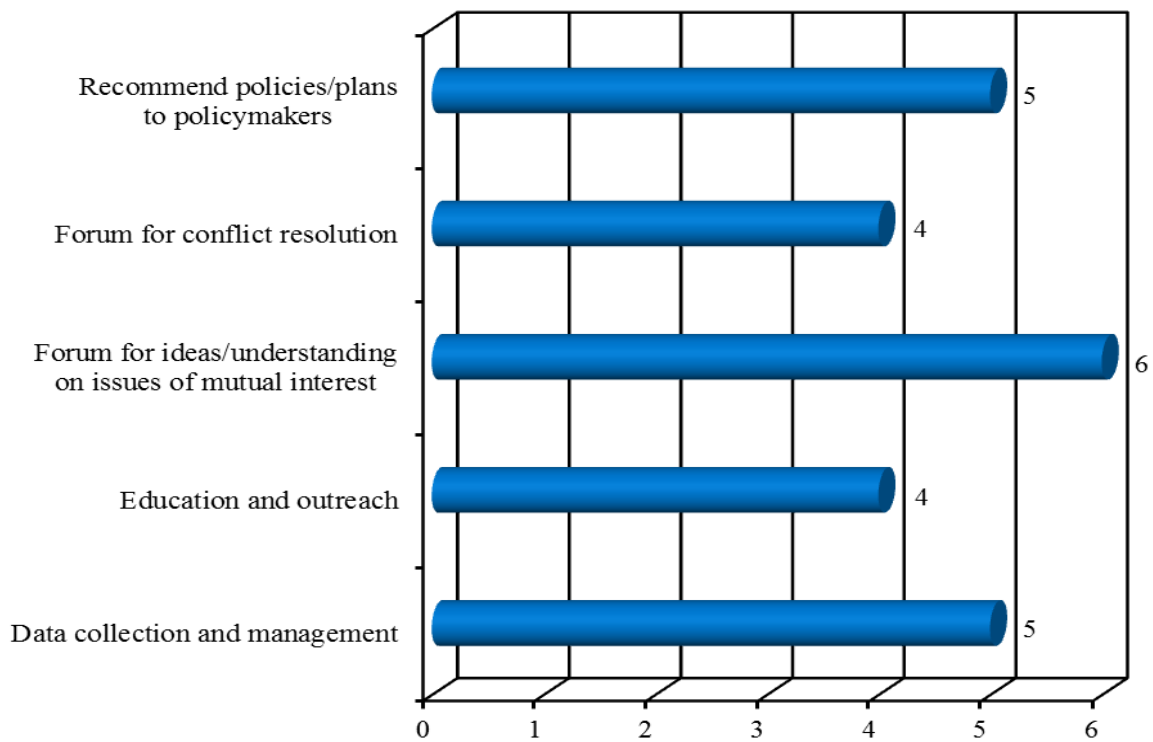


Figure 12. Organizational Functions for Regional Surface Water Coordination and Planning

Potential Impediments to Regional Collaboration and Strategies to Address Impediments

The final two questions sought opinions regarding potential barriers to creating a regional collaborative mechanism and possible strategies to overcome those barriers. Participants were asked to rate the likelihood of certain factors imposing an impediment to the creation of a mechanism on a five-point scale, where a rating of 5 indicated “very likely” and rating of 1 represented “not likely at all.” Collectively, respondents identified lack of political support (mean= 4.6) as the most likely barrier (dotted blue bar on figure below). While one individual did not respond to this question, responses ranged from somewhat likely to very likely. As shown in Figure 13, respondents also identified concerns over state sovereignty in water resources management (mean =3.7) as being a somewhat likely impediment. It should be noted that respondents did not identify lack of support by stakeholder groups (mean =2.6) as a substantial impediment (striped blue bar on figure below). As the result of further elaboration on answers, one respondent added politics (as distinguished from political support) as a potential impediment, while another included opposition from regional water management organizations.

