

Protecting Water Quality

A Report to
the Georgia Environmental Protection Division



Carl Vinson **Institute of Government**

University of Georgia

Athens, Georgia

2006

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EXECUTIVE SUMMARY

Georgia enjoys a relatively plentiful water supply, yet the availability of our water resources varies both seasonally and regionally. When our natural water complexity is considered with regard to increasing water demands, it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have. The following factors, taken together, underscore the need for such a comprehensive approach to water management.

1. **Weather/Climate:** Although Georgia is located in the humid southeastern United States and receives an average of 50 inches of annual precipitation, floods and drought are common and can significantly affect our water resources and how we use them. In fact, in the past two decades, Georgia has experienced the two worst droughts on record and a 100 and a 500-year flood.
2. **Geology/Hydrology:** Georgia encompasses portions of five physiographic provinces that vary in bedrock, soil, and topography, which result in an uneven distribution of water resources. North Georgia generally has more limited surface and ground water resources than south Georgia, which has larger rivers and one of the most prolific aquifer systems in the world. Even with the abundant water resources of south Georgia, pumping too much water from any one place at any one time can result in salt water intrusion or lowering of ground and surface water levels. These problems now face coastal Georgia, an area of high industrial and municipal withdrawals, and southwest Georgia, the agricultural irrigation center of Georgia.
3. **Demographics:** Between 1990 and 2000, the population of Georgia grew by 26.4 percent. This growth is projected to continue so that in the next 25 years, the state's population is expected to approach 12 million people. Population growth is not evenly distributed across the state, exacerbating resource stress caused by greater water demands. Most of the growth in population is expected to occur in the northern part of the state, which has more limited water resources than south Georgia. The second fastest growing region of the state is along the coast, an area faced with salt water intrusion in the Floridan Aquifer, the major water resource of the region.
4. **Economic Growth:** Although Georgia, like the rest of the nation, has been in an economic recession for the past few years, indicators suggest that economic activity is increasing. As our economy grows, demands for water increase to support our expanding industrial and commercial activities.
5. **Federal Laws and Policies:** Federal laws, such as the Clean Water Act and the Safe Drinking Water Act, set national requirements for water resources. In addition, several federal laws affect water resources including the Resource Conservation and Recovery Act, Endangered Species Act, National

Environmental Policy Act, and others. Collectively, these federal laws set parameters within which Georgia must operate. In addition, policies of federal agencies significantly affect Georgia's water resources. For example, the management of federal reservoirs by the U.S. Army Corps of Engineers largely determines flows in rivers, including the Chattahoochee and the Savannah.

6. **Neighboring States:** All of Georgia's major rivers, except those of the Altamaha, Satilla and Ogeechee basins, are shared with neighboring states. The Floridan Aquifer, the major aquifer in south Georgia, is also shared with Alabama, Florida, and South Carolina. Since 1990, Georgia has been in a dispute with Florida and Alabama regarding the management of the waters of two river systems. In addition, Tennessee and South Carolina have voiced concerns over shared water resources.
7. **The Courts:** Increasingly, decisions about water resources are being taken to court. Georgia has been in litigation over ground water use in coastal Georgia, water quality protection, and various other issues. The U.S. Constitution provides the federal courts with a role in resolving interstate disputes, including conflicts over shared water resources. Courts at all levels are becoming increasingly involved, however, in determining how water will be managed in Georgia.
8. **Technology:** Advances in technology have affected how we get water, transport water, treat water, use water, conserve water, and treat wastewater. In fact, technological changes are evident in every aspect of water management. Generally, technology helps us use water more efficiently, but in some cases, it can increase the stress we place on the water system.
9. **Knowledge:** We know a great deal more about our water resources today than we did in past eras. Research has improved our knowledge of how water resources systems work, and what is necessary to have healthy, functioning aquatic systems. Not only have we generated new water-related knowledge and insights, but our ability to communicate this new information has expanded greatly through formal and informal educational programs, the media, and the Internet.
10. **Value of Water:** Water is a valuable resource in many ways. It supports our economy and thus has value in the production of agricultural and industrial products. It has environmental value in that all life is dependent upon water. In addition to water needed to support bodily functions, water provides habitat, nurseries, and refuge for aquatic and terrestrial plants and animals. It has social and cultural value in that our lives are intertwined with water in countless ways. Water provides recreational and aesthetic values. Water not only supports life but it improves the quality of life in myriad ways. Further, growing scarcity of water, whether real or perceived, increases its value for all of these purposes. These factors support the need for a comprehensive approach to managing water resources. The question is whether we have such a water management program in place and, if not, what will it take to create one.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. Collectively, this body of law has set two general water-related goals for us to meet:

- Protect public health and environmental quality; and
- Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation may be desirable but rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

A second challenge in meeting our water goals is that laws are not static. They reflect the values we attribute to water resources at a particular point in time. These laws also reflect the world as we know it—or can reasonably expect it to become—at the point in time when we conceive them. Congress and the General Assembly can amend these statutes, but they do not always change in lock step with a shift in citizens' goals, aspirations, perceptions, activities, and knowledge related to water resources.

To better address the water challenges we face, the Comprehensive State-wide Water Management Planning Act was passed by the Georgia General Assembly during the 2004 legislative session. This law directs the Environmental Protection Division of the Georgia Department of Natural Resources to develop a comprehensive state water management plan and creates the Georgia Water Council composed of legislators, legislative appointees and agency heads with water-related responsibilities to oversee the development of the plan. The plan is to be provided to the Council in July 2007, for its review and adoption and presented to the General Assembly for consideration in the 2008 legislative session.

The first iteration of the comprehensive water management plan will focus on four key policy objectives:

1. Minimizing withdrawals of water by increasing conservation, efficiency and reuse;
2. Maximizing returns to the basin through reducing interbasin transfers and limiting use of septic tanks and land application of treated wastewater where water quantity is limited;

3. Meeting instream and offstream water demands through storage, aquifer management and reducing water demands; and
4. Protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams.

These management objectives are interrelated, and policy options may relate to more than one objective. In addition, an option might be appropriate in one situation but not in another. Consequently, the plans should identify a variety of policy options that are consistent with state and federal laws and usable in different situations. The most appropriate options can then be selected to address the water challenges unique to each river basin and aquifer in the state. The result will be that approaches may vary from region to region depending on water resources and demands, but that all regions will be consistent with the overall state water policy framework.

A series of four reports examines each of the management objectives in terms of current knowledge and policies adopted in other states. As we move through the planning process, the policy options will be considered by various advisory committees, presented at public meetings, and made available on the Georgia Water Council's website (www.georgiawatercouncil.org). The intent is to distribute the information widely and to have as much feedback as possible so that the most effective water management options are identified for use in Georgia.

Water Quality

Sustainability of water resources is becoming an ever-increasing concern in many parts of the country, especially in metropolitan areas that are experiencing rapid population growth. While certain types of pollution have been substantially reduced, sprawling suburban development presents ever-increasing challenges for wastewater disposal infrastructure and stormwater management. The task of maintaining adequate supplies of high-quality water for both human uses and aquatic ecosystems will necessitate new ways of managing both water supply and water demands. By reducing demands through conservation, efficiency and reuse, making efforts to maintain clean water supplies, and providing for effective water management and storage such that demands may be met even during periods of low precipitation, Georgia will help ensure that future generations enjoy the benefits of plentiful, clean water.

Long-term sustainability of water resources will require a holistic approach that considers the natural flow regimes, withdrawals, and storage of surface water as well as ground water withdrawal, ground water-surface water interactions, and conjunctive use of ground and surface water sources. Sustaining high water quality requires the implementation of a variety of measures. This report focuses on: water quality standards, including monitoring, data, and standards assessment; infrastructure financing; stormwater management; and septic tank management. Georgia has made great strides in reducing water pollution from municipal and industrial point sources; however, these issues continue to present policy challenges related to water quality. It is valuable to consider

the policies and practices of other states as they have grappled with the same challenges. For each of the four issues, six states were surveyed: three in the Southeast and three in various other areas of the U.S., the selection of which was guided for the most part by literature references to innovative approaches.

Water Quality Standards and Monitoring: A critical aspect of water quality protection lies in setting appropriate standards and monitoring to ensure that those standards are being met. Are Georgia's standards and monitoring efforts suitable for the variety of circumstances that exist across the state? Are Georgia's water quality standards adequate for protecting the public health and the environment? What improvements may be needed regarding monitoring and data storage/analysis? Is our stream classification system realistic and responsive to future needs? Do we have the necessary tools to adequately address specific water quality challenges such as maintaining dissolved oxygen levels and limiting the entry of sediments, fecal coliform, and emerging pollutants (e.g., endocrine disrupting chemicals)?

The states surveyed for this report varied tremendously in the number and types of freshwater classifications, ranging from four to 13 classes. Instead of having specific classifications, Oregon assigns as many designated uses as are appropriate from a list of 16 possible uses. All six of the states surveyed have a special designation and more stringent water quality criteria for exceptionally high quality waters. Most states have both numeric and narrative criteria that include physical, chemical, and biological parameters. Most of these states also have a tiered and rotating approach for monitoring water quality that help ensure that as many water bodies as possible are monitored on an annual basis.

Stormwater Management: Even with the most effective point source water pollution controls, water quality standards cannot generally be met without effective management of nonpoint source pollutants. Nonpoint sources continue to pose the most significant threat to water quality throughout the state, particularly in rapidly-developing areas where land-clearing contributes to erosion and impervious surfaces reduce natural cleansing processes. How can Georgia better manage stormwater runoff to better control the nonpoint source pollutants entering our waterways? What is the state's role in local decision-making regarding land use?

Stormwater management in the states surveyed is typically an aspect of nonpoint source water pollution abatement programs. Of the four focus issues of this report, stormwater management approaches are the most varied, with technical assistance and education among the most common tools. Most of the states rely heavily on voluntary programs for encouraging structural and nonstructural best management practices. Some states designate priority watersheds and provide targeted funding for program planning and implementation.

On-site Wastewater Management: Septic systems are the primary method of on-site wastewater treatment in Georgia. Properly installed and maintained, they can be a viable and cost-saving alternative to sewers and centralized treatment facilities. They must,

however, be managed in a way that protects water quality. The third report of this series, *Maximizing Returns to River Basins*, addresses how the management of septic tanks can help preserve water quantity. This report focuses on how septic tanks can be managed to protect water quality in rural and suburban watersheds.

Requirements for permitting and inspection of on-site wastewater systems in the states surveyed were similar, with somewhat predictable guidelines for site evaluations (e.g., soil percolation and setbacks from dwellings and water bodies). The most significant differences are found in the rules regarding authorizing alternative technologies and for ongoing monitoring and maintenance of on-site systems. Most of the states have specific maintenance expectations of homeowners, but funding and enforcement of homeowner maintenance is largely lacking.

Infrastructure Financing: In some communities, existing infrastructure has aged and is posing a variety of challenges, including pipe failures that can cause acute pollution emergencies. Other communities are growing and need basic infrastructure to maintain adequate services for their citizens. Both scenarios require significant capital investments. How can Georgia prepare for continued growth while meeting the costs associated with replacing much of the aging wastewater infrastructure?

Financing for water and wastewater infrastructure projects is provided through a variety of ways in the states surveyed, including block grants and revolving loan and grant programs administered through public or public-private entities. In several of the states, emphasis is placed on providing financial assistance to small and/or rural communities, especially those with low income levels.

The goal of this report is to provide an array of information offered by academic literature, state and federal guidance documents, and the experiences of other states, as applicable, to inform Georgia's comprehensive water management policy decisions as they relate to water quality.

Chapter 1

INTRODUCTION

Georgia is a complex state when it comes to water resources. Couple this natural water complexity with increasing water demands, and it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have. To meet the challenges before us, we will need to adopt new measures to conserve water, return more water to the streams, help us balance off stream and instream water needs, and protect water quality. The following factors, taken together, underscore the need for such a comprehensive approach to water management.

1. **Weather/Climate:** Although Georgia is located in the humid southeastern United States and receives an average of 50 inches of annual precipitation, floods and drought are common and can significantly affect our water resources and how we use them. In fact, in the past two decades, Georgia has experienced the two worst droughts on record and a 100 and a 500-year flood.
2. **Geology/Hydrology:** Georgia encompasses portions of five physiographic provinces that vary in bedrock, soil, and topography, which result in an uneven distribution of water resources. North Georgia generally has more limited surface and ground water resources than south Georgia, which has larger rivers and one of the most prolific aquifer systems in the world. Even with the abundant water resources of south Georgia, pumping too much water from any one place at any one time can result in salt water intrusion or lowering of ground and surface water levels. These problems now face coastal Georgia, an area of high industrial and municipal withdrawals, and southwest Georgia, the agricultural irrigation center of Georgia.
3. **Demographics:** Between 1990 and 2000, the population of Georgia grew by 26.4 percent. This growth is projected to continue so that in the next 25 years, the state's population is expected to approach 12 million people. Population growth is not evenly distributed across the state, exacerbating resource stress caused by greater water demands. Most of the growth in population is expected to occur in the northern part of the state, which has more limited water resources than south Georgia. The second fastest growing region of the state is along the coast, an area faced with salt water intrusion in the Floridan Aquifer, the major water resource of the region.
4. **Economic Growth:** Although Georgia, like the rest of the nation, has been in an economic recession for the past few years, indicators suggest that economic activity is increasing. As our economy grows, demands for water increase to support our expanding industrial and commercial activities.

5. **Federal Laws and Policies:** Federal laws, such as the Clean Water Act and the Safe Drinking Water Act, set national requirements for water resources. In addition, several federal laws affect water resources including the Resource Conservation and Recovery Act, Endangered Species Act, National Environmental Policy Act, and others. Collectively, these federal laws set parameters within which Georgia must operate. In addition, policies of federal agencies significantly affect Georgia's water resources. For example, the management of federal reservoirs by the U.S. Army Corps of Engineers largely determines flows in rivers, including the Chattahoochee and the Savannah.
6. **Neighboring States:** All of Georgia's major rivers, except those of the Altamaha, Satilla and Ogeechee basins, are shared with neighboring states. The Floridan Aquifer, the major aquifer in south Georgia, is also shared with Alabama, Florida, and South Carolina. Since 1990, Georgia has been in a dispute with Florida and Alabama regarding the management of the waters of two river systems. In addition, Tennessee and South Carolina have voiced concerns over shared water resources.
7. **The Courts:** Increasingly, decisions about water resources are being taken to court. Georgia has been in litigation over ground water use in coastal Georgia, water quality protection, and various other issues. The U.S. Constitution provides the federal courts with a role in resolving interstate disputes, including conflicts over shared water resources. Courts at all levels are becoming increasingly involved, however, in determining how water will be managed in Georgia.
8. **Technology:** Advances in technology have affected how we get water, transport water, treat water, use water, conserve water, and treat wastewater. In fact, technological changes are evident in every aspect of water management. Generally, technology helps us use water more efficiently, but in some cases, it can increase the stress we place on the water system.
9. **Knowledge:** We know a great deal more about our water resources today than we did in past eras. Research has improved our knowledge of how water resources systems work, and what is necessary to have healthy, functioning aquatic systems. Not only have we generated new water-related knowledge and insights, but our ability to communicate this new information has expanded greatly through formal and informal educational programs, the media, and the Internet.
10. **Value of Water:** Water is a valuable resource in many ways. It supports our economy and thus has value in the production of agricultural and industrial products. It has environmental value in that all life is dependent upon water. In addition to water needed to support bodily functions, water provides habitat, nurseries, and refuge for aquatic and terrestrial plants and animals. It has social and cultural value in that our lives are intertwined with water in countless ways. Water provides recreational and aesthetic values. Water not only supports life but

it improves the quality of life in myriad ways. Further, growing scarcity of water, whether real or perceived, increases its value for all of these purposes.

These factors support the need for a comprehensive approach to managing water resources. The question is whether we have such a water management program in place and, if not, what will it take to create one.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. These statutes relate both directly and indirectly to our water resources. Statutes are implemented through a series of rules, policies, and programs by various departments of federal and state governments. One must look to the statutes themselves for either explicit or implicit expression of our goals for managing water resources. These “goals” (i.e., the outcomes we seek to achieve) reflect best how we collectively, as citizens of the United States and of Georgia, value the attributes of our water resources.

The laws that express our goals vary. Some laws reflect the broader goals of Americans and were passed by Congress. Federal statutes, such as the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, Coastal Zone Management Act, and others, identify overarching goals that have been embraced, to varying degrees, by Georgia statutes. By enacting state laws that are at least as stringent as the federal laws, the state is able to receive primacy, or the responsibility to implement federal policies and programs in Georgia. The primacy mechanism applies to environmental laws administered by the U.S. Environmental Protection Agency (USEPA), such as the Clean Water Act and the Safe Drinking Water Act. Primacy, however, does not apply to all laws. For example, the Endangered Species Act is administered exclusively by the U.S. Fish and Wildlife Service. If there is sufficient change in collective American values or goals relating to water resources management, Congress adds to or amends federal laws to reflect this change; the State of Georgia alone cannot alter the federal requirements.

Some state statutes are Georgia specific and not driven by federal directives. State statutes include the Erosion and Sedimentation Control Act, Safe Dams Act, Georgia Planning Act, the Coastal Marshlands Protection Act, and others. In addition, states have the authority to determine how water should be allocated to various water users. Georgia has enacted legislation establishing permitting requirements for withdrawals of over 100,000 gallons per day of surface and ground water. These laws were enacted by the Georgia General Assembly and reflect goals and values of Georgians. Together, these federal and state statutes serve as the foundation for our water management programs.

Collectively, this body of law has set two general water-related goals for us to meet.

- Protect public health and environmental quality; and
- Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation, while desirable, rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

A second challenge in meeting our water goals is that laws are not static. They reflect the values we attribute to water resources at a particular point in time. These laws also reflect the world as we know it—or can reasonably expect it to become—at the point in time when we enact them. Congress and the General Assembly can amend these statutes, but they do not always change in lock step with a shift in citizens' goals, aspirations, perceptions, activities, and knowledge related to water resources.

Problems Resulting from Uncoordinated Water Management

Some examples of the need for a more comprehensive, thoughtful, and coordinated approach to water management may be instructive.

- **Protecting Water Quality:** Our efforts to meet water quality standards have focused primarily on reducing contamination through controlling discharges from industries and municipalities. We have accomplished a great deal nationally and in Georgia by reducing pollutants that enter our waterways through these industrial and municipal wastewater discharges. Streams, rivers, and lakes across the country are cleaner today than they were when the Clean Water Act was passed in 1972. However, as we reduced the contaminant load from these point sources, and as our knowledge of the affects of nonpoint sources (e.g., runoff from land) increased, land use changes were outpacing our efforts to address resultant nonpoint sources.

Georgia's Erosion and Sedimentation Control Act, passed in 1975, only addresses runoff from certain construction activities. It does not deal with the direct relationship between post-construction land use and nonpoint pollution; nor does it address the broad array of nonpoint pollutant types—such as nutrients, heavy metals, and synthetic organic compounds—that enter our waterways as a result of post-construction land-use practices. The Act also assigns responsibilities to multiple state agencies and to local governments who wish to implement the requirements within their jurisdiction.