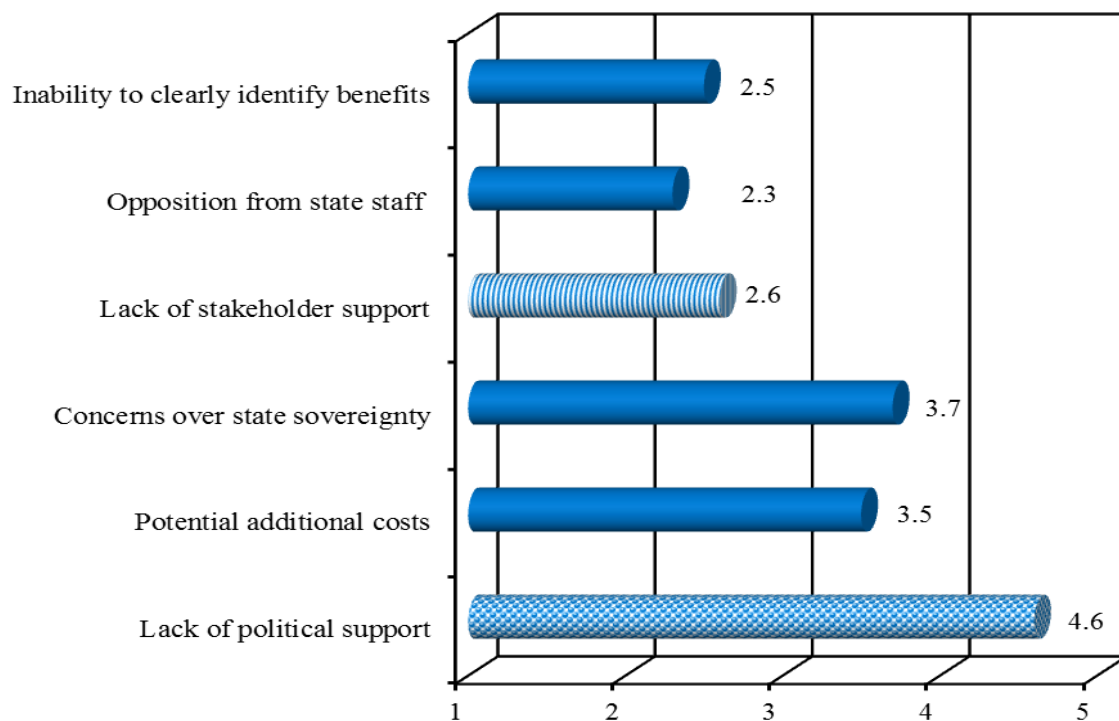


Figure 13. Potential Impediments to Regional Institutional Arrangements

Participating officials were polled about the likelihood of five-predetermined strategies assisting in overcoming impediments using the same rating scale explained above. As Figure 14 indicates, considerable consistency existed among responses. All strategies were considered to be somewhat likely to assist in overcoming barriers. However, lack of stakeholder support was only viewed as a moderate potential impediment, development of support among stakeholders was identified as somewhat likely to overcome impediments (dotted blue bar on figure below). Other strategies identified by participants included: beginning with modest objectives before proceeding to greater expectations; incrementally building commitments; promoting the benefits of taking action by explaining the downside of not acting; engaging in the political dialogue; seeking funding from the federal government to initiate the process; and providing that technical experts talk about technical issues.

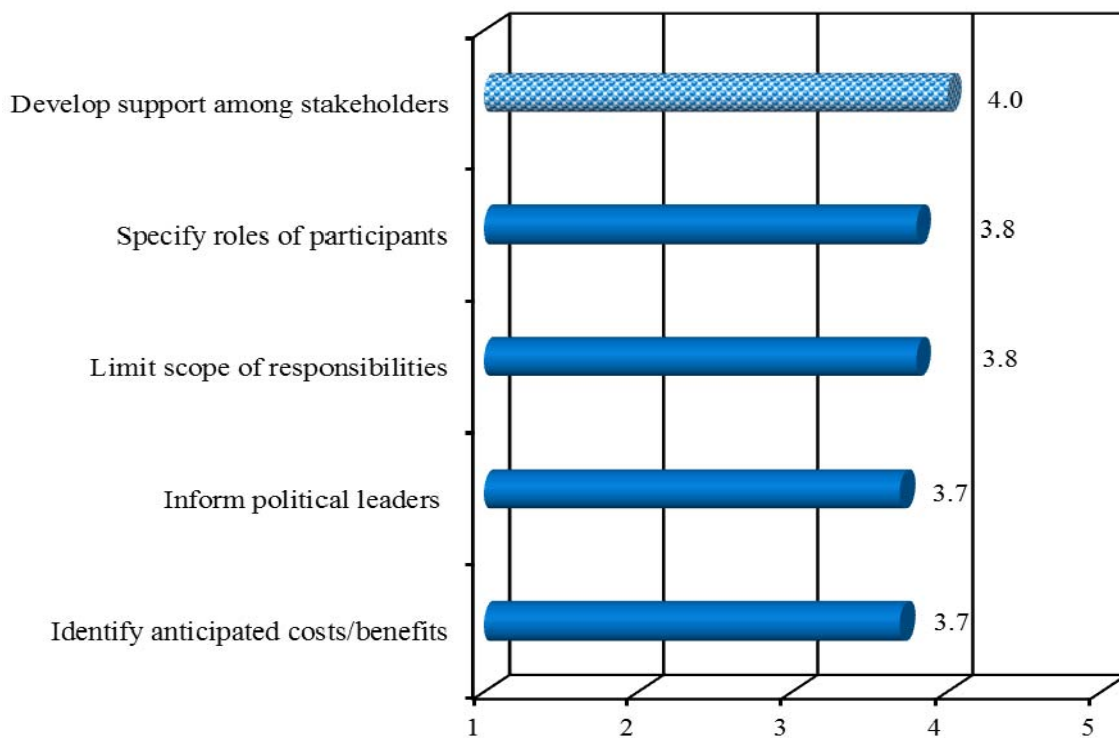


Figure 14. Strategies to Address Potential Impediments

Additional Comments

Prior to completion of the survey, respondents were asked to provide additional thoughts or comments. All participants took advantage of the opportunity. One official observed that any such undertaking would pose significant challenges because it had to overcome the *status quo* and the unfortunate axiom that water resource policy changes typically only occur during or result from a crisis situation. A respondent recommended that initial support should be built through a state working group to ensure all parties are faithfully participating the meet the mission and goals.

Two officials observed that any mechanism must also include groundwater management with a third emphasizing the critical nature of integrating surface water and groundwater management. The need to integrate water allocation and use with water quality was also noted. It was also stressed that coastal waters should be part of any initiative.

A final commenter emphasized that such coordination was definitely needed.

SUMMARY

Respondents agreed that water resource challenges have increased and those challenges have adversely affected users. Some agreement exists that significant contributors include reduced precipitation, interstate water disputes, and conflicts between instate users. States have undertaken a broad range of actions to address these challenges, including discussions among state officials about some type of coordinated regional action. Notwithstanding the lack of crisis conditions, state environmental leaders perceive that water resource management issues have retained a significant place on the public policy agenda.

Further discussion regarding the factors and attributes associated with the creation of a mechanism for regional surface water coordination and planning are discussed in Chapter 5.

CHAPTER 5
DISCUSSION AND CONCLUSIONS
INTRODUCTION

The focus of this dissertation research, the potential establishment of a multi-state regional water resources planning organization among states in the southeastern United States, began over a decade ago with discussions among senior federal environmental protection officials and advisors. Among the matters included in those discussions were the benefits of having and potential impediments to creating a strategy, experiences from organizations in other areas of the country that may be applied to creation of a planning and coordinating organization in the Southeast, and support among stakeholders for a regional water resources planning process and strategy.

To initiate a larger discussion, the Regional Administrator of U.S. Environmental Protection Agency, Region 4, provided funding to the Carl Vinson Institute of Government at the University of Georgia to facilitate sessions discussing the regional concept at the 2003 Southern States Environmental Conference in Biloxi, Mississippi. The resulting report, *Toward a Southeastern Water Resources Planning Strategy: A Report from the 2003 Southern States Environmental Conference*, identified potential goals for a regional water resource planning strategy, concerns and challenges regarding water resources in the Southeast, and anticipated next steps toward development of a strategy.

Before beginning work on the next steps, it was determined that a compendium of existing state laws on water resources allocation and use permitting, water quality control, and water resources planning was needed to facilitate a thorough understanding of current statutory and regulatory authority. The Carl Vinson Institute was contracted to identify relevant types of provisions, review state laws and regulations and report its findings. *A Comparison of Surface Water Laws and Regulations from Southeastern States* and its companion report on groundwater laws and regulations, found that statutes regarding water resource allocation and use and water resources planning varied considerably from state to state. However

water quality control laws showed great consistency, since all states in the Southeast were authorized to implement most federally delegated programs under the Clean Water Act. Due to the emergence of other priorities at Region 4 (*e.g.*, the response to the devastation created by Hurricane Katrina), the regional planning project was shelved in 2005.

In the years since the conceptualization of this research, the concept of coordinated regional action on water resources among southeastern states received support from the commanding general of the South Atlantic Division, United States Army Corps of Engineers. The Corps' efforts culminated in a September 28, 2008, meeting among regional state and federal water resources management officials during which state representatives expressed their intent to lead on collaborative efforts. The initiative has since stalled again.

This research, which centers on consideration of institutional arrangements for multi-state (regional) surface water resources coordination and planning among states in the Southeast, began by focusing on how regional water planning and management organizations in other parts of the United States are structured and how institutions are arranged across constitutional, collective choice, and operational levels of governance. The research also sought to determine the types of coordinated activities undertaken by those organizations to improve water resources management. Relevant characteristics identified from the case studies are summarized in Tables 5 through 7 below (after Heikkila and Gerlak (2005) and Gerlak and Heikkila (2006)).

SUMMARY OF CASE STUDIES

The resource characteristics of the case studies differ from a sizeable single river basin, where management is focused on freshwater and a limited estuarine system to a large marine ecosystem fed by vast inland river basins to a large geographic land area supporting some of the largest freshwater river basins in the United States. However, because of the size of the systems, they share resource problems and identified causes, particularly considering legacy issues. Table 5 provides an overview of resource and socioeconomic characteristics for the case studies.

Table 5. Overview of Case Study Resource and Socioeconomic Characteristics

	Delaware River Basin	Gulf of Mexico	Western States River Basins
Resource Characteristics			
Physical Extent	330-mile river with 13,500 square mile watershed	600,000 square mile gulf with watershed exceeding 1.5 million square miles	2.5 million square miles total land area and 107,000 square miles total water area.
Resource Problems	Disputes over allocation of water; water pollution; flooding; species declines; habitat loss.	Nutrients, toxics and pesticides pollution; habitat loss; species declines; changes in freshwater inflows; coastal erosion.	Disputes over allocation of water; water pollution; flooding; habitat losses; species declines.
Identified Causes of Problems	Population growth; urbanization; overdraft of groundwater; drought conditions; point source discharges; nonpoint sources of pollution; extreme weather events; legacy conditions involving pollutants	Point source discharges; nonpoint sources of pollution; water pollution; population growth; invasive species; dams and increasing diversions; weather conditions.	Drought conditions; over-allocation of supplies; interstate/interbasin transfers; groundwater overdraft; population growth; point source discharges; nonpoint sources of pollution; flow modifications; climate change.
Socioeconomic Characteristics			
Population	Basin population = 8 million; population relying on basin water resources = 15 million.	21 million	95 million
Primary Resource Uses	Water supply; waste assimilation; power generation; tourism; recreational uses; salt- and freshwater fishery; water-borne commerce; hydropower generation.	Waste assimilation; power generation; tourism; recreational uses; commercial and recreational fishing; water-borne commerce.	Water supply; waste assimilation; power generation; tourism; recreational uses; salmon fishery; hydropower generation.
Resource Management Authority	Local governments; state resource management and environmental protection agencies; interstate agencies, including port authorities; federal resource management agencies; Delaware River Basin Commission.	Local governments; state resource management and environmental protection agencies; interstate agencies, including port authorities; federal resource management agencies.	Local governments; state resource management and environmental protection agencies; interstate agencies, including port authorities; federal resource management agencies.