In the effort to render our waters safe and healthy, the federal government, through its executive and judicial branches, recently has increased its focus on controlling nonpoint sources as a pollution management tool. Both USEPA and the Georgia Environmental Protection Division (EPD) have worked to control

stormwater discharges. Since the first flush of stormwater carries most of the nonpoint pollutants to streams, collecting and/or otherwise treating this stormwater can help improve water quality. Additionally, the federal court system has required USEPA, and by extension EPD, to develop total maximum daily loads (TMDLs) in order to bring those streams that do not meet water quality standards into compliance with the Clean Water Act.

In Georgia, there are over 6,000 miles of streams that have been assessed that do not meet water quality standards; most of these impairments are due to nonpoint source pollution. To improve coordination of the nonpoint source control efforts, the Georgia General Assembly enacted House Bill 285 in the 2003 legislative session. This statute better aligns erosion and sedimentation control requirements under state law with stormwater control requirements under the federal Clean Water Act. This legislation will result in better coordination, but to be truly effective, the efforts of federal, state, and local governments, as well as private land owners, must work in concert to protect our waterways from nonpoint pollution.

- **Maintaining Healthy Aquatic Systems:** Achieving and maintaining healthy aquatic systems was built into our statutory foundation for water management in the 1970s when the Clean Water Act made it a national goal to have “fishable” and “swimmable” waters. The term “fishable waters” implies a healthy aquatic habitat that supports fish. Additionally, the Clean Water Act declares that “[t]he objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation’s waters.” To restore and maintain the biological integrity of our waterways, Congress intended that this federal water quality law protect healthy aquatic communities. So too, the Endangered Species Act was designed to protect both terrestrial and aquatic species.

To obtain primacy for implementing the provisions of the Clean Water Act in Georgia, the Georgia Water Quality Control Act, first passed in the 1950s and amended in the 1960s, was again amended by the General Assembly to incorporate federal requirements for healthy aquatic systems. Thus maintaining the biological integrity of Georgia’s waters was incorporated as a goal for the state. Although the Georgia General Assembly enacted the Georgia Endangered Wildlife Act and the Wildflower Preservation Act in 1973, these laws are much narrower in scope than the federal Endangered Species Act that, as noted above, does not have a primacy provision. Consequently, the goal to have healthy aquatic systems has been in place at the federal level and, to a lesser extent at the state level, since the 1970s. That goal has not changed.

What has changed over the past few decades is our understanding of what is required to achieve that goal. In 1972, when the Clean Water Act was passed, it was anticipated that improving water quality would enable us to have healthy aquatic systems. Now, it is clear that we also must maintain sufficient stream

flow—as well as flow patterns that mimic the natural flow regime—in order to maintain healthy communities of fish and other aquatic organisms.

The Supreme Court of the United States has determined that states have retained the authority to allocate water to users within their borders. The Georgia General Assembly enacted the Georgia Groundwater Use Act in 1972 and amended the Georgia Water Quality Control Act in 1977 to provide for a water allocation system that requires major water users to obtain water withdrawal permits from EPD. Before issuing a withdrawal permit, EPD evaluates water withdrawal permit applications to determine if the withdrawal will have an unacceptable adverse impact on the water resource or other water users.

For surface water withdrawals, EPD formerly used annual 7Q10 (e.g., the annual average of a stream segment's 7-day low flow, with a frequency of occurrence of once in ten years) as the standard with which to determine if, after a withdrawal, a sufficient amount of water would be left in the stream for instream uses. Through the 1990s strong scientific evidence was developed that annual 7Q10 was not a sufficient amount of water to maintain a healthy aquatic system. In 2001, the Board of Natural Resources adopted an interim instream flow policy designed to increase the amount of water remaining in streams—after withdrawals—for instream uses, but that change still may be insufficient. As our knowledge improves, new management actions may be necessary to meet our goals. We also may find it necessary to consider changing our goals to reflect our new knowledge.

- **Integrating Water Quality and Quantity Management:** As more water is withdrawn from streams and less is returned, the capacity of the streams to assimilate wastewater discharges decreases. There is simply less water available to dilute pollutants. Currently a number of streams and rivers in the state are above or approaching their limits for assimilating wastewater—not to mention limitations on their ability to meet off stream water demands for public supply, industrial uses, thermoelectric power production, and agricultural irrigation. Similarly, large withdrawals of ground water along the coast have allowed salt water to intrude into the aquifer upon which most coastal residents depend. Meeting our demands for water while ensuring sufficient water is left in the stream to meet instream needs and in the aquifer to maintain hydrologic balance is a significant challenge that will require greater coordination than we currently have.
- **Integrating Surface and Ground Water Management:** Flow in streams during drought periods comes largely from ground water. This is true throughout the state, but it is even more significant in karst areas where dissolvable bedrock (i.e., limestone, dolomite) is at or near the surface. In Georgia, this includes both the southwest and northwest portions of the state. In the lower Flint River basin, it has been estimated that—over an extended dry period—every gallon of water withdrawn from the Floridan Aquifer decreases the amount of ground water that

seeps into streams by 0.6 gallons. This is a high irrigation region of the state, therefore, large withdrawals of ground water during dry periods may have a significant impact on the amount of water in streams. Similarly, large withdrawals of ground water along the coast have resulted in decreases in artesian pressure that reduces ground water discharge to wetlands and streams in portions of this area. To avoid surface water problems relating to inadequate flows, it is increasingly necessary to consider the potential impacts of ground water withdrawals on streams, lakes, and estuaries.

When water management values, statutes, rules or programs change in an uncoordinated fashion, there is an inevitable conflict between our goals/aspirations and the rules/policies/programs that seek to achieve them. Here in Georgia, “new values” have largely grown out of lessons we have learned: 1) by programmatically implementing “old” rules and policies; and 2) from vast leaps forward in the state of our knowledge regarding the physical, chemical, and biological functions of our water systems. Generally, we have addressed these conflicts between “old” programs and “new” values in an issue-by-issue, piece-meal fashion through the legislative process, followed by “fixes” to individual rules and programs. A more comprehensive approach is rarely an option due to the cost in time and resources.

A New Opportunity

An opportunity to comprehensively address water management concerns began with the creation of the Joint Comprehensive Water Plan Study Committee and the Water Plan Advisory Committee during the 2001 legislative session of the Georgia General Assembly. Legislation, based on this effort, was passed in the 2004 legislative session and reflects the most recent articulation of a water vision and guiding principles for water planning in the state. The General Assembly incorporated the study committee’s overall vision for Georgia’s water resources as the state water management goal in the Comprehensive State-wide Water Management Planning Act:

Georgia manages water resources in a sustainable manner to support the state’s economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.

This vision encompasses the concept of sustainability that has never been articulated in earlier goals. It also recognizes the interrelationship of the economy, environmental quality, and quality of life.

Additionally, the study committee identified nine principles to guide the development of the state-wide comprehensive water management plan. These guiding principles were incorporated in the Act:

1. Effective water resources management protects public health, safety and welfare of Georgia’s citizens.

2. Water resources are managed in a sustainable manner so that current and future generations have access to adequate supplies of quality water that supports both human needs and natural systems.
3. All citizens have a stewardship responsibility to conserve and protect the water resources of Georgia.
4. Water management efforts recognize that economic prosperity and environmental quality are interdependent.
5. Water quality and quantity and surface and ground water are interrelated and require integrated planning as well as reasonable and efficient use.
6. A comprehensive and accessible database is developed to provide sound scientific and economic information upon which effective water management decisions can be based.
7. Water resource management encourages local/regional innovation, implementation, adaptability and responsibility for watershed and river basin management.
8. Sound water resources management involves meaningful participation, coordination and cooperation among interested and affected stakeholders and citizens as well as all levels of governmental and other entities managing and/or utilizing water.
9. Periodic revisions of the plan are required to incorporate new scientific and policy insights, as well as changing social, economic, cultural, and environmental factors.

The General Assembly has thus created a framework for developing Georgia's first comprehensive state-wide water management plan by providing a vision/goal for water management and guiding principles for developing the plan.

The planning process must:

1. Evaluate water trends and conditions to determine the types of challenges that we face now or will face in the future;
2. Evaluate our legal/management structure (i.e., statutes, rules, programs, policies) to address those challenges;
3. Identify gaps and other weaknesses in our water management approach; and
4. Identify options for addressing these gaps and weaknesses and the benefits and drawbacks of each option.

The plan will initially focus on four interconnected water management objectives:

1. Minimize withdrawals of water by increasing water conservation, efficiency and reuse;
2. Maximize returns to the basin of origin by managing interbasin transfers, the use of on-site sewage disposal systems, and land application of treated wastewater where water quantity is limited;
3. Meet instream and off stream demands for water through efficient surface storage, aquifer management and reducing water demands (see number 1); and
4. Protect water quality by reducing pollutant loadings from discharges and runoff from the land to ensure the assimilative capacity of the streams is not exceeded and aquatic life is not impaired.

These policy objectives are complementary, with the overall goal to maximize the amount of water available for both humans and natural systems such that our water resources are sustained in a healthy balance within each river basin and aquifer. In order to achieve this goal, an overarching focus must be on preserving instream flows and ground water levels. Instream flow ranges should be protective of water quality, aquatic ecosystems, and the legal responsibility to provide adequate flows for downstream users. Ground water levels should be maintained to prevent salt water intrusion and adverse impacts to surface water flows and to sustain long-term use of the aquifer.

The first objective, to minimize withdrawals through conservation, efficiency, and reuse, will help reduce the need for increased water supplies as our population and water demands grow. Making better use of the available water is usually the least costly alternative for meeting water demands. Water conservation is certainly not a new concept, but its practice should be stressed in order to better meet both instream and offstream demands for water.

The second objective, to maximize returns to the basin of origin (and thus help maintain adequate instream flow in each river basin) focuses on reducing interbasin transfers and judiciously using septic tanks and land application of treated wastewater. Each of these may be useful water management tools, but without careful management, they may threaten the balance of water resources in the basin of origin. Interbasin transfers may be necessary and desirable in some instances, but the benefits to the importing basin must be weighed against the instream and offstream costs to the exporting basin. Septic tanks are important for protecting water quality in rural areas, however, as proliferation of septic tanks has accompanied sprawling suburban growth, how much of the residential water supply is being returned to its basin of origin? Finally, land application of treated wastewater can be beneficial if used to irrigate land where potable water might otherwise be used, but as a wastewater discharge tool, its benefits should be examined relative to the costs of direct discharges of treated wastewater.

The third objective, meeting offstream water needs during seasonal shortages while maintaining instream values, emphasizes the need to balance human water demands with the needs of aquatic systems. Reservoirs provide valuable water storage for municipal, agricultural, industrial, and commercial needs, but they come with monetary and environmental costs that must be considered. Ground water is often connected to surface water systems and must be managed to help preserve instream flows as well as to sustain ground water quality and quantity over time. Conjunctive use of surface water and ground water, such as aquifer recharge and aquifer storage and recovery (ASR), can provide seasonal and year-to-year storage options that should be weighed with other options in terms of storage utility and environmental integrity.

The fourth management objective, protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams, is related to the previous management objectives in that the greater the instream flow, the greater the assimilative capacity of streams. While the other management objectives focus generally on managing water quantity, which affects water quality, this objective focuses rather on mechanisms that can be used to reduce direct and indirect discharges.

As stated above, these management objectives are interrelated and need to be considered in a comprehensive manner. To do so will require that a variety of policy options be available and that, from these available options, the most appropriate ones be selected to address the water challenges unique to each river basin and aquifer in the state. The result will be that approaches may vary from region to region depending on water resources and demands, but that all regions will be consistent with the overall state water policy framework.

A series of four reports examines each of the management objectives in terms of current knowledge and policies adopted in other states. As we move through the planning process, policy options will be considered by various advisory committees and be presented at public meetings and made available on the Georgia Water Council's website (www.georgiawatercouncil.org). The intent is to distribute the information widely and to have as much feedback as possible so that the most effective water management options are identified for use in Georgia.

Protecting Water Quality

Sustainability of water resources is becoming an ever-increasing concern in many parts of the country, especially in metropolitan areas that are experiencing rapid population growth. The challenge of maintaining adequate supplies of high-quality water for both human uses and aquatic ecosystems will necessitate new ways of managing both water supply and water demands. By reducing demands through conservation, efficiency and reuse, making efforts to maintain clean water supplies, and providing for effective water management and storage such that demands may be met even during periods of low precipitation, Georgia will help ensure that future generations enjoy the benefits of plentiful, clean water.

Water quality provides two broad classes of benefits: withdrawal benefits and instream benefits. Withdrawal benefits relate to human uses that meet municipal, industrial, and agricultural needs. The higher the water quality, the less treatment it requires to protect human health, and the less costly it is to use. Instream benefits relate to both human recreational and economic uses and environmental services such as aquatic habitat. High-quality water is necessary for swimming and fishing, as well as for sustaining ecosystem health.

The previous three reports in this series addressed issues specific to water quantity. Those issues greatly impact the policies adopted relative to water quality, however, because water quantity and quality are interrelated in many ways. Most significantly, water withdrawals from both surface water sources and ground water sources affect the waters' ability to assimilate waste. Surface water withdrawals have an obvious effect in this regard, but ground water withdrawals and ground water contamination can also impact surface water quality. Surficial aquifers provide base-flow discharges to surface water bodies, and their overpumping reduces stream flows and affects surface water quality. Interconnections between ground and surface waters can also mean interchange of pollutants between the two sources, with surface water contamination entering ground water and vice versa.

Georgia's Surface Water Resources

Major rivers in Georgia originate within or along the state's boundaries, and the headwaters of many of the river basins are located in the Piedmont, where limited source water and population pressures contribute to drought vulnerability (Mohamoud, Draper). Georgia's 14 major river basins are the Altamaha, Chattahoochee, Coosa, Flint, Ochlockonee, Oconee, Ocmulgee, Ogeechee, Satilla, Savannah, St. Mary's, Suwanee, Tallapoosa, and Tennessee. (See Figure 1.) Because several of the rivers that originate in Georgia flow along or beyond our borders, interstate cooperation has become an important element in regional and state water planning.

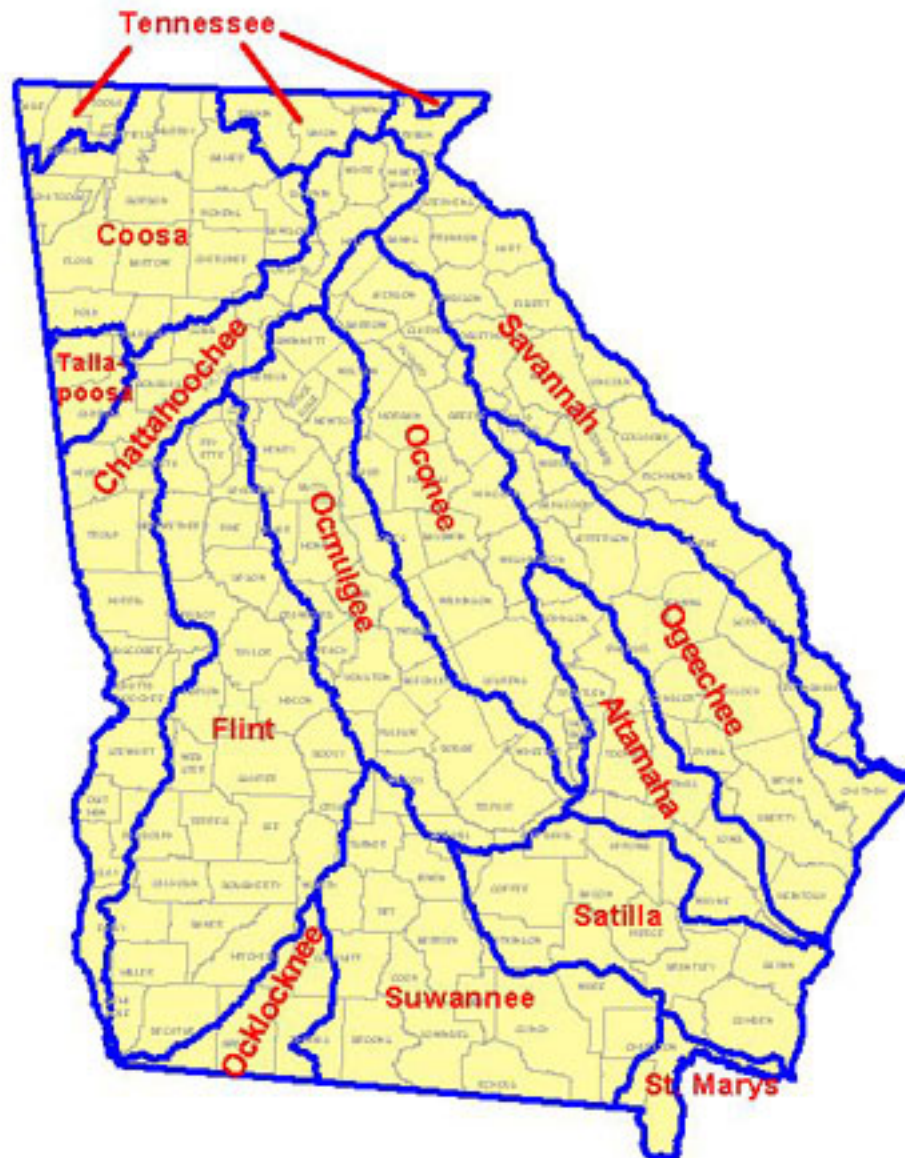
Water Quality: An Historical Perspective

In terms of restoring and protecting the quality of water resources, the U.S. has made great strides in a relatively short period of time. Until the early 1970s, there were no national guidelines for water quality, and early clean-up measures focused primarily on protecting the public from water-borne disease. The first federal legislation related to water pollution, the 1948 Federal Water Pollution Control Act, recognized state responsibility for controlling water pollution and made federal funds available for research and for loans to construct sewage treatment projects.

The impact of the early federal legislation was limited, however: as recently as 1960, 70 percent of Georgia's municipal sewage entered rivers untreated, and sediment from construction projects entered streams unchecked (The New Georgia Encyclopedia). Georgia passed its first legislation dealing with water pollution in 1957, creating a Water

Quality Council, but this was ineffective and was replaced in 1964 by the Water Quality Control Act. This Act established the Georgia Water Quality Control Board, which later evolved into the Environmental Protection Division of the Georgia Department of Natural Resources. (EPD 1998) During the 1960s, the focus of water pollution control in Georgia was on documenting existing conditions, cleaning up the most polluted waterways, and establishing water use classifications and water quality standards. (Ibid.)

Figure 1. Georgia's River Basins



Source: Summit to the Sea Program, University of Georgia

During the 1970s, new awareness of pollution problems brought a flurry of legislative activity at both the national and the state level. In 1972, Congress enacted the Federal Water Pollution Control Act Amendments, which is now known as the Clean Water Act (CWA). The CWA set a national agenda for water protection to provide for “the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and out of the water.” The Act established a process for setting water use classifications and water quality standards, established the National Pollutant Discharge Elimination System (NPDES) to regulate point sources of water pollution through a permitting program, and created a funding program (the Construction Grants Program) for the construction of publicly-owned water pollution control facilities.