The work of the organizations profiled in the case studies spans the range of water resource management issues and concerns, thus involving and impacting numerous stakeholders. Therefore commonality exists in the types of stakeholders affected.

In some cases, significant prior involvement occurred between parties before institutional arrangements could be finalized. This phenomenon is most clearly presented in the Delaware River Basin case study where interactions among affected state officials began more than 50 years before compact negotiations could be acceptably finalized. The Delaware River Basin Compact was built on the experiences of states in three failed attempts to approve a compact and two decisions of the United States Supreme Court affecting water resources of the basin.

Circumstances were different with the Western States Water Council. Although the western states had been having interactions involving water resource issues, most were in adversarial forums. As mentioned in Chapter 3 as a possible explanation for the emergence of the Western States Water Council, Tony Willardson, its current Executive Director, noted that officials engaged in discussions regarding the Council's creation exhibited focus toward establishing a cooperative working relationship where regional statesmanship had to prevail over intraregional politics.

Institutional action was catalyzed or triggered in all three cases by contemporary events as shown in Table 6. While triggers for the Delaware River Basin Commission and the Gulf of Mexico were publicly higher profile, the rationale for the Western States Water Commission involved more legal and philosophical components,

The Delaware River Basin Commission was created by a federal-state interstate compact in 1961 to provide for reduction of flood damage, regulation and control of water uses and stream pollution, development of recreational facilities and hydropower works, enhancement of fisheries, protection of aquatic organisms, and improvement of navigation. Administrative statutory purposes include promoting interstate comity, addressing causes of conflict and controversy, providing for planning, conservation, and management of the basin's resources, and fostering cooperative planning and action among member parties.

Table 6. Overview of Case Study History and Triggers for Institutional Action

	Delaware River Basin	Gulf of Mexico	Western States River Basins
Types of Stakeholders	Local governments; state resource management and environmental protection agencies; interstate agencies, including port authorities; federal resource management agencies; water suppliers; wastewater treatment system owners; public and environmental advocates; electric power generators; farmers; business, commercial and industrial interests.	Local governments; state resource management and environmental protection agencies; interstate agencies; federal resource management agencies; wastewater treatment system owners; commercial and recreational fishermen; tourism officials; public and environmental advocates; electric power generators; farmers; business, commercial and industrial interests; oil and gas development interests; port authorities.	Local governments; state resource management and environmental protection agencies; interstate agencies; federal resource management agencies; tribal governments; wastewater treatment system owners; public and environmental advocates; electric power generators; farmers; business, commercial and industrial interests; oil and gas development interests.
Prior Organizational Efforts	1908 principals meeting to discuss development of the Delaware River; 1925 compact negotiated by the Tri-State Delaware River Commission; 1927 compact renegotiated by the Tri-State Delaware River Commission; Interstate Commission on the Delaware River Basin; 1951 compact prepared, but not acted upon; Delaware River Basin Advisory Committee.	Letter submitted by Texas environmental group to U.S. Environmental Protection Agency Region 6 office.	Southwest Water Council; Western Water Resources Task Force
Institutional Triggers	Disputes over water resources allocation; Water pollution; Flooding from Hurricanes Connie and Diane.	Public focus on hypoxia and marine debris; closure of shellfish beds; Emergency Planning and Community Right-to-Know Act; ocean incineration proposals.	1963 <i>Arizona v. California</i> decision; conflicts over interregional and interbasin water transfers; increasing federal intervention in water management.

The constitutional structure is established by the compact, which was enacted into statute in Delaware, New Jersey, New York, and Pennsylvania and consented to by Congress, thus providing it the force of federal law. The Delaware River Basin Commission, composed of the governors of the four member states and the commanding general of the North Atlantic Division, United States Army Corps of Engineers, serves as the collective choice body. In the collective choice structure, the Commission is served by several advisory bodies developing and considering policies, serving as forums for scientific and public interests, and providing recommendations on issues associated with regulated flows, water management (in general), water quality, toxic chemicals, water resources monitoring, flood warning and response, and fees and charges for water supply.

The Gulf of Mexico Program was created by the U.S. Environmental Protection Agency in 1988 to further the protection, restoration and maintenance of the health and productivity of Gulf of Mexico's resources in as manner consistent with the economic welfare of the region by facilitating collaborative action among federal, state, and local governmental agencies and other stakeholders implementing resource management and protection programs and resource users. While a memorandum of agreement set forth provisions coordinating activities between the headquarters' office and the regional offices of the Environmental Protection Agency, the constitutional structure of the Program arose through the Federal Advisory Committee Act charter providing for the creation of a 20-member Policy Review Board. The Board, which has served as the collective choice body, provided a forum for coordination of resource management planning among federal and state interests, evaluated existing federal and state program plans to determine the adequacy for overall resource management, assessed the progress of program implementation toward resource protection, sought consensus on federal funding needs and uses, and reported periodically to the Administrator of the Environmental Protection Agency on programmatic needs and concerns. Historically, the collective choice structure included a Management Committee to assist in making routine program decisions and in the operation of day-to-day program affairs; a Technical Advisory Committee, including issue specific subcommittees (subsequently reorganized as alliance teams and operational committees) to provide scientific and technical advice and support; a

Scientific Review Committee to ensure proper peer review of studies and program reports; and a Citizens Advisory Committee to promote better involvement of stakeholders in program decisions and improved communication of program activities to interested persons.