In 1987, the Clean Water Act was strengthened and changed to increase the emphasis on nonpoint source pollution of streams, rivers, lakes, wetlands, and estuaries, and on toxic pollutants. The amended act required that states evaluate water quality standards and adopt numeric criteria for toxic substances. The Act also required states to evaluate nonpoint source pollution impacts and develop management plans to address problems.

The Clean Water Act has produced mixed results in Georgia, as in other states. On one hand, by the early 1970s, most of Georgia’s industries had installed water pollution controls, and by the mid- to late-1970s, the federal Construction Grants Program had been utilized by municipal facilities throughout the state to help reduce wastewater pollutants (USEPD 1998). However, Georgia failed to comply with certain aspects of the Act. In 1994, a group of nonprofit organizations filed suit against the U.S. Environmental Protection Agency (USEPA) to compel the establishment of pollutant discharge limits (total maximum daily loads, or TMDLs) in the state. The expansion of the NPDES program in 1987 to include stormwater provisions strengthened the effectiveness of the Act by requiring permitting of land-disturbing activities.

In addition, in 1975, the Georgia General Assembly passed the Erosion and Sedimentation Act, which established a statewide program for controlling erosion and sedimentation related to land-disturbing activities. This Act has been amended several times to make it more effective, but erosion and sedimentation remain problematic in the state.

Water Quality Today

Although surface water quality has improved nationwide since the passage of the Clean Water Act, the 2000 National Water Quality Inventory found that approximately 39 percent of evaluated U.S. river and stream miles are considered impaired and do not meet their designated uses. The same report found 45 percent of assessed lakes and ponds to be impaired (Mas 2006).

Programs targeting point source pollution (end-of-pipe) and certain sources of nonpoint source pollution have been effectively implemented and have resulted in significant improvements in water quality. However, Georgia has faced chronic shortages of funding

devoted to monitoring and enforcement of water quality regulations, and as a result, only 14 percent of the state's river and stream miles are currently monitored, and of almost 10,000 stream miles assessed, approximately 6,000 miles do not meet water quality standards for one or more pollutants.

Pollutants and Processes that Harm Water Quality

Water quality can be harmed in a variety of ways and by hundreds of different kinds of pollutants. Some of these pollutants, called conventional pollutants, have been studied for years and are well understood. These include substances that deplete oxygen, suspended solids, fecal coliform bacteria, acids and alkalines that alter pH, and oil and grease. Toxic pollutants can cause death, disease, physical and behavioral abnormalities, cancer, mutations, and other problems in organisms. Toxic pollutants include solvents, organic chemicals, metals, and various pesticides. Non-conventional pollutants, although not toxic, are subject to the same regulatory standards as toxic pollutants unless it can be shown that such standards are not necessary in a specific circumstance. Non-conventional pollutants are substances such as iron, ammonia, chlorides, and nitrates. Andreen (2004) identified the following common pollutants and processes.

Oxygen-depleting substances

Adequate levels of dissolved oxygen (DO) are necessary to support fish and other aquatic life, and prolonged exposure to low levels can suffocate mature fish, eggs, and larvae, and can kill insect larvae. Most game fish, such as trout and bass, will suffer if dissolved oxygen falls below 3.0-4.0 milligrams/liter, and larvae and juvenile members of such species need even higher concentrations of oxygen, ranging from 5.0 to 8.0 milligrams/liter. Oxygen levels can fluctuate under natural conditions. For instance, lengthy periods of hot, dry weather can lower dissolved oxygen levels, sometimes severely. More often, however, oxygen depletion results from the discharge and decomposition of organic material such as sewage, food wastes, discharges from some industrial facilities, and animal waste.

Nutrients

Nutrients such as nitrogen and phosphorus are essential components of healthy and productive aquatic habitats. Excessive amounts of these nutrients, however, can produce conditions where the nutrients over-stimulate the growth of algae and various aquatic weeds, which later decay. Oxygen used in the decaying process reduces the oxygen available to fish and other life forms, a process called eutrophication. The most common sources of nutrients that enter waterways are lawn and crop fertilizers, sewage, manure from fields and feedlots, and detergents that contain phosphorus. Atmospheric nitrogen also enters water bodies from emissions of automobiles, coal-fired electric generating stations, some industrial facilities, and other combustion sources.

Pathogens

A number of waterborne viruses, bacteria, and protozoa can cause infections and other illnesses in humans ranging from typhoid fever and dysentery to minor skin diseases and eye, ear, nose, and throat infections. Waterborne microbes are responsible for more than 900,000 infections in the U.S. every year. These microbes originate in the excrement of humans and other warm-blooded animals and enter waterways through septic tanks, stormwater discharges, and runoff from livestock feeding/grazing areas.

Suspended solids and sediments

Suspended solids include eroded soil particles such as sand, gravel, clay, and silt, collectively known as sediment, and other solid particles that can be suspended in sewage and other liquid pollutants. The turbidity that results from sedimentation can directly damage fish and other aquatic organisms. It can also reduce the sunlight available to normal aquatic vegetation, thus lowering the levels of dissolved oxygen, and sediments can settle on stream beds to alter the natural substrate often necessary for aquatic organisms. Sediments may also contain bacteria or toxic substances.

pH

pH is a measure of the acidity or alkalinity of a particular water. A low pH value (less than five) indicates acidic conditions, whereas a high value (over nine) indicates alkaline conditions. A value of 7.0 is neutral. Acidic water can cause fish kills and can aggravate toxic contamination because acidic conditions release toxic materials that are present in streams or lake sediments. Mining activities and acid rain are among the primary sources of acidic water conditions. Tannic acid and carbon dioxide (forming carbonic acid) are natural sources of acidity.

Toxic substances and metals

Some toxic pollutants can be dangerous at extremely low concentrations, while others have a latency period before they cause harm, and still others bioaccumulate in the tissue of living organisms and pose the greatest danger to predators at the top of the food chain. Synergistic effects from combinations of chemicals may also pose dangers. Determining whether a substance is toxic, and if so, at what concentration the substance poses risk, are often difficult because some toxic pollutants can have an obscure impact on human health and the environment.

Thermal pollution

Heat reduces the capacity of water to absorb oxygen, making it less efficient in assimilating oxygen-demanding materials and in supporting fish and aquatic life. A number of industries and some thermoelectric power generating facilities release heated cooling water to water bodies, and in urban areas, the stormwater that runs off from predominantly dark impervious surfaces raises temperatures in urban streams and rivers.

Habitat and Hydrologic Modifications

Habitat modifications include removing vegetation from stream banks, which may increase water temperature and may increase streambank erosion; piping of streams; dredging, filling and draining of wetlands; building reservoirs; and other activities that change normal drainage patterns and increase the amount and intensity of stormwater runoff. (See the companion report, *Meeting Offstream Needs While Maintaining Instream Values*.)

Infrastructure aging

Numerous water and wastewater systems are aging and leaking, and these need significant capital investments for maintenance.

Protecting Water Quality: Opportunities and Challenges

As there are many sources of water pollution, there are a variety of locations and mechanism for safeguarding water quality. These generally fall into one of three categories:

- At the source, through prevention of polluting discharges and runoff;
- Treatment, through filtration and disinfection; and/or
- Maintaining infrastructure to prevent contamination by aging pipes and by untreated water that enters through a break in the distribution system.

Georgia has made great strides in reducing water pollution from municipal and industrial point sources; however, several issues continue to present policy challenges related to water quality.

Water Quality Standards: A critical aspect of water quality protection lies in setting appropriate standards and monitoring to ensure that those standards are being met. Are Georgia's standards and monitoring efforts suitable for the variety of circumstances that exist, or are likely to exist in the future, across the state? Are Georgia's water quality standards adequate for protecting the public health and the environment? What improvements may be needed regarding monitoring and data storage/analysis? Is Georgia's stream classification system realistic and responsive to future needs? Are the necessary tools in place to adequately address specific water quality challenges such as maintaining dissolved oxygen levels and limiting the entry of sediments, fecal coliform, and both conventional and emerging pollutants (e.g., endocrine disrupting chemicals)?

Stormwater Management: Even with the most effective point source water pollution controls, water quality standards cannot generally be met without effective management of nonpoint source pollutants. Nonpoint sources now pose the most significant threat to

water quality throughout the state. How can Georgia manage stormwater runoff to better control the nonpoint source pollutants entering our waterways?

On-site Wastewater Management: Septic systems are the primary method of on-site wastewater treatment in Georgia. Properly installed and maintained, they can be a viable and cost-saving alternative to sewers and centralized treatment facilities. They must, however, be managed in a way that protects water quality. The third report of this series, *Maximizing Returns to River Basins*, addresses how the management of septic tanks can help preserve water quantity. This report focuses on how septic tanks can be managed to protect water quality in rural and suburban watersheds.

Infrastructure Financing: In some communities, existing infrastructure has aged and is posing a variety of challenges, including pipe failures that can cause acute pollution emergencies. Other communities are growing and need basic infrastructure to maintain adequate services for their citizens. Both scenarios require significant capital investments. How can Georgia prepare for continued growth while meeting the costs associated with replacing much of our aging wastewater infrastructure?

The goal of this report is to provide an array of information offered by academic literature, state and federal guidance documents, and the experiences of other states, as applicable, to inform Georgia's policy decisions regarding the most effective and appropriate ways to safeguard water quality.

Chapter 2

FEDERAL WATER QUALITY LAW

The principle federal mechanisms for protecting water quality are the Clean Water Act (CWA, 33 USCA § 1251 et seq.) and the Safe Drinking Water Act (SDWA, 42 USCA § 300f et seq.). The Clean Water Act is the primary federal statute for the protection of surface water resources. The Safe Drinking Water Act regulates public drinking water systems throughout the U.S., focusing on protection of public health and of water resources that serve as public water supplies. Several other federal laws, such as the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Coastal Zone Management Act (CZMA), the Resource Conservation and Recovery Act (RCRA), and others, also play important roles in protecting the nation's water quality.

The Clean Water Act

The Clean Water Act dates back to 1948 with the passage of the Water Pollution Control Act (WPCA), which gave states the primary role in water quality protection and provided funding for state and local governments for water quality protection projects. The Act was amended in 1956 and 1961 to give additional funding to local wastewater treatment plants, and in 1965 the Water Quality Act required states to develop water quality standards for interstate waters and to determine pollutant loading standards for these waters. The Federal Water Pollution Control Act (FWPCA) Amendments of 1972 was the first comprehensive federal regulation of surface water quality. It set specific goals for water quality in the U.S. and established programs for permitting discharge of pollutants into surface waters. In 1977, amendments to the act more fully addressed toxic pollutants and renamed the FWPCA the Clean Water Act (CWA). Amendments to the CWA in 1987 added mechanisms for controlling nonpoint source pollutants. These amendments included the establishment of a \$400 million federal grant program to help states develop and implement, with USEPA approval and evaluation, nonpoint source management and control programs.

The primary objective of the CWA is to “restore and maintain the chemical, physical, and biological integrity of the Nation's waters.” This objective is addressed through permitting of pollutant discharges (the National Pollutant Discharge Elimination System, or NPDES, permits); establishing water quality standards; and establishing Total Maximum Daily Loads, or TMDLs, for water bodies that do not meet applicable water quality standards. A TMDL is the amount of a specific pollutant a stream, river, or lake can assimilate and still meet water quality standards.

NPDES Permitting

NPDES permits are issued either by USEPA or by a state that has received primacy from USEPA to implement the federal program. Currently 46 states are authorized to issue permits, conduct inspections and monitoring, and take enforcement actions (USEPA 2003d).

Until 1987, the NPDES program (CWA § 402) regulated only point source pollution discharges, including discharges of industrial and municipal wastewater, as well as municipal stormwater conveyances and large agricultural operations. Amendments to the Act in 1987 expanded the program to include nonpoint stormwater discharges, based on water quality criteria.

NPDES point source permitting has traditionally focused on limiting the discharge of specific pollutants. Regulated pollutants are defined in the CWA as any type of municipal, industrial, or agricultural waste discharged in water. The Act regulates both direct (point source) and indirect (nonpoint source) discharges, including “conventional” pollutants, “priority” pollutants, and “nonconventional” pollutants. “Conventional” pollutants include biochemical oxygen demand, total suspended solids, fecal coliform, pH, and oil and grease. “Priority” pollutants include toxic pollutants and consist of more than 100 substances or combinations of substances that cause adverse effects in organisms or their offspring. “Nonconventional” pollutants are those not identified specifically as conventional or priority pollutants.

Discharge permits issued under the NPDES program can be either general or individual. General permits cover a number of dischargers that require the same permit conditions, while individual permits are issued to distinct dischargers under conditions specific to that discharger. Each NPDES permit applicant must provide quantitative data identifying the types of pollutants that are/will be included in its discharge. The permit, whether general or individual, establishes specific effluent limits and conditions under which discharges may take place. Permits are issued for a fixed term of no more than five years.

Effluent limits may be either technology-based or water-quality based. Technology-based limits require existing discharges to use the “best practicable control technology,” (BPT) to clean up waste discharges, and as of March, 1989, the “best technology economically achievable” (BAT). BPT level controls focused primarily on controlling discharges of conventional pollutants, while BAT controls include toxic substances. New discharges must comply with more stringent New Source Performance Standards (NSPS). Water-quality based effluent limits, based on designated uses and use classifications, vary significantly from state to state.

NPDES-permitted Stormwater Discharges

As of 1987, USEPA is required under the CWA to include stormwater discharges in the NPDES program. Implementation of the stormwater discharge program has been a two-

phase process. Phase I, developed by USEPA in 1990, requires NPDES permitting under any one of three scenarios:

- Local governments operating municipal stormwater systems (MS4s) serving populations greater than 100,000 people;
- Construction activities disturbing between one and five acres of land; or
- One of ten categories of industrial activity.

Phase II, begun in 1999, expanded permitting requirements to include small MS4s located outside of urban area, along with other stormwater discharges USEPA may designate for coverage. Requirements of small systems also include the following activities:

- Develop, implement, and enforce a stormwater management program designed to reduce pollutant discharges to the “maximum extent practicable.”

Stormwater management programs must include:

- public education and outreach;
 - public participation/involvement;
 - illicit discharge detection and elimination;
 - construction site runoff control;
 - post-construction runoff control; and
 - pollution prevention/good housekeeping.
- Regulated operators must report to USEPA the system’s choice of best management practices (BMPs) and an evaluation of measurable goals achieved by the BMPs.

In addition to permits for stormwater collected by municipal systems, NPDES permits may also be required for local governments or private entities engaged in activities such as construction or storage of chemicals. A variety of land disturbing activities are included in these permits, and disturbance of less than one acre of land may be designated for permitting if it is part of a larger project or if USEPA determines that the activity may cause significant water pollution and/or violate water quality standards. Local governments and industrial water users may also be subject to regulations governing discharges to wastewater treatment plants and regulations of land application of sludge generated by water treatment facilities.

NPDES permitting also includes provisions for combined sewer overflows (CSO). Under these provisions, municipal systems must meet specific requirements for controlling water quality impacts of combined sewer overflow events and develop a long-term plan for making improvements to the system.

Water Quality Standards

In addition to permitting based on limiting discharge of specific pollutants, the CWA requires each state to adopt, with USEPA approval, water quality standards applicable to its waters. States are responsible for implementing programs to meet these standards. Water quality standards have three fundamental components:

- Establishing designated uses for each waterbody;
- Establishing specific quantitative measures of water quality criteria; and
- Antidegradation measures that maintain water quality.

Designated uses are those water uses established by states, based on social and environmental factors, as appropriate for each waterbody. They may include domestic, industrial, or agricultural water supply; aquatic habitat; recreational use; fishing, and other beneficial uses. (Designated uses vary from state to state, in part because states were given 180 days to establish them in the early 1970s, and they relied on the general goal of the CWA – “fishable and swimmable” – to guide their designated use categories.) Quantitative criteria are then established to provide thresholds for water quality to support each designated use.

Each segment of a river or stream is assigned one or more designated uses; however, there is no standardized river segment size for classifying water quality attainment. States generally partition waters to represent homogeneity in physical, biological, or chemical conditions, and entire river basins may be assigned the same designated use.

A document published by USEPA in 2005, *Guidance for 2006 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d), 305(b), and 314 of the Clean Water Act*, advocates the use of the five-category approach for classifying the water quality standard attainment status for each segment, as follows.

Category 1: All designated uses are supported; no use is threatened;

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported;

Category 3: There is insufficient available data and/or information to make a use support determination;

Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed; or

Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

States may refine these categories by creating sub-categories. For instance, USEPA has established sub-categories for Category 4 that states may choose to adopt, as follows.

4a: A TMDL to address a specific segment/pollutant combination has been approved or established by USEPA.

4b: A use impairment caused by a pollutant is being addressed by the state through other pollution control requirements.

4c: A use is impaired, but the impairment is not caused by a pollutant.
(USEPA 2005b)

In addition, stream/river segments may be included in more than one category, such as both Category 2 and Category 5 in the case of a stream that meets some designated uses but requires TMDL development and implementation to attain all designated uses.

If a stream/river segment previously listed in Category 5 is listed in a different category, USEPA may request that states provide “good cause,” which can include the following determinations:

- The assessment and interpretation of more recent or more accurate data demonstrate that water quality standard are being met;
- The results of more sophisticated water quality monitoring demonstrate that water quality standards are being met;
- Flaws in the original analysis of data and information led to the segment being incorrectly listed;
- A demonstration that more stringent effluent limitations will result in attainment of water quality standard for the pollutant causing the impairment.

TMDLs

The TMDL program was established by Section 303(d) of the CWA in 1972, but its implementation remained dormant for about 25 years, due in part to lack of resources at both the state and federal level. However, during the 1990s, more than 20 lawsuits by environmental groups prodded states and USEPA to implement the provision (Copeland).

This section of the CWA requires states, territories, and authorized tribes to identify the waters within their state boundaries that do not meet established water quality standards after point source measures have been implemented to minimum required levels. Once identified as impaired, these waters must be prioritized for cleanup and separate TMDLs must be established for each pollutant affecting each listed waterbody. Defined as the amount of a specific pollutant a stream, river, or lake can assimilate and still meet water quality standards, TMDL also refers to the written document that includes the sources of pollution (both point and nonpoint) of a waterbody and the specific amount of the pollutant that each source may contribute. TMDLs and their rankings must be reported to USEPA every two years.

A waterbody is listed as impaired if it fails to meet either general water quality standards or specific standards for its designated use (i.e., fishing, swimming). An impaired waterbody placed on a 303(d) list can be partially supporting, or not supporting its designated use. Waters are considered not supporting when 25 percent or more of the samples collected do not meet the standards for a specific pollutant. Waters are listed as partially supporting when 11 to 25 percent of the samples collected do not meet standards (Please see comment regarding assessment methodology on page 67). Regulatory agencies must develop TMDLs for all partially supporting or not supporting waters where there are no ongoing programs to correct the problem in a reasonable length of time. A TMDL must include considerations of seasonal variability as well as a “margin of safety” that reflects uncertainties in the way pollutants enter the system, the quality of receiving waters, and future increases in pollution loading. State regulatory agencies are also expected to include TMDLs in their state Water Quality Management Plans.

Although USEPA did not enforce this provision for many years, failure of states to implement the federally mandated TMDL program may result in USEPA taking over TMDL development. In 1996, a group of environmental organizations in Georgia filed suit against USEPA for failing to force Georgia’s compliance with the program. The environmental groups won the case, and in a consent decree, USEPA agreed to take ultimate responsibility for ensuring completion of TMDLs in Georgia. If Georgia were not to develop TMDLs in a timely fashion, USEPA would do so. As a result, the focus on TMDLs has greatly increased, and from 1996 to 2006, 1277 TMDLs have been approved in Georgia (USEPA 2000a).

Antidegradation Policies

While TMDL policies are intended to improve water quality, antidegradation policies are intended to maintain water quality. In the 1987 amendments to the Clean Water Act, Congress revised section 303(d)(4)(B) to require all states to adopt policies which limit the degradation of existing water uses or water quality. Under USEPA’s regulations under the Act, limits on degradation of water quality are based on a tier system (Gaba):

- Tier 1 includes essentially all waters with water quality below “fishable/swimmable” levels; “existing uses” in these waters must be maintained.

- Tier 2 includes “high quality” waters, or those with water quality exceeding fishable/swimmable levels. Degradation of these waters is allowed only if a public review process determines that lowering the water quality is “necessary to accommodate important economic or social development;” if point-source statutory requirements have been met and reasonable best management practices are implemented for nonpoint sources; and if it will not result in loss of an existing use.
- Tier 3 includes high quality waters that “constitute an outstanding national resource” (ONRWs). USEPA policy prohibits any degradation of these waters; however, the designation of these ONRWs is a matter of state discretion.

Water Quality Monitoring Under the CWA

NPDES permits usually include monitoring requirements specifying the type of pollutants to be monitored, the methods used in sampling and analyzing data collected, and record keeping and reporting responsibilities. States may choose the balance between monitoring certain individual pollutants and monitoring biological indicators of water quality. In making determinations of impairment, states must use “all existing and readily available” water quality related information, including information from a wide variety of organizations and individuals, including:

- Other state agencies such as fish and wildlife, parks, and agriculture departments;
- Federal agencies, including USEPA, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and U.S. Fish and Wildlife Service;
- Local governments;
- Drinking water utilities and state agencies responsible for SDWA implementation;
- Universities and consulting firms;
- National Pollutant Discharge and Elimination System (NPDES) permittees;
- Conservation/environmental organizations;
- Outdoor recreation organizations; and
- Citizen monitoring groups.

States are expected to strike a balance between using only the highest quality data and employing as much useful information about the condition of as many segments as possible (USEPA 2005).

Biological Assessments

Because chemical analysis does not always provide for a complete evaluation of water quality as it affects habitat, USEPA has suggested that states include biological assessment in monitoring programs. Minimum requirements for state biological assessment programs have been suggested by USEPA as part of the Section 305(b) reporting requirements and by the Intergovernmental Task Force on Monitoring Water Quality. Recommended program characteristics are as follows:

- *Multiple assemblages* - Use of no more than one organism group (e.g., bottom dwelling organisms and/or fish) is believed to give greater accuracy in detecting water resource quality impairment from human activities, as well as decreasing uncertainty in the assessment.
- *Multiple metric indices* – Several ecological attributes of the community can be tested and combined into an index for an overall assessment of biological condition.
- *Habitat structure assessment* – This is a critical element of a biosurvey to assist in the interpretation of biological data and discerning effects of physical habitat alteration from chemical impacts.
- *Regional reference condition* – Aggregate data from several minimally-impaired sites is preferable to using data from only a single reference site.
- *Index period* – A defined time period during which data are collected minimizes the effects of year-to-year variability, reduces seasonability, provides optimal accessibility of target assemblages, and maximizes efficiency of sampling.
- *Standard operating procedures and quality assurance program* – The validity of a biological assessment and the interpretation of the results is dependent upon effective accountability for precision, accuracy, and completeness of the data collection activities (USEPA 2006).

Monitoring Methods

During the 1990s, USEPA developed a series of guidance manuals for volunteer monitoring of lakes, streams, and rivers: *Volunteer Lake Monitoring: A Methods Manual* (1991); *Volunteer Estuary Monitoring: A Methods Manual* (1992); *Volunteer Stream Monitoring: A Methods Manual* (1997); and *Volunteer Water Monitoring: A Guide for State Managers* (1990). These documents may be obtained by contacting USEPA, Office of Wetlands, Oceans, and Watersheds, Volunteer Monitoring (4503F), 401 M Street, SW, Washington, D.C. 20460.

Reporting by States

The Clean Water Act requires states to submit water quality information to USEPA on a regular basis, including a description of water quality of all waters of the state; a list of impaired and threatened waters still requiring TMDLs; identification of impairing pollutants; and priority ranking of impaired waters targeted for TMDL development (CWA Sections 303(d), 305(b), and 314).

In summary, the Clean Water Act has been an invaluable tool in the protection of the nation's water quality. Water quality has improved as a result of the use of technology to reduce industrial and municipal wastewater discharges. The addition of stormwater provisions and implementation of the TMDL provisions have significantly increased the effectiveness of the Act in recent years. USEPA has also strengthened states' ability to implement the Act by developing guidance documents and data systems that allow governmental and nongovernmental groups access to water quality information.

The Safe Drinking Water Act

The first drinking water standards were published in 1914 by the U.S. Public Health Service, and by 1925, the government had regulated only three inorganic compounds and bacteria. The primary concern during this period was the prevention of waterborne diseases, such as typhoid fever and cholera. Standards were strengthened in 1946 and again in 1962. The Safe Drinking Water Act (SDWA) was passed in 1974 to ensure the quality of the nation's drinking water. The Act requires USEPA to establish regulations to protect human health from water-borne contaminants. It authorizes USEPA to develop national drinking water standards and to create a system for enforcing those standards. Of particular concern is the protection of underground sources of drinking water through regulation of underground injection of liquid contaminants.

Under the Act, National Primary Drinking Water Standards (NPDWS) provide the basic measure for protecting public health. These are specific enforceable standards of drinking water quality established by USEPA for physical, chemical, biological, or radiological substances or matter in the drinking water of public water systems. A public water system is regarded as such if it is "a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such a system has at least 25 individuals (SDWA §1401(4)(A), §300(4)(A)). In addition to contaminants normally regulated by USEPA, the SDWA requires specific regulation of arsenic, sulfate, and radon (SDWA §1412(b)(12)-(13), §300g-1). States are responsible for enforcement of primary drinking water standards if they have adopted drinking water standards that are at least as stringent as the federal standards (SDWA §1413(a)(1), §300g-1(a)(1)).

National Secondary Drinking Water Standards are non-enforceable standards established by USEPA to protect public welfare. These regulations apply to appearance, odor, and other aesthetic qualities of drinking water that may affect the public welfare (SDWA §1401(2), §300f(2)).

In 1986, Congress amended the law to set mandatory guidelines for regulating key contaminants, require monitoring of unregulated contaminants, establish benchmarks for water treatment technologies, increase enforcement, and promote ground water quality protection. These amendments included a provision that every three years, beginning January, 1988, USEPA is required to list and regulate 25 contaminants known or anticipated to occur in public water systems which may require regulation.

The SDWA was amended again in 1996. The previous requirement for listing 25 contaminants every three years was changed such that USEPA must publish a list of contaminants (known or anticipated to occur in public water systems which may require regulation) within 18 months of enactment and every five years thereafter. The agency is required to consult with the scientific community, including the Science Advisory Board (SAB) in compiling the list. Within five years, and every five years thereafter, the agency must decide whether to regulate at least five contaminants on the list based on findings that:

- The contaminant may have an adverse effect on health;
- The contaminant is known to occur or there is substantial likelihood that the contaminant will occur in public water systems with a frequency and level of public health concern; and
- In the sole judgment of the Administrator, regulation presents a meaningful opportunity for public health risk reduction.

In selecting contaminants, USEPA may select those that pose the greatest public health concern, taking into consideration the effects of contaminants on sensitive populations such as infants, children, pregnant women, the elderly, the seriously ill, and other sensitive subpopulations. The agency then has two years within which to propose a national primary drinking water regulation and 18 months thereafter to finalize or promulgate the regulation (AMWA).

A landmark amendment to the SDWA in 1996 was the addition of the Source Water Assessment Program (SWAP), designed to inform communities about the location of their drinking water sources and threats to water quality so that local governments and water utilities could implement appropriate protection programs. Also required are annual reports by USEPA or the state informing the public of violations within the state.

Underground sources of drinking water are protected by the SDWA through wellhead protection; the sole source aquifer demonstration program (a grant program that reimburses states for 50 percent of their costs in developing and implementing state programs to identify and conserve critical aquifer protection areas); and the underground injection control program (which regulates waste injections into any aquifer that is now or may ever be used for water supply purposes).

Although the Safe Drinking Water Act has been vital for ensuring that the public is protected against waterborne contaminants, the most important aspects of the Safe Drinking Water Act in terms of ambient water quality have been its source water protection and wellhead protection programs.

The Endangered Species Act

The Endangered Species Act (ESA) preserves aquatic ecosystems from a standpoint of habitat protection. The Act protects federally designated threatened and endangered species, along with any habitat deemed necessary for their survival. Section 7 of the ESA requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) if their activities jeopardize the existence of an endangered or threatened species or its critical habitat. This section applies only to federal actions, thus if there is no federal actor, this section does not apply. It also applies to *proposed actions* and not to existing structures or activities that may jeopardize species habitat.

Section 9 of the ESA prohibits the “take” of an endangered species. “Take” is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” Section 9 and its implementing regulations define a taking to include disrupting normal behavioral patterns and modifying or degrading habitat such that it results in killing or injuring endangered wildlife. According to the NMFS, this can occur by removing water or altering stream flow to the extent that it “impairs spawning, migration, feeding or other essential behavior patterns” (USFWS). Unlike Section 7, which applies only to federal agencies, Section 9 applies to any actors and to existing activities and facilities.

Other Federal Laws Affecting Water Quality

Several other federal laws affect water quality, including the following.

- The *National Environmental Policy Act* (NEPA) requires environmental assessments or environmental impact statements for federal actions that could significantly impact the environment, and requires that if such actions have the potential to cause harm, alternative actions must be considered. Some activities undertaken by local governments may also require compliance with NEPA requirements.
- The *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), commonly known as Superfund, authorizes USEPA to respond to releases of hazardous substances into the environment. It also enables USEPA to force cleanup of environmental contamination by the responsible party, or reimbursement of cleanup and remediation costs incurred by the Agency.
- The *Coastal Zone Management Act* (CZMA) encourages states to protect, preserve, and enhance coastal natural resources and the habitats they provide. The

- Act makes federal financial assistance available for implementing a comprehensive coastal management program. In its reauthorization of the Act in 1990, Congress identified nonpoint source pollution as a major factor in the degradation of coastal water, and recognized that effective control of nonpoint sources could be implemented at the state and local levels. Section 6217(g) of the reauthorization amendments makes USEPA responsible for developing technical guidance to assist states in designing coastal nonpoint pollution control programs.
- The *Resource Conservation and Recovery Act* (RCRA) addresses hazardous and nonhazardous waste management activities. Subtitle C of the Act establishes a “cradle-to-grave” system governing waste handling from generation to disposal. RCRA provisions include prohibition of disposal of hazardous waste on land without prior treatment, used oil management standards, storage and handling standards for tanks and containers, and solid waste management (USEPA 1999b).

Summary

This brief discussion of federal water-quality related laws suggests that the federal government plays a significant role in achieving and maintaining high water quality, with the USEPA at the forefront of providing states with guidance to develop water quality protection tools. Emphasis has shifted in recent decades from point source regulation to a more comprehensive approach that considers how land use management affects water quality and how biological monitoring tools can lead to better water quality assessment and management.

Chapter 3

CURRENT STATUS OF GEORGIA'S WATER QUALITY PROTECTION POLICY

Georgia's water quality protection is overseen by the Environmental Protection Division (EPD, Division) of the Georgia Department of Natural Resources (DNR). The Watershed Protection Branch is responsible for water use designations, water quality standards and criteria, and water quality monitoring and assessment. Any changes in designations or standards and criteria are proposed in a formal rule-making process culminating in the final review, consideration and adoption by the Board of Natural Resources. The EPD also regulates industrial and municipal wastewater discharges, stormwater discharges, erosion and sedimentation, and nonpoint source pollution.

Georgia has enacted a number of protective state laws, in support of federal water quality protection laws, including the Georgia Water Quality Control Act, the Erosion and Sedimentation Control Act, the Georgia Planning Act, the Metropolitan River Protection Act, and others.

The Georgia Water Quality Control Act

The Georgia Water Quality Control Act is the primary policy tool for protecting water quality in the state. The Act establishes specific criteria for issuing waste discharge permits and establishes EPD as the agency responsible for setting water quality standards, regulating water withdrawals, and issuing and enforcing water withdrawal and waste discharge permits. The Act establishes the policy of the State of Georgia regarding water quality as follows:

The water resources of the state shall be utilized prudently for the maximum benefit of the people, in order to restore and maintain a reasonable degree of purity in the waters of the state and an adequate supply of such waters, and to require where necessary reasonable usage of the waters of the state and reasonable treatment of sewage, industrial wastes, and other wastes prior to their discharge into such waters. To achieve this end, the government of the state shall assume responsibility for the quality and quantity of such water resources and the establishment and maintenance of a water quality and water quantity control program adequate for present needs and designed to care for the future needs of the state, provided that nothing contained in this article shall be construed to waive the immunity of the state for any purpose (O.C.G.A. §12-5-21).

The Act, amended and strengthened several times since its passage, charges the Georgia EPD with the responsibility to regulate the withdrawal, diversion, or impoundment of waters of the state and to require reasonable methods for

controlling water pollution. The rules and regulations developed and implemented by EPD may include but are not limited to the following (O.C.G.A. §12-5-23(a)(1)).

1. Prescribing the procedure to be followed in applying for permits and requiring the submission of such plans, specifications, verifications, and other pertinent information deemed relevant in connection with the issuance of such permits;
2. Establishing or revising standards for water purity for any of the waters of the state, specifying the maximum degree of pollution permissible in accordance with the public interest in water supply; the conservation of fish, game, and aquatic life; and agricultural, industrial, and recreational uses;
3. Governing water use classifications and water quality standards;
4. Providing minimum standards for treatment of discharges; and
5. Providing minimum standards for wastewater pre-treatment.

As the management agency for water pollution control and surface-water resources, EPD receives and expends any federal funds made available under federal acts within the purview of the Act and approves projects for which related federal loans or grants are made to any municipality, county, or agency of state government or to any private person or entity (O.C.G.A. §12-5-32).

The Director's duties under the Act include surveying the waters of the state to determine the extent, character, and effects of existing pollution and preparing a comprehensive plan for the prevention of any further pollution and reduction of existing pollution. Duties also include establishing or revising standards of water purity which specify the maximum degree of pollution permissible, the conservation of fish, game, and aquatic life; and agricultural, industrial, and recreational uses. This includes establishing or revising, through rules and regulations, effluent limitations and permissible limits of surface water usage. The Division must consider the technical means available for the reduction of pollution and the economic factors involved (O.C.G.A. §12-5-23).

Water Quality Classification

Assessment of water quality requires a baseline for comparison. A statewide baseline is provided by Georgia's water quality standards, which contain water use classifications, numeric standards for chemical concentrations, and narrative requirements for water quality. The Georgia DNR is responsible for setting and enforcing water quality standards. The purposes and intent of the State in establishing water quality standards are

to provide for enhancement of water quality and prevention of pollution; to protect the public health or welfare in accordance with the public interest for drinking water supplies, conservation of fish, wildlife and other beneficial aquatic life, and agricultural, industrial, recreational, and other reasonable and necessary uses; and to maintain and improve the biological integrity of the waters of the State.

Georgia's water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. The water use classification system was applied to interstate waters in 1972. There have been a number of changes to Georgia's water quality standards since 1972. Georgia's waters are currently classified as one of the following water use classifications:

1. Drinking Water Supplies: Those waters approved as a source for public drinking water systems permitted or to be permitted by the Environmental Protection Division. Waters classified for drinking water supplies will also support the fishing use and any other use requiring water of a lower quality.
2. Recreation: General recreational activities such as water skiing, boating, and swimming, or for any other use requiring water of a lower quality, such as recreational fishing. These criteria are not to be interpreted as encouraging water contact sports in proximity to sewage or industrial waste discharges regardless of treatment requirements.
3. Fishing: Propagation of Fish, Shellfish, Game and Other Aquatic Life; secondary contact recreation in and on the water; or for any other use requiring water of a lower quality.
4. Wild River: For all waters designated in 391-3-6-.03(13) as "Wild River," there shall be no alteration of natural water quality from any source.
5. Scenic River: For all waters designated in 391-3-6-.03(13) as "Scenic River," there shall be no alteration of natural water quality from any source.
6. Coastal Fishing: This classification will be applicable to specific sites when so designated by the Environmental Protection Division. For waters designated as "Coastal Fishing", site specific criteria for dissolved oxygen will be assigned and detailed by footnote in Section 391-3-6-.03(13), "Specific Water Use Classifications." All other criteria and uses for the fishing use classification will apply for coastal fishing.

Georgia employs narrative and numeric criteria. Narrative criteria, referred to as "free froms", address toxic substances harmful to humans, animals or aquatic life; waste which will settle to form objectionable sludge deposits; oil, scum and floating debris from treated wastewater discharges; or other material related to discharges that produce turbidity, color, odor or other objectionable conditions which interfere with legitimate

water uses. Georgia also has a narrative standard for turbidity. The narrative standards are summarized in Table 1.

Specific numeric criteria for dissolved oxygen, pH, temperature and fecal coliform bacteria are established to support each water use designation. It should be noted that the criteria for waters designated as Drinking Water, Recreation and Fishing are the same for the period of May through October each year. For the remainder of the year November through April the only difference in criteria for these waters is the fecal coliform bacteria criteria for Recreation waters is more stringent than for Drinking Water or Fishing. Table 2 provides a summary of water use classifications and basic water quality criteria for each water use.

In addition to the basic water quality standards discussed above, Congress made changes in the CWA in 1987 that required each state to adopt numeric limits for toxic substances for the protection of aquatic life and human health. In order to comply with these requirements, in 1989 the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Georgia has adopted all numeric standards for toxic substances promulgated by the USEPA.

In 1995, the Board of Natural Resources adopted additional water quality standards for West Point Lake. Additional standards for Lakes Jackson and Walter F. George were adopted in 1996, for Lakes Lanier and Allatoona in 2000, and for Carters Lake in 2002. These lake standards have limits for chlorophyll a, pH, total nitrogen, phosphorus, fecal coliform bacteria, dissolved oxygen, and temperature. In addition, standards for major tributary phosphorus loading were established for each lake.

In addition to these primary use designations, a water body may also be afforded an additional protection with the designation as a 1) primary trout stream, 2) secondary trout stream, 3) waters generally supporting shellfishing, and 4) outstanding natural resource waters.