Since the establishment of the Gulf of Mexico Alliance in 2004 (later the Gulf of Mexico Alliance), the Program structure has undergone several revisions. The collective action role of the Policy Review Board has been assumed by the Alliance Management Team. The most recent revision to the Federal Advisory Committee Act charter provided for a 25-member Citizen Advisory Committee, appointed by the U.S. Environmental Protection Agency to focus on revitalizing and rebuilding of resilient communities, developing habitat conservation strategies, improving water quality, and protecting marine resources. However, no evidence of further activity in this matter exists.

The Western States Water Council was established in 1965 pursuant to a resolution of the Western Governors' Conference (now Western Governors' Association) to provide a forum for coordination of water planning programs to ensure intergovernmental cooperation in integrated resource development; opportunities for discussion of views and perspectives among members, and assist member states in evaluating the impacts of federal and state water laws, programs, and projects on western water resources.

The constitutional structure is established by the resolution and the referenced suggested rules of organization. The collective choice body is the Western States Water Council, which includes three gubernatorially appointed representatives from each member state. Governors serve as *ex officio* members of the Council. The collective choice structure includes several advisory committees. An Executive Committee was established to facilitate day-to-day functions of the Council. The Water Policy and Legislative Committee (now Legal Committee) focuses on the social, political, and legal aspects of the Council's activities and programs, particularly those associated with interstate water resources management. Aspects addressed by the Water Resources Committee include planning, data and information management, and regional water development activities and programs. As its name implies,

the Water Quality Committee considers water quality problems and water quality implications of state and federal resource programs.

Operational rules of the Delaware River Basin Commission are highly structured and are contained in the Delaware River Basin Water Code and the Rules of Practice and Procedure discussed in Chapter 3. The Water Code specifies the processes and procedures used by the Commission and programmatic requirements imposed on parties subject to the Commission's jurisdiction. These rules include screening criteria for project review, requirements for water conservation, processes for allocation and controlling the withdrawal and diversion of surface waters, procedures regarding storage and release of surface waters, limitations on withdrawals of groundwaters and import and export of waters, requirements for control of soil erosion and other watershed protection measures, provisions for protection of fish and wildlife, other aquatic resources, recreational values, and habitat. The Delaware River Basin Water Code also contains provisions regarding the use of water for hydropower generation.

The Rules of Practice and Procedure specify the process for adoption and revision of the comprehensive plan and annual water resources program. These rules explain the concepts behind development of a comprehensive plan, the applicability of requirements to be included in the plan, the process of submitting projects for inclusion in the plan, and procedures for approval of projects by the Commission. Similar provisions are included for the annual water resources program. Additional details regarding project reviews, such as those types of projects categorically requiring review or categorically exempt, are also provided by the rules. Other matters covered in the Rules of Practice and Procedure include a process for appealing decisions of the Executive Director and the procedures used in conducting hearings. These rules also set forth enforcement provisions for use by the Commission in addressing violations of its laws, rules or orders and provisions governing the public's access to records and information.

To minimize duplication and facilitate implementation, the Commission has entered into administrative agreements with agencies in Delaware and New Jersey to conduct certain program activities. The Commission also utilizes contractual assistance in implementation of its responsibilities.

In implementing its activities, the Gulf of Mexico Program employs a two-pronged approach. The Program relies significantly on participation by agencies or other stakeholders that have programmatic responsibilities for protecting the resources of the GOMP. As a result, operational rules include requirements associated grant funding and cooperative agreements. The U.S. Environmental Protection Agency annually provides funding for Program activities, a portion of which is typically designated for use in financing extramural projects.

The Program annually announces the availability of funding for grants and cooperative agreements through the Catalog of Federal Domestic Assistance and requests the submission of projects from eligible entities. The announcement contains total amount of available funding, the range of past award amounts and average amount of previous awards. Funding priorities, which are specified in the announcement, may change annually and are set consistent with an annual workplan developed by the Program staff and endorsed by the Policy Review Board. Program staff evaluate submitted proposals in accordance with the Environmental Protection Agency's policies and procedures for reviewing applications for competitive assistance and identifying selected recipients. Recipients of grants and cooperative agreements are required to monitor performance and report periodically.

Gulf of Mexico Program scientists and engineers participate as collaborators in projects. Projects may involve resource assessments and/or application of management approaches to the protection of resources. Chapter 3 provides examples of projects undertaken through grants and cooperative agreements, as well as those where Program staff members have participated as collaborators.

Like operations associated with the Gulf of Mexico Program, Western States Water Council staff members are not directly involved in resource management. Given the small size of its staff, the Commission relies significantly on its committee structure for the development and consideration of proposed policies and the review and evaluation of proposals and issues. Committees adopt detailed work plans identifying new proposed initiatives, existing initiatives that will be subject to continuation, and specific issues subject to study or investigation over the subsequent months. Work plans are submitted to the Council for approval.

Table 7. Overview of Case Study Constitutional and Collective Choice Structures

	Delaware River Basin	Gulf of Mexico	Western States River Basins
Year Established	1961	1988	1965
Authority	Delaware River Basin Compact	Clean Water Act, Section 104(b)	Resolution of the Western Governors' Conference
Program Mission	Provide for reduction of flood damage, regulation and control of water supply uses and stream pollution, development of recreational facilities and hydropower works, enhancement of fisheries, protection of aquatic organisms, and improvement of navigation.	Protect, restore, and maintain the health and productivity of Gulf of Mexico and its resources consistent with the economic welfare of the region by facilitating collaborative action among federal, state, and local governmental agencies and other stakeholders.	Provide a forum for coordination of water planning programs ensuring cooperation in integrated resource development; opportunities for discussion of views among members; and assist member states in evaluating the impacts of federal and state actions on western water resources.
Constitutional Structure	Delaware River Basin Compact	Federal Advisory Committee Act, Gulf of Mexico Program Policy Review Board charter*	Western Governors' Conference resolution and rules of organization.
Collective Choice Body	Delaware River Basin Commission	Policy Review Board	Western States Water Council
Structure of Collective Choice Body	Governors of Delaware, New Jersey, New York, and Pennsylvania; Commander of the North Atlantic Division, U.S. Army Corps of Engineers.	20-members representing federal and state agencies and non-governmental interests.	Governors of the 18 member states (<i>ex officio</i>); 3 appointed members from each member state.
Advisory Bodies	Flood Committee; Monitoring Committee; Regulated Flow Committee; Toxics Committee; Water Charges Committee; Water Management Committee; Water Quality Committee.	Management Committee; Citizens Advisory Committee; Scientific Review Committee; Technical Advisory Committee and issue-based subcommittees and operational subcommittees.	Executive Committee; Legal Committee; Water Resources Committee; Water Quality Committee.
* Reflects organizational structure before 2009.			

The committee structure also provides for the development of policy proposals. Since the committees are composed of representatives of member states who are not required to be members of the Council, the structure allows the Council to involve individuals with expertise in relevant matters from across the region in policy development. Once developed, proposed policies are submitted to the Council for approval.

The Council's staff supports both committee functions. Such support commonly results in the preparation of reports resulting from committee activities. Chapter 3 provides examples of issues and concerns addressed over the past few years.

SUMMARY OF SURVEY RESULTS

Survey respondents agreed that water resource management challenges in the Southeast have been increasing over the last 10 years and that users have faced difficulties in obtaining sufficient quantities of good quality water. Among the identified causes of water shortages were reduced precipitation, interstate water disputes, and conflicts among intrastate users.

Respondents also viewed water resource management as very important to state economic development, quality of life, and environmental protection, but perceived that state policymakers only viewed related issues as somewhat important. In response to challenges, states have employed various management approaches to address water resource issues.

Five of six respondents reported that state officials have participated in discussions regarding strategies for improving water resources management on a multi-state regional basis. All respondents agreed that such mechanism would benefit their state and a mechanism should be created.

When asked about which states should participate in a multi-state approach, responses varied considerably ranging from three to eight states. As discussed in this dissertation, these responses may demonstrate a problem with regional identity, a factor reportedly important to establish successful regional collaborative organizations.

In expressing preferences for the most appropriate type of arrangements, most participants supported the use of a federal-state interagency council. The type of coordination mechanism is reflective

of the Title II commissions used under the Water Resources Planning Act during the 1960s and 1970s. While several Title II commissions were created around the country, none involved the southeastern United States. As noted in Chapter 2, the Comptroller General observed that the river basin commissions did not meet their intended mission and identified reasons that contributed to that failure. The Gulf of Mexico Program, profiled in this research, also provides an example of a federal-state interagency council or commission.

Given the nature of institutional arrangements for coordination and planning functions, as opposed to water management functions, a presumption was made that any coordination mechanism created for multi-state (regional) surface water resources coordination and planning among states in the Southeast would engage in “soft” management functions. Responding to the list of identified options, participants unanimously supported the creation of a forum for sharing ideas toward a better understanding on issues of mutual interest. Participants also identified the need for functions associated with data collection and management and development of water resource management recommendations (policies and/or plans) for consideration by state policymakers. Some respondents noted that providing education and outreach and serving as a forum for conflict resolution may also be worthwhile functions.

An important component of the survey sought opinions regarding impediments to establishing regional coordination and potential strategies to overcome those impediments. Among the top impediments, respondents identified lack of political support, concerns over state sovereignty, and additional potential costs. Less likely impediments involved lack of support by stakeholder groups, inability to clearly identify benefits, and opposition from state staff due to potential for redirection of resources. One respondent emphasized politics as an impediment.

To address potential impediments, respondents curiously strongly supported development of support among stakeholders as a top strategy. Other beneficial strategies included limiting the scope of responsibilities of any organization, specifying the roles of participants, identification of anticipated costs and benefits, and provision of information to political leaders highlighting success stories. As reported in Chapter 4, respondents added suggested strategies, which included beginning with modest objectives

before proceeding to greater expectations, incrementally building commitments, and promoting the benefit of taking action by explaining the downside of not acting.