A water use classification may be changed at the request of a citizen, local government, industry or other group. The Watershed Protection Branch reviews each request and conducts an assessment of the water body to determine if reclassification is appropriate. Any changes to the use classifications are carried out using the formal rule-making process including review and adoption by the Board of Natural Resources.

Table 1. Georgia Narrative Water Quality Standards for All Waters (Excerpt from Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6-.03 - Water Use Classifications and Water Quality Standards)

- (5) General Criteria for All Waters. The following criteria are deemed to be necessary and applicable to all waters of the State:
- (a) All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.
 - (b) All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.
 - (c) All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.
 - (d) All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.
 - (e) All waters shall be free from turbidity which results in a substantial visual contrast in a water body due to man-made activity. The upstream appearance of a body of water shall be observed at a point immediately upstream of a turbidity-causing man-made activity. The upstream appearance shall be compared to a point which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone. For land disturbing activities, proper design, installation and maintenance of best management practices and compliance with issued permits shall constitute compliance with [this] Paragraph...

Table 2. Georgia Water Use Classifications and Water Quality Standards by Use

Use Classification ¹	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams) ²		pH	Temperature (other than trout streams) ²	
	30-Day Geometric Mean ³ (#/100 mL)	Maximum (#/100 mL)	Daily Average (mg/L)	Minimum (mg/L)	Std. Units	Maximum Rise (°F)	Maximum (°F)
Drinking Water requiring treatment	1,000 (Nov-Apr) 200 (May-Oct)	4,000 (Nov-Apr)	5.0	4.0	6.0-8.5	5	90
Recreation	200 (Freshwater) 100 (Coastal)	--	5.0	4.0	6.0-8.5	5	90
Fishing Coastal Fishing ⁴	1,000 (Nov-Apr) 200 (May-Oct)	4,000 (Nov-Apr)	5.0	4.0	6.0-8.5	5	90
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

1. Improvements in water quality since the water use classifications and standards were originally adopted in 1972 provided the opportunity for Georgia to upgrade all stream classifications and eliminate separate use designations for "Agriculture," "Industrial," "Navigation," and "Urban Stream" in 1993.
2. Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/L and a minimum of 5.0 mg/L. No temperature alteration is allowed in Primary Trout Streams, and a temperature change of 2 deg. F is allowed in Secondary Trout Streams.
3. Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.
4. Standards are the same as fishing with the exception of dissolved oxygen, which is site specific.

Water Quality Standards for Lakes

The EPD Director is also responsible for establishing water quality standards to ensure that publicly owned lakes with a normal pool level surface average of 1,000 or more acres are safe for fishing and swimming and for use as a public water supply, unless such standards are determined to be unattainable. Provided funds are available from any source, there shall be a comprehensive study of each lake prior to adopting water quality standards for each lake. Based on the results of the comprehensive studies, numerical criteria must be adopted for the following:

- pH (maximum and minimum);
- Fecal coliform bacteria;
- Chlorophyll a for designated areas determined as necessary to protect a specific use;
- Total nitrogen;
- Total phosphorus loading for the lake in pounds per acre feet per year; and
- Dissolved oxygen in the epilimnion [layer] during periods of thermal stratification. (O.C.G.A. 12-5-23.1(c))

Water quality standards for each lake are to take into account the geographic location of the lake within the state, its location within its watershed, and the hydrological conditions within each lake. The Director is also responsible for establishing nutrient limits for each of the lakes' major tributary streams, including streams with permitted discharges. After standards are established, EPD is expected to monitor each lake on a regular basis to ensure that standards are reached and maintained. Data from such monitoring is public information (O.C.G.A. §12-5-23.1(d)-(f)).

Metropolitan North Georgia Planning District Standards

The Director establishes standards specifically for water plans prepared by the Metropolitan North Georgia Planning District and certifies that the plans are consistent with those standards. Such standards must include but are not limited to the following objectives (O.C.G.A. §12-5-23(c)).

- Maintaining water quality in all streams and public lakes that meet state water quality standards;
- Improving water quality in all streams and lakes that do not meet state water quality standards; and

- Maintaining appropriate levels of stream flow downstream of new or expanding surface-water withdrawal facilities.

Water Quality Monitoring

Georgia EPD implements water quality monitoring programs across the state in coordination with the Coastal Resources Division (CRD) and the Wildlife Resources Division (WRD), described in EPD's recent report, "Georgia Water Monitoring Assessment Program 2005-2015," summarized in this section. The comprehensive water monitoring strategy includes all water body types, including rivers, lakes, reservoirs, estuaries, coastal areas, wetlands, and ground water. The program is based predominantly on a rotating basin approach that allows focus on individual river basins over a five-year rotation. The state's annual expenditure for ambient surface water quality monitoring is currently approximately \$ 1.2 million to \$1.4 million per year, including monitoring contracted to USGS.

Georgia's early monitoring efforts emphasized municipal and industrial point sources and studies sought to determine appropriate treatment levels for meeting water quality standards. During the 1980s, EPD initiated toxic substance monitoring and aquatic toxicity monitoring. In the 1990s, a number of comprehensive lake studies were used to develop water standards specific to lakes and reservoirs. During this time, the current rotating basin approach was developed, biological monitoring intensified with the use of fish and macroinvertebrate assessments, and CRD developed the coastal beach monitoring program.

The objectives of Georgia's water monitoring program are enumerated in EPD's 2005 report, as follows:

- Protect the public health;
- Assess environmental and public health effectiveness of voluntary and required pollution control programs;
- Collect baseline and trend data;
- Document existing conditions;
- Study impacts of specific discharges;
- Determine improvements resulting from upgrade water pollution control plants;
- Support enforcement actions;
- Establish wasteload allocations for new and existing facilities;
- Verify water pollution control plant compliance;

- Document water use impairment (determine waters attaining and not attaining water quality standards) and reasons for problems causing less than full support of designated water uses;
- Document the effectiveness of nonpoint source program and projects;
- Develop Total Maximum Daily Loads;
- Support water quality standards development;
- Support water quality management programs; and
- Determine the environmental and public health effectiveness of voluntary and required pollution control programs.

Currently, Georgia's water quality monitoring and assessment program includes the following elements: trend or ambient monitoring; river basin monitoring; intensive surveys; lake/reservoir monitoring; biological monitoring; fish tissue monitoring; toxic substance stream monitoring; aquatic toxicity testing; state park beach monitoring; facility compliance sampling; coastal monitoring; coastal beach monitoring; estuary monitoring; shellfish water quality monitoring; volunteer monitoring; and wetlands monitoring.

Trend Monitoring

Much of the state's trend or ambient monitoring is currently conducted through cooperative agreements with federal, state, and local agencies and by EPD associates. Monthly stream sampling takes place at five locations: on the Chattahoochee and South rivers downstream of Atlanta, the Conasauga River below Dalton, the Coosa River at the state line, and the Ocmulgee River downstream of Macon. In addition, monthly samples are collected at 55 stations across the state.

River Basin Monitoring

In 1995, the number of fixed monitoring stations was reduced in order to focus resources on a particular group of basins each year, according to the rotating basin planning schedule. Beginning that year, the river basins of focus were, in turn,

- the Chattahoochee and Flint River Basins;
- the Coosa, Tallapoosa, and Oconee River Basins;
- the Savannah and Ogeechee River Basins;
- the Ochlockonee, Suwannee, Satilla, and St. Marys River Basins; and

- the Ocmulgee, Oconee, and Altamaha River Basins.

Intensive Surveys

Intensive surveys allow short-term monitoring that addresses a specific issue or problem. In 2005 and 2006, intensive survey work has been conducted in the Coosa River Basin in support of an ongoing study to refine the dissolved oxygen TMDL in the lower Coosa River.

Lake/Reservoir Monitoring

Lake water quality studies have taken place in Georgia since the late 1960s; however, lake monitoring increased with the 1990 passage of Georgia Senate Bill 714. This bill mandated that the State conduct comprehensive studies of publicly owned lakes (in excess of 1000 acres) and develop water quality standards for pH, fecal coliform bacteria, chlorophyll a, total nitrogen, total phosphorus loading, and epilimnion dissolved oxygen. The bill also required the establishment of nutrient limits for major tributary streams to the lakes.

Monitoring of publicly owned lakes greater than 500 acres is conducted as part of the rotating basin monitoring program. Basin rotation lakes are typically sampled four times during the year of basin focus.

Biological Monitoring

In order to assess fish community health, the WRD uses the Index of Biotic Integrity (IBI), which provides a direct and quantitative assessment of the biotic integrity of an aquatic community based on its fish population. Although Georgia has used macroinvertebrates for biological monitoring since the 1960s, a ranking system similar to that used for fish populations will be used in the future to help classify stream quality.

Fish Tissue Monitoring

Fish tissue samples are taken each fall from Georgia's lakes and rivers, with the locations based on the rotating basin schedule and other information needs. Purposes of this monitoring include protecting public health, assessing impacts of contaminants, documenting water quality impairment, and collecting trend data.

Toxic Substance Stream Monitoring and Aquatic Toxicity Testing

Toxic substances are regulated by the National Pollutant Discharge Elimination System (NPDES). These permits require periodic sampling and assessment of effluent samples. Additionally, toxic substances are monitored in the annual river basin monitoring rotation. Georgia also conducts aquatic toxicity testing or biomonitoring as a component of its NPDES program.

State Park Beach Monitoring

DNR Parks, Recreation, and Historic Sites Division (PRHSD) conducts monitoring of fecal coliform bacteria on public beaches the division operates on small lakes and reservoirs at several state parks in Georgia.

Facility Compliance Sampling

In order to verify self-reported data, EPD conducts compliance inspections of municipal and industrial water pollution control plant and industrial pretreatment systems.

Coastal Monitoring

CRD conducts coastal monitoring in cooperation with the National Coastal Assessment Program, created in 1988 by the USEPA and other federal agencies to provide information to help protect coastal ecological resources.

Coastal Beach Monitoring

CRD monitors coastal recreational waters, protected by state and federal programs that have established recommended bacteria levels. In 2000, the federal CWA was amended to include significant new swimmer protection provisions and to require states to develop procedures for notifying swimmers when bacteria levels are high.

Estuary Monitoring

The estuary nutrient monitoring program assesses nutrient loads in coastal rivers, sounds, and estuaries. CRD collects samples at 89 randomly selected stations along the coast.

Shellfish Water Quality Monitoring

The Shellfish Sanitation Program includes water quality monitoring, permitting shellfish harvesting, leasing state shellfish areas, and sanitary surveys. Administered in cooperation with the corresponding federal program, CRD monitors 67 stations along the coast for bacteria levels.

Volunteer Monitoring

In response to Georgia Rule 391-3-6-.03(13), promulgated in 2002, EPD has created specific requirements for submission of water quality data by outside agencies or volunteer groups. Monitoring data that meet the EPD criteria may be used in listing or delisting impaired waters under the federal CWA.

Wetlands Monitoring

Wetlands monitoring is included in the rotating monitoring schedule for streams and rivers.

Discharge Permits

Permits are required for all facilities that discharge pollutants from a point source into waters of the state. “Any person who owns or operates a facility of any type or who desires to erect, modify, alter, or commence operation of a facility of any type which results or will result in the discharge of pollutants from a point source into the waters of the state shall obtain a permit from the director to make such discharge” (O.C.G.A. §12-5-30(a)).

Nonpoint sources are also subject to permitting requirements. Any person who wishes to erect or modify facilities of any type which will result in the nonpoint discharge of pollutants into waters of the state, which will render, or is likely to render such waters harmful to public health, safety, or welfare, or harmful or substantially less useful for beneficial purposes or for wildlife, must obtain a permit prior to any discharge (O.C.G.A. 12-5-30(b)). The director may require submission of plans, specifications, or other information as deemed relevant in connection with the issuance of such permits. In addition, EPD issues special permits for land application of waste.

Land Application/Disposal Permits

Georgia statutes (O.C.G.A. §12-5-30.3) require permitting for all land application/disposal systems and requires the Board of Natural Resources to adopt technical regulations governing land application and procedural regulations for approval of sludge land application systems. Land disposal and permit requirements for the land application of treated wastewater and sludge are covered under the Department of Natural Resources (DNR) Rules 391-3-6-.11. Department of Natural Resources (DNR) rules define a land disposal system as any method of disposing of pollutants (treated wastewater or sludge) in which the pollutants are applied to the surface or beneath the surface of land which results in the pollutants percolating, infiltrating, or being absorbed into the soil and then into the waters of the state. Land disposal systems exclude landfills and septic tank systems (DNR Rules 391-3-6-.11(2)(b)). “Sludge” (or biosolids) refers to the solid or semisolid residue generated at a wastewater treatment or pretreatment plant (the term does not include treated effluent). Land application or disposal of sludge refers to placement of sludge on or under the ground surface for disposal, soil conditioning, or agricultural enhancement (and excludes disposal in a permitted landfill). The land application of sludge is regulated under DNR Rules 391-3-6-.17 and the Federal Regulations 40 CFR Part 503.

Stormwater Permits

Stormwater point sources are subject to the NPDES permit program. The Division may issue an NPDES permit for discharges into waters of the state from a stormwater source covering all conveyances, which are part of that stormwater point source. Where there is more than one owner or operator of a stormwater point source, any or all discharges into that stormwater point source must be identified in the application as would be required if the dischargers were submitting separate applications. All dischargers into a stormwater point source must either be covered by an individual permit, an area-wide permit, or a general permit issued to the owner or operator of that portion of the system that directly discharges into waters of the state (DNR Rules 391-3-6-.16(3)(a)).

Pretreatment Permits

Permits are also required to provide for the degree of wastewater pretreatment required and the uniform procedures and practices to be followed. With certain exceptions, industrial users discharging any pollutant into a wastewater treatment facility and then into waters of the state must obtain a pretreatment permit from EPD (DNR Rules 391-3-6-.08(3)(a)).

Permitting Criteria

The Division issues permits for the discharge of pollutants on the condition that the discharge meets or will meet all applicable water quality standards and effluent limitations included in the permit's schedule of compliance (O.C.G.A. §12-5-30(d)).

If EPD has reasonable cause to believe that an applicant for a permit who has less than three years of compliance history in Georgia is not in compliance with laws or permits, then EPD may require an applicant to submit a compliance history disclosure form. This form includes a statement to the effect that the applicant has not been convicted of a felony or been adjudicated in contempt of court. The Division may refuse to issue a permit to any applicant with or without three or more years of compliance if it finds clear and convincing evidence that the applicant has:

- Intentionally misrepresented or concealed a material fact in the application;
- Has obtained or attempted to obtain another permit from the director by misrepresentation or concealment;
- Has pleaded guilty or been convicted by final judgment in Georgia or any other state or federal court of any felony involving moral turpitude within three years preceding the date of the application;
- Has pleaded guilty or been convicted by final judgment in Georgia of a third or subsequent material violation of any environmental law that presented a

substantial endangerment to human health within three years preceding the date of the application;

- Has been adjudicated in contempt of any court order enforcing any environmental laws within three years preceding the application date;
- Was the holder of any permit required for the discharge of pollutants which was revoked for reasons of noncompliance within three years of the application date; or
- Was denied for reasons of noncompliance the issuance of any permit required for the discharge of pollutants within three years preceding the date of the application. (O.C.G.A. §12-5-23(d)(1)-(7))

Permits are issued for a maximum term of 5 years. The Director may revoke, suspend, or modify any such permit for any of the following causes:

- Violation of any condition of the permit;
- Obtaining a permit by misrepresentation or failure to disclose fully all relevant facts;
- Change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge. (Ibid)

Combined Sewer Overflow

Combined sewer overflow (CSO) refers to a sewage system constructed to allow surface-water runoff to enter the conduit carrying sewage, industrial waste, or other waste. When the conduit exceeds its capacity, allows untreated or incompletely treated sewage or waste to flow directly or indirectly, into water bodies. Georgia Statute §12-5-29.1 basically called for the elimination of CSOs in Georgia: construction and implementation was expected to be completed by the end of 1995.

Because the Water Quality Control Act assigns specific responsibility to EPD for setting water quality standards and issuing and enforcing water withdrawal and waste discharge permits for both point and nonpoint sources, it gives the Department significant authority for protecting the state's water quality.

The Erosion and Sedimentation Control Act

The Erosion and Sedimentation Control Act of 1975 has also been an important tool for protecting water quality. It amended the Georgia code to “strengthen and extend the erosion and sediment control activities and programs of the state and to provide for the establishment and implementation of a state-wide comprehensive soil erosion and

sediment control program to conserve and protect the land, water, air, and other resources of the state” (O.C.G.A. §12-7-2).

The Act requires the governing authority of each county and each municipality to adopt a comprehensive ordinance establishing the procedures governing land-disturbing activities which are conducted within their respective boundaries. These governing authorities may delegate these responsibilities in whole or in part to a local planning and zoning commission, and where appropriate, land-disturbing provisions may be integrated with tree protection, flood plain protection, stream buffers, or storm-water management (O.C.G.A. §12-7-5). For localities without ordinances, EPD shall develop rules and regulations that meet minimum requirements for best management practices (below) (O.C.G.A. §12-7-5).

Best Management Practices

The Erosion and Sedimentation Act requires all land-disturbing activities to implement best management practices (BMPs). Proper design, implementation, and maintenance of BMPs constitute a complete defense to any action by EPD or to any other allegation of noncompliance with the Act (O.C.G.A. §12-7-6(a)(1)). A discharge of stormwater runoff from disturbed areas where BMPs have not been properly designed, installed, and maintained shall constitute a separate violation of any land-disturbing permit issued by a local issuing authority or of any state general permit issued by EPD for each day that such discharge results in specified increases of turbidity. The Division may require monitoring of the turbidity level of receiving waters into which discharges from land-disturbing activities occur.

Rules, regulations, ordinances, or resolutions adopted pursuant to the Act require at a minimum, protections at least as stringent as the state general permit, and best management practices must be at least as stringent as those contained in the *Manual for Erosion and Sediment Control in Georgia*, published by the State Soil and Water Conservation Commission as of January 1 of the year in which the land-disturbing activity was permitted. In addition, the following measures must be included:

1. Stripping of vegetation, regarding, and other development activities shall be conducted in such a manner to minimize erosion;
2. Cut and fill operations must be kept to a minimum;
3. Development plans must conform to topography and soil type, so as to create the lowest practicable erosion potential;
4. Whenever feasible, natural vegetation shall be retained, protected, and supplemented;
5. The disturbed area and the duration of exposure to erosive elements shall be kept to a practicable minimum;

6. Disturbed soil shall be stabilized as quickly as practicable;
7. Temporary vegetation or mulching shall be employed to protect exposed critical areas during development;
8. Permanent vegetation and structural erosion control measures must be installed as soon as practicable;
9. To the extent necessary, sediment in runoff water must be trapped by the use of debris basins, sediment basins, silt traps, or similar measures until the disturbed area is stabilized;
10. Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping surfaces of fills;
11. Cuts and fills may not endanger adjoining property;
12. Fills may not encroach upon natural watercourses or constructed channels in a manner so as to adversely affect other property owners;
13. Grading equipment must cross flowing streams by means of bridges or culverts, except when such methods are not feasible, provided, in any case, that such crossings must be kept to a minimum;
14. Land-disturbing activity plans for erosion and sedimentation control shall include provisions for treatment or control of any source of sediments and adequate sedimentation control facilities to retain sediments on site or preclude sedimentation of adjacent waters beyond the levels specified herein;
15. (A) There is established a 25 foot buffer along the banks of all state waters, as measured horizontally from the point where vegetation has been wrested by normal stream flow or wave action, except as provided by specified exceptions.
(B) No land disturbing activity shall be conducted within such buffer, and a buffer shall remain in its natural, undisturbed state of vegetation until all land-disturbing activities on the construction site are completed.
(C) On or before December 31, 2004, the board shall adopt rules which contain specific criteria for the grant or denial of requests for variances. [Specific circumstances for variances are enumerated.]
(D) This buffer requirement does not apply to stream crossings for water lines or sewer lines.
16. There is established a 50 foot buffer along the banks of any state waters classified as "trout streams," except that such streams which discharge an average annual flow of 25 gallons per minute or less shall have a 25 foot buffer or they may be piped according to terms established by the EPD or local issuing authority. Any

such pipe must stop short of the downstream landowner's property. (See (B), (C), and (D) above.)

Permits Required for Land-disturbing Activities

All operators of land-disturbing activities must first secure a permit from a local issuing authority or provide notice of intent to EPD. In those counties and municipalities which are certified as local issuing authorities, the local issuing authority is responsible for conducting inspections and enforcing the permits it issues. In those counties and municipalities which are not certified, the terms of the state general permit apply and no land-disturbing permit will be required, provided that notice of intent is submitted to EPD prior to commencement of any land-disturbing activities (O.C.G.A. §12-7-7(a) through (c)).

Except as provided for by this statute, permits are not issued unless an erosion and sediment control plan has been approved by the appropriate soil and water conservation district (O.C.G.A. §12-7-7(e)). In addition, as of July 1, 2003, the Department of Transportation and the State Road and Tollway Authority may not contract with an individual, firm, corporation, or combination thereof, or a governmental organization for any land-disturbing activity until it has developed an erosion and sediment control plan for the project and the plan has been accepted by the EPD. The contractor for a construction or maintenance project is responsible for implementing the plan, overseen by the Department of Transportation or the State Road and Tollway Authority (O.C.G.A. §12-7-7.1).

The soil and water conservation districts and/or the State Soil and Water Conservation Commission are expected to periodically review the actions of counties and municipalities which have been certified as local issuing authorities. The districts or the commission or both may provide technical assistance to any county or municipality in order to increase the effectiveness of the erosion and sedimentation control program (O.C.G.A. §12-7-8(b)).

Permit Conditions and Corrective Actions

The permit application and plan for erosion and sediment control are generally referred directly to the appropriate district where land-disturbing activities are proposed to take place. The soil and water conservation district approves or disapproves the plan, and if the plan is approved, the local authority approves or denies the permit application. The district must approve or disapprove a plan within 35 days of receipt. Failure of the district to act within 35 days is considered an approval of the pending plan. The local issuing authority is expected to issue or deny a permit application within 45 days of its submission (O.C.G.A. §12-7-9 through 12-7-10).

The local issuing authority may deny a permit if the applicant has had two or more violations of previous permits or of this Code section within three years prior to filing application (O.C.G.A. §12-7-7(f)(1)). To help ensure compliance, the authority may

require the permit applicant to post a bond up to, but not exceeding, \$3,000.000 per acre of the proposed land-disturbing activity prior to issuing a permit. If the applicant does not comply with the conditions of the permit after issuance, the authority may call the bond to be forfeited and may use the proceeds to hire a contractor to stabilize the site and bring it into compliance (O.C.G.A. §12-7-7(f)(2)). The local issuing authority may also suspend, revoke, or modify a permit upon finding that the holder is not in compliance with the approved erosion and sediment control plan or that the holder is in violation with any pertinent ordinance, rule, or regulation (O.C.G.A. §12-7-11).

If EPD has reason to believe that a violation of a rule, regulation, or order has occurred, the director may issue an order specifying the provisions or rules alleged to be violated and may require that the land-disturbing activity be stopped until necessary corrective action and mitigation have been taken or will be taken within a reasonable period of time. This is referred to as a “stop work order.” The local issuing authority may also issue a stop work order (O.C.G.A. §12-7-12).

Any person who violates rules, regulations, or permit conditions pursuant to this Act or who negligently or intentionally fails or refuses to comply with any final or emergency order issued by the director is liable for a civil penalty not to exceed \$2,500 per day. Each day during which the violation or failure or refusal to comply continues is considered a separate violation (O.C.G.A. §12-7-15). If evidence exists that land-disturbing activities are presenting an imminent and substantial danger to the environment or to the health of humans, the director may bring an action to restrain immediately any person causing or contributing to the danger or to take such other action as may be necessary (O.C.G.A. §12-7-14).

Permit Exemptions

Erosion and sedimentation rules and regulations do not apply to the following activities:

1. Surface mining;
2. Granite quarrying and land clearing for such quarrying;
3. Minor land-disturbing activities such as home gardens and individual home landscaping, repairs, maintenance work, fences, and related activities;
4. The construction of single-family residences, when such construction disturbs less than one acre and is not part of a larger common plan of development or sale with a planned disturbance of one acre or more;
5. Agricultural operations;
6. Forestry land management practices except where prohibited by buffer requirements, above;

7. Any project carried out under the technical supervision of the Natural Resources Conservation Service of the U.S. Department of Agriculture;
8. Any project involving less than one acre of disturbed area, unless it is part of a common plan of development or sale with a planned disturbance area of one acre or more or within 200 feet of the band of any state waters;
9. Construction or maintenance projects undertaken or financed by the Department of Transportation, the Georgia Highway Authority, or the State Road and Tollway Authority; or any road construction or maintenance project undertaken by any county or municipality, which are regulated under separate authority;
10. Any land-disturbing activities conducted by any electric membership corporation or municipal electric system or any public utility under the regulatory jurisdiction of the Public Service Commission or the Federal Energy Regulatory Commission;
11. Public water system reservoirs.

Education Required for Erosion and Sedimentation Control

After December 31, 2006, all persons involved in land development design, review, permitting, construction, monitoring, or inspection, or any land-disturbing activity, must meet specified education and training certification requirements, dependent on their level of involvement with the process, as developed by the State Soil and Water Conservation Commission and the Stakeholder Advisory Board (O.C.G.A. §12-7-19). The Stakeholder Advisory Board consists of not more than 13 members, appointed by the governor, who represent a broad range of interests. The role of the Board is to work together with EPD and the Commission to establish, evaluate, and maintain the education program for those involved with land-disturbing activities.

In addition to the education program, House Bill 285, passed in 2003, reformed the Georgia Erosion and Sedimentation Act in the following ways:

- Requires locally issued land-disturbing permits to match state standards which are based on the federal Clean Water Act.
- Charges developers a fee not to exceed \$80 per disturbed acre, with half being paid to the Local Issuing Authority. This is the first water quality “user fee” ever imposed by the Georgia state government. The EPD estimates the new fees will cost the construction industry five million dollars a year; however, the \$100 million cost of water monitoring will be reduced by 50 to 90 percent.
- Provides for the issuances of stop-work orders at sites violating the law. Previously, fines of up to \$2,500 per day were imposed.
- Streamlines the existing permitting process.

- Eliminates the requirement that ad valorem taxes be paid prior to the issuances of land-disturbing permits. (Georgia Conservancy)

The fees collected from developers provide EPD and local governments funding needed for additional staff to do inspections and to review reports submitted by developers.

Georgia Planning Act

The Georgia Planning Act of 1989 encourages local governments to develop a comprehensive plan to guide activities over a 20-year planning horizon and required the Georgia Departments of Community Affairs (DCA) and Natural Resources (DNR) to develop a set of minimum requirements for these plans. Planning criteria exist for five areas: water supply watersheds, ground water recharge areas, wetlands, and river corridors, and mountains. The criteria are not mandatory regulations, but must be considered in the development of each local government's comprehensive plan. If any of these environmentally sensitive areas exist within the local government's jurisdiction, the planning process should consider whether all or part of these minimum criteria should be implemented. Four of the five areas designated for special protection involve water quality. The criteria for protection in these areas are as follows.

Water Supply Watersheds

Water supply watershed criteria are divided into large and small watersheds and water supply reservoirs. Alternative criteria may be presented to DNR by all the local governments within a water supply reservoir, and the Department may approve such criteria if it deems them to provide an equivalent level of protection.

Large Water Supply Watersheds

A large water supply watershed has 100 square miles or more of land within the drainage basin upstream of a governmentally owned water supply intake. The corridors of all perennial streams within a seven mile radius of the reservoir boundary are protected as follows.

- A buffer shall be maintained for a distance of 100 feet on both sides of the stream;
- No impervious surfaces shall be constructed within a 150 foot setback area on both sides of the stream; and
- Septic tanks and septic tank drainfields are prohibited in the setback area above.

Small Water Supply Watersheds

A small water supply watershed has less than 100 square miles of land within the drainage basin upstream of a governmentally owned water supply intake. The corridors

of all perennial streams within a seven mile radius of the reservoir or intake are protected by the same criteria as for large water supply reservoirs, above, and also are subject to the following criteria that apply *outside* of the seven mile radius.

- A buffer shall be maintained for a distance of 50 feet on both sides of the stream;
- No impervious surface shall be constructed within a 75 foot setback area on both sides of the stream
- Septic tanks and septic tank drainfields are prohibited in the setback area above.

In addition, within all locations within a small water supply watershed, sanitary landfills are allowed only if they have synthetic liners and leachate collection systems; new hazardous waste treatment or disposal facilities are prohibited; impervious surface area is limited to 25 percent of the entire watershed; and new facilities handling hazardous materials must operate within guidelines established by DNR.

Water Supply Reservoirs

The owner of a water supply reservoir must develop a management plan approved by DNR; the plan must address recreational uses of the reservoir and maintenance of a buffer around the reservoir. In order to protect water quality, the plan must specifically address prohibition or restrictions on swimming, fishing, boating, docks, and public access. A buffer must be maintained for a distance of 150 feet from the reservoir boundary, with allowable vegetation and disturbance specified in the plan. With approval by DNR, different buffer sizes may be allowed.

Ground Water Recharge Areas

Within significant recharge areas that have been identified and mapped (approximately 22 to 23 percent of the state), criteria include but are not limited to the following.

- No new sanitary landfills may be permitted;
- No new permits may be issued for land disposal of hazardous wastes;
- All new facilities that handle hazardous waste must follow procedures prescribed by DNR;
- Above-ground chemical or petroleum storage tanks with a minimum volume of 660 gallons must have secondary containment for 110 percent of that volume;
- New agricultural waste impoundment sites must be lined if they exist within certain pollution susceptibility areas;

- New homes and new mobile home parks shall be located on minimum lot sizes (local governments may exempt certain of these requirements);
- Septic tank installation must abide by regulations established by DHR;
- Spray irrigation or land spreading of wastewater sludge in high pollution susceptibility areas must follow criteria established by DNR; and
- Permanent storm water infiltration basins may not be constructed in areas having high pollution susceptibility.

Wetlands

Most activities in wetlands require a Section 404 permit from the Corps of Engineers. If wetlands are altered or degraded, mitigation to offset losses are required as a condition of a Section 404 permit. In the development of land use plans, wetlands should be appropriately identified and mapped, according to specified definitions. Land use plans should consider potential impacts to wetlands and should specify acceptable and unacceptable uses of wetlands, which may include the following.

Acceptable uses:

- Timber production and harvesting;
- Wildlife and fisheries management;
- Wastewater treatment;
- Recreation;
- Natural water quality treatment or purification; and
- Other uses permitted under Section 404 of the Clean Water Act.

Unacceptable uses:

- Receiving areas for toxic or hazardous waste or other contaminants;
- Hazardous or sanitary waste landfills; and
- Other uses unapproved by local governments.

River Corridors

The Georgia Planning Act requires local governments to develop River Corridor Protection Plans, as part of their comprehensive plans, to maintain the integrity of this

buffer area. River corridors regulated under the Act are those areas within 100 feet of both sides of a protected river, and which are not regulated under the Metropolitan River Protection Act or the Coastal Marshlands Protection Act (below).

Single-family dwellings may be constructed within the buffer area, subject to specific conditions. Industrial and commercial land uses existing prior to the development of the protection plan may be exempt from criteria, provided that such uses do not impair the drinking quality of the river water and that they meet all state and federal environmental rules and regulations.

Land use plans may allow for the following uses within river corridors:

- Timber production and harvesting;
- Wildlife and fisheries management;
- Waste-water treatment;
- Recreation;
- Natural water quality treatment or purification;
- Agriculture production and management; and
- Other uses including those permitted by the Department of Natural Resources or under Section 404 federal Clean Water Act.

The following uses are not acceptable:

- Receiving areas for toxic or hazardous waste or other contaminants;
- Hazardous or sanitary waste landfills; and
- Other uses unapproved by local governments.

Metropolitan River Protection Act

The Metropolitan River Protection Act (O.C.G.A. 12-5-440 through 12-5-457) applies to all metropolitan areas with a population of more than 1,000,000 which have a major stream that provides more than 40 percent of the public water supply. As of the current census, the regulations pertain only to a section of the Chattahoochee River in Atlanta.

The Act requires those regional development centers to develop land use plans for river corridors, and specifies that until a plan is adopted, it is unlawful for any land disturbing activity within stream corridors which will:

- Adversely affect the efficiency of or restrict the capacity of the watercourse or flood plain;

- Appreciably increase runoff or flood heights;
- Adversely affect the control, protection, allocation, or utilization of the water and related land resources of the stream corridor;
- Harmfully obstruct or alter the natural flow of flood waters; or
- Harmfully increase erosion, siltation, or water pollution.

After the adoption by the regional development center of a plan, it is unlawful to engage in any land disturbing activity, within those areas regulated by the plan, which is incompatible with the plan. The governing authority must adopt ordinances, regulations, or procedures as necessary to ensure that any land disturbing activity is conducted in compliance with the plan and the certificate that must be issued by the authority prior to commencement of the activity (O.C.G.A. 12-5-520).

Coastal Marshlands Protection Act

The Coastal Marshlands Protection Act created the Coastal Marshlands protection Committee, which evaluates proposed development projects that may affect these areas and may deny permits if the project is likely to have negative environmental impacts. A permit under the Act is required for any project involving dredging, draining, removing, filling, or otherwise altering marshlands. Projects are generally permitted if they do not increase erosion, alter channels, or create pools, and if they do not interfere with wildlife or other resources (O.C.G.A. §12-5-281).

On-site Sewage Management Regulations

On-site sewage (or wastewater) management system refers to a sewage management system other than a public or community sewage treatment system serving one or more buildings, mobile homes, recreational vehicles, residences, or other facilities designed or used for human occupancy or congregation (O.C.G.A. §31-2-7(a)(1)). Technologies approved in Georgia for onsite wastewater treatment and disposal include chamber systems, gravelless systems, peat filters, alternative aggregate systems (e.g. tire chips and polystyrene), drip systems, and mounds. Other technologies require review for approval as alternative or experimental systems.

Prior to 1997, the rules concerning the regulation of on-site sewage management systems were handled by each County Board of Health. In 1997, the law was changed to give the Department of Human Resources (DHR) authority to adopt state-wide regulations (O.C.G.A. §31-2-7). The Department manages the state's responsibilities regarding the regulation of septic system installations and repairs as well as providing technical assistance and training. The Department has written a manual (the *Manual for On-site Sewage Management Systems*) that details the criteria for design, site suitability parameters, and installation and operation requirements for these systems. The Manual

was last updated January 1, 2006. These regulations establish minimum standards that are enforced by the County Boards of Health. Septic systems that are not greater than 10,000 gallons are regulated and permitted through this program, while systems larger than 10,000 gallons are permitted by EPD (EPD/DHR MOU).

The Department must certify all individuals performing services related to site approval, the design, location, installation, inspection, and maintenance of an on-site sewage management system. Guidelines for certification are established by the Department and are published in the Manual for On-site Sewage Management Systems (GADHR Rules 290-5-26-.17(1), (2)).

Under O.C.G.A. §31-3-5, the County Boards of Health regulate the installation of septic systems by conducting the following activities:

1. Specifying the location within the incorporated and unincorporated area of the county where on-site sewage management systems may be installed;
2. Specifying the minimum lot size or land area which may be served by an on-site sewage management system;
3. Specifying the types of residences, buildings, or facilities which may be served by on-site sewage management systems;
4. Issuing permits for the installation of on-site sewage management systems prior to their installation;
5. Inspecting on-site sewage management systems prior to the completion of the installation; and
6. Providing for ongoing maintenance of such systems *except for non-mechanical residential sewage management systems*.

These requirements help ensure that the septic systems are adequate for the size of the homes or other buildings, and that the system will function in a way that protects water quality.

Septic or Public Treatment?

Where public or community service is not available, the owner or lessee of every building, residence, or property, designed, used, or intended to be used for human occupancy or congregation, must provide an approved on-site sewage management system sufficient for persons normally expected to use the property for two hours or more. Where public or community sewage treatment is available within 200 feet of the property line, or available in a public right-of-way abutting the property, connection must be made to the public or community system (GADHR Rules, 290-5-26-.03(1)).

Permitting and Inspections of On-site Sewage Management Systems

No person may begin the physical development of a lot or structure where an on-site sewage management system will be utilized, nor install an on-site sewage management system or component thereof without having first applied for and obtained from the County Board of Health a construction permit for the installation (GADHR Rules, 290-5-26-.03(2)). No building permit will be issued unless the sewage treatment installation conforms with the standards contained in Georgia Code and the regulations of the County Board of Health (O.C.G.A. §31-3-5.1). It is recommended that developers seek a predevelopment review by the County Board of Health when considering subdivision or mobile home park development where on-site sewage management systems will be used (GADHR Rules 290-5-26-.14(1)).

Application for a construction permit must be made in writing on forms provided by the County Board of Health. The board will approve or disapprove the application within 12 days of receipt. Each application must include the following information:

1. Name and address of the owner and the applicant, of other than the owner;
2. Location of property;
3. Plans and specifications, including location and design of the proposed on-site sewage management system including surface and subsurface drainage and piping;
4. Nature of the facility to be served;
5. Location of all water supplies, geothermal systems, or other utilities and trash pits on or off the lot, which will bear upon the location of the on-site sewage management system;
6. Number of bedrooms in the dwelling, or the number of persons to be served in other types of establishments, or other sewage flow or water usage data;
7. Soil characteristics, including soil types and capabilities, frequency and evaluations of seasonal high groundwater tables, occurrence of rock and other impervious strata;
8. Signature of the owner or agent applying for permit;
9. Any additional information deemed necessary to determine the suitability of the site. (GADHR Rules, 290-5-26-.03(2)(a))

Permits shall be issued only after a site inspection by the County Board of Health shows favorable findings relative to absorption rates, soil characteristics, ground water, rock and other factors which would affect the acceptability of the lot. Where a public water system

is to be utilized, no construction permits for on-site sewage management are to be issued prior to the approval of the public system (GADHR Rules, 290-5-26-.03(3)).