IMPLICATIONS FOR REGIONAL COORDINATION

AND WATER PLANNING IN THE SOUTHEAST

The author of this dissertation understands there are problems with generalizing conclusions from research using a few case studies and survey research results based on a small sample. However, the findings of this study should be considered in the discussion and development of institutional arrangements for regional surface water planning and coordination in the southeastern United States.

Chapter 2 includes a discussion of institutional attributes that increase the likelihood of success. Among those attributes is ensuring that activities are occurring at an appropriate scale such that participants share a sense of stewardship with the resource. In several places in this dissertation, this attribute is referred to as regional identity. The profiled organizations have embraced this concept. The extent of the Delaware River Basin and the reliance on the river and other waterways in the basin for economic activity and quality of life has created that sense of stewardship among basin states. The persistence shown in trying to reach a collaborative approach to improve water management provides further evidence of such sense. Despite the vast area covered by western states' river basins, the Western States Water Council has been able to rely on common culture and heritage, climatological conditions leading to decades of struggles to obtain sufficient water resources, philosophical underpinnings (decision-making at governmental level closest to resource), and common water rights institutions to forge a strong regional identity. While the Gulf of Mexico states have a strong identity for reasons similar to the Western States Water Council among its five member states, the reported sources of water quality challenges (discharge of nutrients and toxics into waterways) originate in locations far from the Gulf. Actors in those locations may have difficulty seeing themselves as part of a problem that exists hundreds or thousands of miles away. Considering the responses to the survey, determining which states may be appropriate for participation and forging a regional identity may be a threshold question for creation of a regional surface water planning and coordination mechanism in the Southeast.

The three organizations studied have different missions and employ a different type of coordination mechanism or set of institutional arrangements. The Delaware River Basin Commission provides a comprehensive water management programs that include planning, regulation, monitoring, and enforcement. The provisions of the compact provide sufficient authority and support those functions.

The Gulf of Mexico Program, a voluntary, non-regulatory collaborative program, depends on cooperation from other agencies and organizations for success. Although Program staff participates as collaborators in some programmatic activities, substantial success derives from activities externally funded by the Program. As the availability of funding has changed, the Program has worked to build relationships allowing for continued progress toward its mission. While the Federal Advisory Committee Act charter provides a mechanism for coordination, it does not allow the Program to compel participation. Despite success in implementing programs and projects, the Policy Review Board does not appear to have achieved its full potential in providing executive-level coordination of the plans and activities of the numerous governmental agencies and non-governmental organizations engaged in resource management affecting the Gulf of Mexico.

Created by the Western Governors' Conference, the Western States Water Council, comprised of governors and gubernatorial appointees, acts with the imprimatur of gubernatorial authority. As a result, the organization has been afforded opportunities to become directly involved in some very complex western water resource issues. Serving in a policy advisory capacity, successful implementation of policies, programs, and recommendations relies on implementation authorities of federal agencies or member state agencies.

While a counterpart organization, the Southern Governors' Association, exists for southeastern states, the organization's membership includes states across a wide geographic region, from Texas and Oklahoma to Virginia to Florida. A similar action to create an analog, a Southern States Water Council, is unlikely due to problems with regional identity.

Steps must be taken to ensure that the mission and functions of an organization are supported through use of an appropriate coordinating mechanism and embodiment of clear rules in institutional arrangements.

While not originally contemplated as part of this research initiative, the vital role of leadership emerged as a significant element in developing appropriate arrangements and creation of organizations. Mayors and governors ultimately served as policy entrepreneurs in the Delaware River Basin Commission case study. The Gulf of Mexico Program largely sprang from an initiative of the Administration of Region 4. Gubernatorial support was critical to the establishment of the Western States Water Council.

As diagramed in Chapter 3, institutional arrangements of case study organizations rely significantly on a committee structure to assist in making collective action decisions. The structure allows for participation by numerous stakeholders in the review and development of policies and thorough vetting of proposals and policy positions before they reach the collective choice body. Such vetting allows for consideration of numerous perspectives with the intent of reducing opposition and building support for proposals as well as greater legitimacy of policy decisions. Workflow may occur in both directions with identification of issues and concerns and development of proposals and policy options at the committee level. Alternatively, collective action bodies may refer information or proposals for consideration, review, comment, or other actions by committees. A similar approach will likely be vital to any regional water planning and coordination effort in the Southeast.

Case study organizations have lengthy records in participating in some aspect of water resources management. To some extent, the endurance of these organizations is attributable to their ability to adaptively manage—that is to re-evaluate goals, objectives and priorities allowing the organizations to address new issues and challenges, as they are presented, and respond to more current information on on-going projects.

All organizations have faced funding challenges. Given budget shortfalls and other priorities, funding from participating members has been unreliable. In the case of the Delaware River Basin

Commission, the United States has not contributed its share of funding for more than 15 years. Other members have had difficulties securing funding at different times. A similar situation exists with the Western States Water Council where members have been placed in associate member status due to inability share in annual funding commitments. As discussed, funding for the Gulf of Mexico Program has had some stability because the U.S. Environmental Protection Agency has borne a significant share. However, the agency's funding for the Gulf Program has been significantly less than funding provided to its sister great waterbody programs. Not surprisingly, appropriate rules to ensure adequate funding and an independent support staff appear to contribute to organizational success. The employment of an independent staff tends to avoid conflicts in requiring existing agency staff to bear additional workloads from an outside organization.

Avoiding conflicts or turf wars with existing agencies and organizations has been identified as important to success. Given the nature of their missions, the Gulf of Mexico Program and the Western States Water Council work with existing agencies and programs extensively for implementation of recommendations and programmatic initiatives. That is not to say that interagency or interorganizational tensions have not increased at times, thus at least temporarily reducing the effectiveness of collaboration. The Delaware River Basin Commission faced this issue when Congress failed to recognize its authority in amendments to the Federal Water Pollution Control Act. The Commission and its staff have resolved matters by developing effective working relationships with state agencies allowing achievement of the same ends. Any mechanism for surface water planning and coordination in the Southeast will also likely rely on existing agencies to implement actions and recommendations.

Other factors contributing to the successful adoption of institutional arrangements involve a prior history of interactions and the presence of external triggers. Relationships matter. Before successful adoption of a compact in 1961, leaders across the Delaware River Basin had interactions, sometimes cooperative and other times adversarial, regarding water resource issues for more than 50 years. While western governors may have had some interactions over water resource issues, they almost certainly interacted in other areas such as economic development and land use/management.

External triggers facilitated the adoption of institutional arrangements establishing all organizations studied in this dissertation. Concerns over water pollution, water allocation and use, and flood damage provided incentives for creation of the Delaware River Basin Commission. Facilitation of establishment of the Gulf of Mexico Program involved responses to pollution and degradation of resources, increasing demands in resource use, and likely, proposals for incineration of hazardous wastes in Gulf waters. Motivations for formation of the Western States Water Council included implications of the 1963 *Arizona v. California* decision, increases in proposals for inter-regional, interstate or interbasin transfers of water, and the evolving role of the federal government in water resources management.

Many of the factors discussed above lead to a central principle—expectations must be managed. Inadequate authority, inappropriate scope, insufficient funding and resources will hamper success.

CAN WE MOVE FROM CONFLICT TO COOPERATION?

Based upon the considerations and factors derived from this study, conditions appear unfavorable for adopting institutional arrangements for regional surface water planning and collaboration across the eight-state area. As demonstrated by the variability in survey responses regarding the geographic participation in any initiative, there appears to be a lack of shared sense of resource conditions and challenges, as well as responsibilities toward addressing conditions and challenges. As mentioned in Chapter 4, this effect may be more pronounced along the borders of the study area where states share significant resources with states outside the region.

Furthermore, there seems to be no “champion” or policy entrepreneur for a proposal. While not originally part of the study design, case study results indicate the important role of this person or these people in building acceptance and support for a proposal.

Difficult economic times have resulted in budget reductions and funding issues for many federal and state agencies. Notwithstanding the merit of any proposal, such propositions may not receive attention due to financial reasons. In some outcomes, this outcome may be preferred over establishment of an organization with inadequate funding and resources to complete its mission.

While theory may posit that sound long-term resource management decisions are not best made during or as the result of a crisis, practice actually provides that is when such decisions are actually made. No external trigger (crisis) is apparent.

Although regional surface water planning and coordination may not be achievable over the study area, a significant amount of good work is being done on smaller scales. As noted in Chapter 1, the ACF Stakeholders is an organization of individuals and groups attempting to seek water sharing arrangements among users in the three-state basin area (Appalachicola-Chattahoochee-Flint Stakeholders 2014). The Cumberland River Compact is also a stakeholder-driven group which seeks to reduce water pollution, address issues at the land-water interface, and revitalize the bi-state Cumberland River (Cumberland River Compact 2014). As determined through the survey, the initiatives of these organizations and other watershed protection groups across the region may serve as the basis for building stakeholder support.

CONTRIBUTIONS OF THIS RESEARCH

This study contributes to the body of academic research in two ways. As discussed in Chapter 2, substantial research exists regarding management of common pool resources on a smaller scale. Only in recent years have researchers begun to examine collaborative organizations and collective choice institutions for managing larger, more complex systems. Case studies provide an effective way of investigating details of these systems, thus contributing to the body of knowledge.

In addition, this research has identified factors, attributes, and circumstances that should receive consideration, if a coordination mechanism for multi-state water resources surface water planning and coordination is proposed for the southeastern United States. As the result of such consideration, institutional arrangements may be able to be tailored to enhance possibilities of organizational success.

OPPORTUNITIES FOR FURTHER RESEARCH

As discussed earlier in this chapter, this study was conceived as part of a larger initiative to encourage regional water resources planning and coordination. The basis for case selection was included in Chapter 2. With regard to establishing institutional arrangements for regional water resources planning and coordination, the following questions bear further study and consideration:

- Is a federal-state interagency council mechanism appropriate for water planning and coordination in the Southeast? If not, what are the likely shortcomings and can they be addressed through innovative institutional approaches?
- What are the advantages and disadvantages of adding groundwater planning as a potential mission component for a regional initiative?
- How can experiences associated with creating and institutional arrangements embodied in other collaborative regional organizations, such as the Southern States Energy Board and the Southern Growth Policies Board, further inform efforts to create a regional water planning approach?
- How important are the roles of policy entrepreneurs and external institutional triggers in incentivizing the creation of mechanisms?

In addition, some of the next steps or variants thereof identified in the 2003 report could provide fertile ground for further research.

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