Repairs, replacements, or additions to existing systems must also be permitted and inspected.

The Department has the authority to adopt state-wide regulations for on-site sewage management systems, including but not limited to experimental and alternative systems. The department may require that any such on-site sewage management system be examined and approved prior to its use, provided that any prior approved system shall continue to be approved for installation pursuant to manufacturer's recommendations. Upon written request of one-half or more of the health districts in the state, the department is authorized to require the reexamination of any such system indicating unsatisfactory service of such system or component thereof (O.C.G.A. §31-2-7(b)).

County environmental health specialists generally conduct site evaluations for permitting. In addition, a soil evaluation report from a certified soil scientist must be submitted with the site evaluation application. Once permits are approved, DHR keeps records of all issued permits. (NESC) Construction permits for on-site systems remain valid for not more than 12 months from the issue date (GADHR Rules, 290-5-26-.03(3)).

Georgia does not require regular inspections for investigating the performance and operation of on-site systems after initial construction. However, grading, filling, digging trash pits, or other landscaping or construction activities on the lot subsequent to final inspection renders the approval void. Removal or alteration of system components after the final inspection also voids the approval (GADHR Rules, 290-5-26-.03(4)(b)). Property transfers provide some opportunities for periodic inspection: although not mandated by law, the State does have a process for the pre-sale inspection of on-site waste water systems at property resale. An applicant may request an existing system evaluation by the County Board of Health. Inspectors are certified by a state testing program, and continuing education is required for recertification (NESC).

Design and construction

Septic tanks must provide a minimum of 24 hours of retention and must be designed and constructed to equal or exceed minimum design and construction criteria established by the Department as published in the current Manual for On-site Sewage Management Systems. After the effective date of these regulations, any person seeking approval of septic tanks to be used in on-site sewage management systems, shall submit detailed plans and specifications for tank manufacture and other information as may be required by the Department. Manufacturers and suppliers may be subject to periodic inspection, and approval by the County Board of Health or the Department. An approved filter must be installed on the outlet end of the septic tank in compliance with the *Manual for On-site Sewage Management Systems* (GADHR Rules, 290-5-26-.05(1)).

Alternative on-site sewage management systems must be designed in accordance with the minimum design and construction criteria established by the current *Manual for On-site Sewage Management* systems. The Department is to maintain a list of approved alternative on-site systems (GADHR Rules, 290-5-26-.09(2)). Experimental systems may be provisionally accepted, based on review by the Department's Technical Review Committee (GADHR Rules, 290-5-26-.10).

Location

Septic tanks must be located with minimum setbacks, as follows (GADHR Rules 290-5-26-.05(2)). No septic tank may be installed:

- Within 50 feet from existing or proposed wells, springs, sink holes, or suction water lines, and tanks must be located downgrade from wells or springs if physically possible;
- Less than 25 feet from lakes, ponds, streams, water courses, other impoundments;
- Less than 10 feet from pressure water supply lines;
- Less than 10 feet from a property line; or
- Less than 15 feet from a drainage ditch or embankment.

The minimum lot size requirement for use of an on-site wastewater treatment system in Georgia is by law under the jurisdiction of the County Boards of Health. The State recommends a minimum lot size of one-half acre if served by public water and one acre if served by an individual well, to help ensure that disease-causing organisms from the septic system do not contaminate the well. Percolation test or soil characterization is required as part of the site evaluation (NESC).

Capacity

The liquid capacity of septic tanks for single family dwellings must be 1000 gallons for one, two, three, or four bedrooms, and 250 additional gallons for each bedroom over four. Septic tank capacity must be increased by 50 percent where garbage grinders are to be used (GADHR Rules 290-5-26-.05(3)).

Maintenance

Property owners are responsible for properly operating and maintaining on-site sewage management systems to increase the life expectancy and prevent system failure, in accordance with criteria established in the current *Manual for On-site Sewage Management Systems* (GADHR Rules 290-5-26-.18(2)).

Rules of DHR prohibit any unapproved discharge or spillage of sewage, or any use that allows seepage or discharge of effluent to the ground surface, to a water course, drainage ditch, open trench, canal, storm drain or storm sewer, water well, abandoned well, lake, stream, river, estuary, or other body of water (GADHR Rules 290-5-26-.18(1)).

Septage Disposal

Permitting is required for any removal or disposal of the contents of any type of on-site sewage management system. The written application for removal/disposal must be submitted to the Department or the County Board of Health at least 10 days prior to engaging in such activities (GADNR Rules 290-5-26.11).

In Georgia, septage from on-site wastewater treatment systems is disposed either by land application or treatment at wastewater treatment facilities. There seems to be a general consensus that some areas of the state lack adequate disposal facilities, and this has become a controversial topic in terms of where responsibility lies for creating additional facilities (Edwards). Senate Resolution 818 established the Senate Septage Disposal Study Committee, an 11-member committee composed of representatives from a variety of state agencies (including EPD), local governments, associations, and interest groups, which will make recommendations in a report to be released on or before December 1, 2006.

A memorandum of understanding between EPD and the Division of Public Health of the Georgia Department of Human Resources establishes guidelines based on the Code of Federal Regulations, Title 40, Part 503. It includes the following requirements for septage disposal in Georgia:

- Land application of domestic septage may be applied only to land with a low potential for public exposure, including but not limited to agricultural land, forests, and reclamation sites located in unpopulated areas; and
- The two approved methods of disposal are subsurface application and surface spreading.

Septic System Failure

A failed system is one in such condition that it constitutes a public hazard by inadequate treatment and/or disposal of sewage. The most common reasons for system failure include the age of the system and poor maintenance or lack of maintenance. No funding programs exist to assist homeowners in repairing or replacing failing systems or installing new systems, nor are programs in place to offer homeowners insurance policies for on-site systems (NESC).

Onsite Wastewater Management in the Metropolitan North Georgia Water Planning District

In the summer of 2005, the Metropolitan North Georgia Water Planning District conducted a survey of County Environmental Health Officers on the status of septic systems in each of the District's 16 counties. The report summarizing the data collected in the survey was published in March, 2006. The survey showed that District-wide, 90 percent of septic systems are residential. Based on this survey and data from the U.S. Census Bureau, 26 percent of the homes in the District are served by septic systems. Septic systems exist in every county in the District, with the highest concentration in the more rural counties. Survey results indicated that almost 40 percent of septic systems are more than 20 years old. Septic systems this old were installed under less rigorous standards than are currently required.

The District survey also approximated the number and cause of septic system failures. Approximately one percent, or 4,000, septic systems fail each year in the District. The main causes of failure were, in descending order of occurrence:

- Unsuitable soil and location;
- Age of system;
- Excessive water use;
- Poor maintenance; and
- Surface runoff.

Although a significant number of system failures were due to poor maintenance, the survey indicated there is very little support for mandatory pumping or inspection of septic systems. Seventy-five percent of the County Health Departments interviewed did not support such a program, acknowledging implementation problems such as lack of resources, enforcement, and lack of capacity to dispose of septage. (Note that these three issues are fundamentally related to resources.) The preferable approach was said to be educating homeowners about septic system maintenance.

A number of suggestions for improvement were made during the District's survey and report development. Because this list was developed with the participation of County Environmental Health Officers, it may be particularly useful for learning the perspective of those who deal directly with local program implementation. The suggestions included in the report are as follows.

Soil Classification Process

- A program needs to be developed to require oversight of engineers who perform poor soil classifications, including a way to enforce or punish consistent mistakes

made by installers, pumpers, and soil classifiers. There could be a State Soil Classifier whose full time job is to settle soil classification disputes throughout the state.

- More aggressive action is needed by the state to decertify unscrupulous contractors and poor soil classifiers.
- Soil classifiers need to do a more complete job. They often give the Environmental Health Department inadequate information to make decisions, knowing that certain conditions will require more tests, such as checking for rock. Environmental Health then must go back to the property owner, who must go back to the soil classifier to have more work done.
- County Environmental Health Department personnel should be required to bore one hole per lot to verify soil classifications.

State Design Criteria

- The number of bedrooms is a major issue. Rooms that are not labeled as bedrooms are often used as bedrooms. There should be better guidance on extra rooms and how they should be included in the design, planning, and permitting process.
- Inspection risers should be installed.
- Minimum design criteria should be increased for septic systems, especially for alternative systems.
- The minimum standard for soils, depth to restrictive layer, lot size, etc. appear to be too minimal. A high water table, poor soils, and rock problems all need to be addressed when considering the minimum standards.
- More testing is needed on the lots that require alternative systems.

Long-range Planning

- The county zoning office should change the zoning to account for septic minimum lot size.
- Local County Boards of Health and city and county governments should work together to evaluate the soil conditions in their county as part of their land use planning to determine which areas are suitable for septic systems.

Management and Planning

- It is most important that preliminary work is done properly and that the land and soils can support what is proposed. This should be considered at the beginning of the development process, and lots that don't meet the requirements should not be permitted for septic.
- Pre-planning with the county zoning department should be required, including review of lot designs.
- Environmental Health staff should be involved in the development process from the beginning. When plats are submitted to engineering staff, a copy should be sent to all departments for comment.
- Plans should be submitted to all agencies for approval before any roads are cut, and a soils study and septic approval should take place before the lots are approved and building permits issued.
- Builders and contractors should be required to follow plans more closely.

Coordination

- Communications between Planning and Zoning and the Health Department needs improvement.
- Planning and Zoning and Utilities should include the Health Department representative in planning meetings.
- The Health Department should develop a working relationship with the utility that addresses pump-out disposal locations and water usage information sharing.
- County Health Department should be brought into the county organizational structure.

Minimum Lot Size

- The minimum lot size should be based on the amount of suitable soil and other site-specific conditions.
- Downsizing of absorption/drain fields should be reduced.
- The length of drain lines should be reevaluated.
- Larger lot sizes and drain fields should be required.

Drain Fields

- Use of serial drain field systems should be eliminated.
- Landscaping that diverts runoff away from the drain field should be encouraged.
- Wet weather installations should be prohibited, especially the drain fields which may cause damage to the soil structure.
- Installation of dual drain fields so that fields can be alternated on an annual basis should be considered where septic systems will be the permanent wastewater treatment solution.

Staffing

- More staff is needed to address unapproved changes that builders make to approved plans.
- Staff training should be improved/increased.
- Better pay would draw more qualified people.
- More inspectors are needed.

Public Sewer

- County Board of Health should work with the Water and Sewer Department to plan for extending sewer lines to areas of the county experiencing high septic system failure rates.
- Public sewer should be expanded in the region.

Maintenance

- Ongoing maintenance contract should be required for all alternative and mechanical septic systems for the life of the system.
- Septic system users should decrease their water usage and perform timely maintenance.

Education

- Homeowners should be educated about septic system operation and maintenance.
- An environmentalist should conduct education and consultation during the repair process.

- Maintenance presentations should be conducted at the subdivision or community level in areas with a high amount of septic problems and failures.
- Builders should be educated about the sensitivity of drain field soils. Builders often destroy the soil structure during construction.
- Homeowner education could include providing an informational packet about their septic system at the time of closing. The packet could contain contact information and information about planning for a replacement system.
- Water saving fixtures and appliances and regular plumbing maintenance would help prevent excessive water entering the septic tank.
- Data access for homeowners should be improved so that homeowners could access information about their systems online.

Regulations Related to Infrastructure Financing

The Environmental Protection Division is the water pollution control and surface-water resource management agency for the state for all purposes of any federal water pollution act or other related federal acts. This role includes receiving and expending on behalf of the state all funds which are now or will be allotted to the state by any act of Congress or regulation of the federal government or by virtue of any appropriation by the General Assembly for water quality control, management, and allocation of the state's surface water resources (O.C.G.A. §12-5-32). It also includes administering funds granted to the state by USEPA for the purpose of providing local assistance for construction of wastewater treatment facilities (O.C.G.A. §12-5-38.1(a)). Any such funds received from USEPA are to be deposited in one or more water pollution control and drinking water revolving funds established by EPD. In addition to such federal funds, other nonfederal funds may be deposited in such revolving funds as they become available. These funds are transferred to the Georgia Environmental Facilities Authority (O.C.G.A. §12-5-38.1(b)).

The Division is authorized to use funds appropriated by the General Assembly to match federal funds as may be necessary to secure federal grants (O.C.G.A. §12-5-32(5)). The Division is also authorized to make grants, as funds are available, to any county, municipality, or any combination thereof, or to any public authority, agency, commission, or institution, to assist them in the construction of those portions of water pollution control projects which qualify for federal aid or by appropriate action by the General Assembly with or without qualification for federal aid (O.C.G.A. §12-5-33).

The state's contribution toward the construction of water pollution control projects is not limited by percentage contribution and may make grants up to the full cost of construction where local need is shown and where funds are available. State funds may also be used in conjunction with federal grants (O.C.G.A. §12-5-34).

The Division is authorized to develop and operate a continuing area-wide waste treatment management planning process (O.C.G.A. §12-5-39).

Wellhead Protection

To ensure that drinking water sources are not source contaminated, the Division is required to develop Wellhead Protection Plans for protecting those wells and springs used for public water supply for community systems owned by and/or serving local government. Plans include identification of present and potential pollutants, a management plan for potential pollution sources identified, and a contingency plan for providing alternate water supplies in the event of source water contamination (DNR Rule 391-3-5-.40(3)). Permits for well construction may not be permitted where potential pollution sources exist within a radius from 100 feet to 500 feet of the borehole (DNR Rule 391-3-5-.40(5)(a)(b)(c)).

Other State-wide Water Quality Protection Efforts

A number of water quality programs are administered by the Environmental Protection Division and other state agencies. Some have been developed in response to federal laws and regulations, while others are state-initiated.

Georgia Environmental Facilities Authority

Funds for Georgia's water and wastewater infrastructure are provided through the Georgia Environmental Facilities Authority (GEFA). The Authority was created in 1983 specifically to provide local governments with financial assistance for water and sewer systems. Originally, the Authority provided grant funds; however, its programs have since changed to the provision of low-interest loans. The Authority's role has also expanded over the years to include assistance with solid waste and recycling, energy efficiency, and fuel and storage tank removal, but the bulk of its work continues to be with water and wastewater systems.

Authority water and sewer financing program is open to any local government in the state, but most of the loan recipients are small cities and counties. The Authority can offer loans for projects that might otherwise be cost-prohibitive. For example, by providing lower interest rates than private lending institutions, GEFA saved local governments approximately \$21 million in interest costs over the life of loans approved in 1999.

The Authority provides funding for water projects through three major programs: Water and Wastewater System Financing, the federal Clean Water State Revolving Loan Fund, and the federal Drinking Water State Revolving Fund. (For a description of the federal funding programs, please see Chapter 7, Infrastructure Financing.)

Water and Wastewater System Financing

Several types of loans are available for water and sewer projects:

- Through the *Georgia Fund Loan Program*, state bond-funded loans finance all types of water and sewer projects, including water and sewer lines, treatment plants, pumping stations, wells, and storage tanks. For water and wastewater loans, the maximum loan amount is calculated according to a formula based on the population of the applicant community, ranging from \$10 million for a community of up to 3,000 people to \$50 million for a community of more than 300,000 people. Financing is currently offered at a 4.10 percent interest rate; however, if communities meet certain conditions, they may qualify for lower interest rates under one of the following programs:
 - *OneGeorgia* – Water and/or sewer fees for 6,000 gallons usage must exceed one percent of the city or county’s monthly median household income. Depending on the ability of the applicant to meet the debt service coverage requirement, interest rates can be as low as two percent.
 - *WaterFirst* and *Signature Community* designations – Communities that qualify for one of these designations from the Department of Community Affairs may be eligible for reduced rates on Georgia Fund loans.
 - *Environmental Emergency* loans are available at a two percent interest rate.
- The *Environmental Emergency Loan Program* was established to assist communities in financing improvements necessary to eliminate actual or potential public health hazards or violations of environmental regulations. The project must have an element of emergency, and the maximum loan amount per project is \$100,000.
- The *Sewer System Grant Program* provides one-time grants of up to \$100,000 to small cities, counties, and water and sewer authorities that own or operate a public water system. Funds are used to help build or expand public sewer systems.
- The *Construction Loan Program* was established to provide temporary financing for the construction period of water and sewer projects, where the community has a known source of permanent financing.

Adopt-A-Stream

Coordinated by EPD’s Nonpoint Source Pollution Program, Georgia Adopt-A-Stream is designed to involve members of the public throughout the state in water quality assessment and protection. More than 7000 volunteers in about 225 Adopt-A-Stream groups, “adopt” parts of rivers and streams, wetlands, and lakes for protection. With each

group funded by local governments and/or nonprofit organizations, the program provides manuals, training, and technical support for volunteers to conduct biological and chemical monitoring in their adopted waterways. The program has four specified goals:

- Increase public awareness of the state's nonpoint source pollution and water quality issues;
- Provide citizens with the tools and training to evaluate and protect their local waterways;
- Encourage partnerships between citizens and their local government; and
- Collect quality baseline water quality data.

The Georgia Forestry Commission

The Georgia Forestry Commission has an agreement with EPD to educate the forestry community and promote the use of BMPs. Under the same agreement, the Commission monitors BMP implementation and investigates and mediates water quality and wetland complaints resulting from forestry practices. BMP workshops are available for foresters and loggers through the Master Timber Harvester (MTH) Program offered by the University of Georgia's Center for Forest Business. Continuing education is also available through the Southeastern Wood Producers Association. Most timber companies require loggers to attend MTH workshops in order to deliver wood to their yards (GFC).

Georgia Soil and Water Conservation Commission

The Georgia Soil and Water Conservation Commission (GSWCC) was formed to help conserve and protect Georgia's water resources. The Commission works to control erosion, sedimentation, and non-point source pollution from agricultural and urban lands through education of land disturbers, local governments, and erosion and sediment professionals, and through the promotion of BMPs. Financial assistance from the federal Farm Bill for BMP implementation is administered through the soil and water conservation districts. The Commission's Water Resources and Land Use Planning program also helps to identify water policy issues that can be addressed in river basin plans.

The Georgia Department of Community Affairs

The Georgia Department of Community Affairs (DCA) assists state agencies, regional development centers, and communities with a variety of development issues, including environmental concerns such as water quality protection. Its Planning and Environmental Management Division helps to support local government efforts by reviewing land use plans and ordinances designed to protect water quality, and the Division provides funding and technical assistance for many programs that impact water resources. The Department's Water Resources Toolkit provides a variety of information and resources for local governments to use in developing watershed protection programs. The

Department also houses Keep Georgia Beautiful, the state affiliate of Keep America Beautiful. Sixty-three affiliates across the state promote community environmental activities, which have expanded to include water conservation, watershed protection, and nonpoint source pollution control.

The Association of County Commissioners of Georgia

The Association of County Commissioners of Georgia (ACCG) is a nonprofit organization of Georgia's county governments. The purpose of ACCG is to assist county governments by providing an organizational structure that allows consensus building in all areas of policy. The Association has six standing policy committees, including one on natural resources and the environment. In addition to its involvement in policy formulation, ACCG hosts meeting and training programs throughout the state to assist in information exchange and education, and offers an array of member services including insurance, financial, technical, and managerial assistance.

Georgia Municipal Association

Representing municipal governments, the Georgia Municipal Association (GMA) is a non-profit organization that provides educational, technical, advocacy, and consulting services to its members. The Association has provided information and training to help communities deal with financial and infrastructural issues related to water and wastewater, particularly those issues arising from new development and growth.

The Georgia River Network

Georgia River Network is the only statewide nonprofit environmental organization solely dedicated to the conservation of Georgia's waters. The Network helps people organize to protect and restore rivers and watersheds by building local watershed group capacity and providing statewide policy analysis. Its stated goals are to:

- Increase the number of people involved in the protection and management of Georgia's waters;
- Improve awareness of the issues that threaten the health of our waters;
- Establish infrastructure for the exchange of resources among parties working to improve the protection of Georgia's waters.
- Provide necessary means to advocate for the physical, chemical, and biological integrity of our waters.

Summary

Georgia statutes and regulations have largely been established in support of water quality protection goals established by the Clean Water Act and other federal laws. Although

authority for water quality protection rests largely with EPD, a number of other state-wide, regional, and local entities play important roles as well. As the duties and responsibilities of the various governmental entities are further refined in the comprehensive planning process for Georgia, it will be important to avoid redundancies while providing cooperative and effective programs.

Chapter 4

WATER QUALITY STANDARDS/MONITORING

In their natural state, the biological and physical characteristics of surface waters and ground waters are highly variable; even in the absence of human influences, some water bodies are less able to support certain uses than others. Nevertheless, establishing minimum standards for water quality is critical for sustaining the highest possible water quality for all uses.

Water quality standards provide the foundation for permitting decisions and other mechanisms for protecting water quality. As noted in the previous chapter, water quality standards established by the Clean Water Act have three components: (1) a designated use or classification, (2) criteria, and (3) an antidegradation policy. The designated use determines the lowest acceptable water quality for a category of water bodies or stream/river segments, based on needs for domestic, industrial, or agricultural water supply; aquatic habitat; recreational use; fishing, and other beneficial uses. Criteria are used to determine what constitutes adequate water quality for each designated use. Finally, antidegradation policy is used to help ensure that present water quality, whether excellent or poor, is not degraded or further degraded.

The Clean Water Act sets specific goals for water quality, requires states to implement water quality protection programs (e.g., NPDES permitting and TMDL development), and helps provide funding for these and other programs. Under these guidelines, states are responsible for establishing appropriate designated use classifications, developing criteria for meeting those uses, monitoring waterways to ensure that water quality standards are met, and reporting on the quality of their waters to USEPA.

For the purpose of 303(d) listing under the Clean Water Act, a waterbody is considered impaired if it fails to meet water quality standards or the specific standards for its designated use established by the state. Waters on this list are divided into those that only partially support or do not support their designated use. If identified as impaired, the waterbody is subject to TMDL establishment and increased protective measures, as described in Chapter 2.

States vary widely, however, in the approaches they use to identify impaired waters. According to a 2002 report by the U.S. General Accounting Office, differences among state approaches to water quality standards and classification stem from differences in the following:

1. Water quality standards (including designated or beneficial uses and criteria) for determining which waters are impaired;
2. Types of monitoring practices used to ascertain whether those standards are exceeded;

3. Procedures used to assess water quality data to make listing decisions; and
4. Guidance USEPA regions give on grounds for removing waters from state lists of impaired waters. (USGAO)

Water quality can be impaired by a wide variety of inputs, including conventional and toxic pollutants, sediments, nutrients, and/or by alterations in natural temperatures. Table 3 shows the most common impairments found in water bodies.

Table 3. Top Ten Most Common Impairments in Georgia

General impairment	Percent reported
Fecal	47.6
Biota	15.9
Dissolved Oxygen	17.7
Fish Consumption	12.2
Metals	3.8
Organic Toxins	0.1
Toxicity	1.1
pH	1.4
Temperature	0.2
Chlorophyll a	0.1

Source: EPD

Water Quality Criteria

Criteria for attaining water quality standards describe physical, chemical, and biological attributes or conditions as measurable numeric (e.g., parts per million of a pollutant) or narrative (e.g., free from sludge, oil, and scum). Both types of criteria are valuable in assessing water quality. Numeric criteria are invaluable for establishing measurable goals, while narrative criteria provide a means of conveying contextual information that may be missed in quantitative analysis alone.

Biological Assessment

Biological integrity is commonly defined as “the ability to support and maintain a balanced, integrated, and adaptive community with a biological diversity, composition, and functional organization comparable to those of natural aquatic ecosystems in the region” (USEPA 1995). Components of biological assessment include the presence and seasonality of key indicator species; the abundance, diversity, and structure of the aquatic community; and the habitat conditions required for these organisms (USEPA October 2005).

The use of biological integrity as an indicator of environmental quality is unique in its ability to:

- Use information gathered directly from the aquatic organisms and the biological community of which they are a part;
- Consider that biota is shaped by all environmental factors to which it is exposed over time; and
- Combine multiple, community level, biological response characteristics into an indicator of cumulative environmental impacts. (USEPA 1995)

When using biological assessments to make listing determinations, states should also consider other types of data (i.e., physical and chemical). However, when biosurvey data and chemical and/or physical data differ, USEPA supports the principle of independent applicability, meaning that if one indicator shows that a segment should be listed as impaired, that indicator is sufficient for listing.

In its *Summary of State Biological Assessment Programs for Streams and Rivers* (1995), USEPA suggested applying minimum requirements for state biological assessment programs as part of the Section 305(b) reporting requirements. The following are the characteristics the agency recommended for state programs.

- *Multiple assemblages*: Use of more than one organism group is believed to give greater accuracy in detecting water resource quality impairment from human activities, as well as substantially decreasing uncertainty in the assessment.
- *Multiple metric indices*: These are recommended to strengthen data interpretation and reduce error in judgment based on isolated indices and measures. Reliance on several ecological attributes of the community that can be tested and combined into an index is recommended for an overall assessment of biological condition.
- *Habitat structure assessment*: This is a critical element of a biosurvey used to assist in the interpretation of biological data and discerning effects of physical habitat alteration from chemical impacts. Habitat structure assessments are used with biosurveys to establish the biological potential of water bodies.
- *Regional reference condition*: Describing a reference condition from an aggregate of data from several minimally-impaired sites is preferable to using data from only a single reference site from which to compare biosurvey results. The regional reference condition is based on data collected from those minimally-impaired sites representing regions of similar physical characteristics such as climate, soils type, physiography and vegetation (e.g., ecoregions) and further stratified by drainage area, stream order, size, and/or subcoregions.
- *Index period*: This is a defined time period during which the data are collected; an index period minimizes effects of year to year variability, reduces seasonal variability, and provides optimal accessibility of the target assemblages, and maximizes the efficiency of sampling gear.

- *Standard operating procedures (SOPs) and quality assurance (QA) program:* The validity of a biological assessment and the interpretation of the results is dependent on an effective QA plan, and documented SOPs for developing study plans, maintenance and application of field sampling gears, and performance of laboratory activities are integral quality control components for any program.

Antidegradation

The concept of antidegradation is to prevent pollution of waters that are meeting water quality standards and to prevent additional pollution of waters that violate standards. This policy also prevents an impaired waterbody from being downgraded to a lower water classification so that it can then meet its designated use. As described in Chapter 2, the federal antidegradation policy established by amendments to the Clean Water Act is based on a three-tier system. Tier one is a prohibition on increased pollution of already impaired waters. Tier two requires a cost-benefit analysis for new pollution sources that propose to discharge into “high-quality waters.” Tier three provides the highest level of protection to Outstanding Natural Resources Waters (ONRW).

Antidegradation methods or procedures generally include reviews for all new and expanded regulated activities that might lower water quality, such as wastewater treatment, stormwater, confined animal feeding operations (CAFOs), and other point source and nonpoint source effluent discharges subject to NPDES discharge permits (as well as other certain other activities regulated by federal or state authorities, such as dredging/filling) (USEPA October 2005).

Water Quality Monitoring

Water quality monitoring can serve a variety of purposes. It is generally done for one of five reasons:

1. Characterize water quality and identify trends over time;
2. Identify specific water quality problems;
3. Design pollution prevention or remediation programs;
4. Determine whether existing water quality regulations are effective; and
5. Respond to emergencies. (USEPA 2006)

How is water quality measured?

The abundance and variety of aquatic plant and animal life, particularly assemblages of macroinvertebrates, can be an efficient way to assess water quality. Indices of biotic integrity (IBIs) are a common tool for assessing water quality and overall stream health.

Typically, IBI scores of a disturbed site are compared to those of a nearby site in a more pristine setting; however, it may be difficult, if not impossible, to locate a stream segment that is in a purely natural state. A second way to assess stream condition is to test for specific constituents, such as dissolved oxygen, suspended sediments, nutrients, metals, pesticides, and the like. A third method is to assess certain physical features of the stream, such as stream bank conditions and water flow, temperature, clarity and color. Because none of the three methods give a complete picture of water quality, water monitoring programs often employ a combination of these methods. Depending on the type of monitoring, determinations of impairment can therefore be quite varied from one state to another.

In 1991, the Intergovernmental Task Force on Monitoring Water Quality, composed of more than 80 federal, state, local, and private organizations, issued two reports and a set of recommendations for a nationwide water monitoring strategy. Among its recommendations were the following:

- Develop closer working relationships among organizations that monitor and use water information;
- Facilitate the design of monitoring programs that measure progress in meeting clearly stated goals;
- Identify national indicators to answer key water quality questions;
- Develop comparable technical methods;
- Facilitate data automation, sharing, and accessibility;
- Improve quality assurance/quality control; and
- Improve assessment and reporting of water quality conditions. (USEPA 2006)

In 2003 USEPA published the document, *Elements of a State Water Monitoring and Assessment Program*. To achieve an effective monitoring and assessment program, the agency expects states to implement the following elements for a comprehensive monitoring and assessment program within a ten-year period:

1. The state needs a comprehensive watershed assessment strategy that addresses all State waters, including all waterbody types.
2. Objectives of the watershed assessment program need to be consistent with the Clean Water Act (CWA) and address all the data requirements of the CWA.
3. The monitoring strategy needs to describe the design and rationale for selecting monitoring sites.

4. The strategy should describe what parameters the state will use for assessing water quality. Parameters should include physical/habitat, chemical/toxicological, and biological/ecological endpoints as appropriate to assess attainment of water quality standards throughout the State.
5. The strategy needs to include quality assurance objectives and quality management plans that ensure the quality of data collected and reported.
6. State monitoring and assessment programs should also address data management, and provide for an accessible electronic data system for water chemistry, fish tissue, toxicity, sediment chemistry, habitat, and biological data.
7. The methodology used for data analysis and assessment should also be addressed and describe the monitoring strategy.
8. The watershed assessment program needs to provide timely reporting of data results and lists as described under Sections 305(b), 303(d), and 314 of the CWA and Section 406 of the Beaches Act.
9. The monitoring strategy should be periodically reviewed by the state in conjunction with USEPA. This audit of the monitoring program will determine how well each of the elements is addressed and specify what changes or additions are needed to the monitoring program.
10. Finally, the strategy should describe current and future resource needs to fully implement the state's monitoring program. This should address, funding, staffing, training, laboratory resources, and needed improvements.

Georgia EPD developed a Monitoring Strategy which was approved by USEPA in 2005.

Who conducts monitoring?

Monitoring takes place on many levels of organization and of expertise, from federal agencies to local citizen monitoring groups. How this information is used is determined by state-level water pollution authorities. Examples of monitoring groups include:

- State pollution control agencies;
- Interstate commissions;
- Local governments;
- USEPA;
- USGS (through its National Stream Quality Accounting Network (NASQAN) and its National Water Quality Assessment Program (NAWQA);

- U.S. Fish and Wildlife Service (FWS);
- National Oceanic and Atmospheric Administration (NOAA);
- U.S. Army Corps of Engineers (USACE);
- Tennessee Valley Authority (TVA);
- Other federal agencies; and
- Private universities, watershed associations, environmental groups, industries, water and wastewater treatment plant operators, and individuals.

Data Collection and Submission

Each state is required to “assemble and evaluate all existing and readily available water quality related data and information” from a variety of organizations, such as those listed above, to develop lists of impaired waters (40 CFR section 130(b)(5)). Data and information should include but not be limited to the following types:

- Observed effects;
- Closures, restrictions, and other advisories applicable to swimming, fish consumption, and drinking water;
- Violations of Safe Drinking Water Act standards;
- Segment-specific ambient monitoring (chemical, physical, and/or biological);
- Large-scale probabilistic monitoring designs;
- Simple dilution calculations;
- Predictive (simulation) modeling;
- Landscape analysis;
- Remote sensing; and
- Complaints and comments from the public.

Because information may come from a wide variety of sources, obtaining the greatest amount of high-quality data requires evaluation of existing and readily available information and “should strike a balance between (1) employing only the highest quality data, and (2) employing as much useful information about the condition of as many

segments as possible.” USEPA also recommends that states work with data-generating organizations on a continual basis to help ensure that data are collected and stored such that data will be of high quality (USEPA 2005b). In addition, EPD accepts data from organizations that have submitted a state approved Sampling and Quality Assurance Plan.

Reporting and Data Storage

The Agency “strongly encourages” states to submit a single report that satisfies the reporting requirements of CWA sections 303(d), 305(b) and 314. Georgia has prepared and submitted an integrated report since the early 1990s. The following individual reporting requirements can be integrated into one report and may also satisfy requirements for certain federal grant applications (e.g., section 106 grant funds and section 205(j) grant funds):

- Section 303(d): By April 1 of all even numbered years, a list of impaired and threatened waters still requiring TMDLs; identification of the impairing pollutant(s); and priority ranking of these waters targeted for TMDL development within the next two years.
- Section 305(b): By April 1 of all even numbered years, a description of the water quality of all waters of the state (including rivers/streams, lakes, estuaries/oceans, and wetlands.
- Section 314: In each section 305(b) submittal, an assessment of status and trends of significant publicly owned lakes, including extent of point source and nonpoint source impacts due to toxics, conventional pollutants, and acidification. (USEPA 2005b)

Some agencies and organizations maintain databases for storing and sharing water quality information. One such database is USEPA’s STORET (for STOrage and RETrieval) system, which stores data collected by federal, state, and local agencies, and some private entities.

Emerging Water Quality Issues

Issues that have gained recognition as water quality protection concerns within the last decade or so, commonly referred to as “emerging” issues, are pollutants that have become ubiquitous in our environment and pose subtle yet significant dangers. These pollutants are substances found in household cleaning agents, personal care products, pharmaceuticals, chemicals used in gardening and large-scale agricultural activities, and others. The literature commonly refers to two broad categories of these pollutants: “pharmaceuticals and personal care products,” or PPCPs, and a broad class of “endocrine disrupting” chemicals (also known as “hormone imposters”). There is significant overlap between these two categories of pollutants, as many pharmaceuticals and personal care products can also be disruptive of endocrine system functions in wildlife and humans.

Endocrine disrupting chemicals alter hormone functions in the following ways:

- Mimicking estrogens and androgens by binding to hormone receptors or influencing cell signaling pathways;
- Blocking or altering hormonal binding to hormone receptors or influencing cell signaling pathways. Chemicals that block or antagonize hormones are referred to as anti-estrogens (hormones that generally promote female characteristics) or anti-androgens (hormones that generally promote masculine characteristics);
- Altering production and breakdown of natural hormones; and
- Modifying the development and function of hormone receptors. (Tulane)

Numerous examples of such alterations have been identified in fish, bird, and other species. Among the most well publicized examples are eggshell thinning and abnormal mating behavior of fish-eating birds in the Great Lakes area and population decline in American alligators in South Florida due to hormonal and developmental abnormalities. Such dramatic effects in nature have raised concern about effects on humans of low-level exposure to endocrine disrupting chemicals. Human and experimental animal studies have determined that high-level exposure to certain environmental chemicals can impair fertility and increase the rate of spontaneous abortion. Although changes in human health trends (e.g., increased cancer rates and younger average timing of puberty) have raised concern about linkages to environmental contaminants, data are lacking to firmly support causal connections.

Because tens of thousands of man-made and naturally-occurring chemicals have the potential to act singly or synergistically on various biological systems, the identification and regulation of endocrine disrupting chemicals is uniquely difficult. This does not lessen their significance. In 1999, USEPA listed more than 52,000 U.S. lakes for having toxic levels of contaminants (generally mercury, PCBs, chlordane and DDT) in fish or wildlife (Windham). Predatory species are especially likely to have high levels of contaminants because many chemicals bioaccumulate, or become more concentrated as they move up the food chain.

The Office of Research and Development at USEPA is placing a high priority on the investigation of suspected endocrine disrupting chemicals. Risk management strategies are being developed to minimize exposure of humans and wildlife to these chemicals, focusing on areas such as wastewater treatment, drinking water treatment, and pollution prevention. For more information, visit USEPA's Endocrine Disrupting Chemicals Risk Management Research page at <http://www.epa.gov/ORD/NRMRL/EDC/>.

Water Quality Standards and Monitoring in Other States

Please note that more detailed summaries of water quality policies in other states are provided in Appendix B through E. References for these appendices are provided by state in the Reference section. A summary of Georgia's standards and monitoring policies can be found in Chapter 3.

Connecticut

The Planning and Standards Division of the Bureau of Water Management (BWM) within the Connecticut Department of Environmental Protection (DEP, Department) is responsible for the management of the state's surface water, including water quality.

Water Quality Classification

Connecticut has established nine surface water classifications used to describe designated uses, and for each class there is an associated set of narrative and numeric criteria including parameters such as dissolved oxygen concentrations, aesthetics, color, indicator bacteria concentrations, chemical constituent concentrations, and the taxonomic composition of benthic invertebrates. Connecticut DEP produces and maintains GIS-based maps of the surface and ground water classifications for the entire state. Each stream or river is assigned a single classification, and reclassification is subject to public notice requirements and a public hearing.

Connecticut's water quality criteria do not apply to certain conditions brought about by natural hydrologic and geologic causes. Also, conditions that exist in the surface water that are brought about in part due to normal uses of land may be considered natural, provided that BMPs are implemented. *E. coli* are measured in freshwaters with designated uses that include swimming and other recreational uses, and total coliform is measured in waters that are existing or proposed drinking water supplies.

Water Quality Monitoring

Ambient monitoring: Connecticut DEP has organized surface waters of the state into a hierarchical system of natural drainage basins comprised of four levels: major basins, regional basins, subregional basins, and local basins. The state has eight major basins, 45 regional basins, 336 subregional basins, and 2,893 local basins. The Department monitors water quality on a rotating basis. The eight major basins are divided into five hydrologic assessment units, and monitoring and assessment efforts concentrate on one unit each year over a five-year period. Prior to implementation of the rotating strategy, approximately 10 percent of the stream miles in the state were monitored, yet one year after implementation, this percentage increased to an average of 20 percent of stream miles within each targeted basin. Connecticut's annual expenditures for ambient surface water quality monitoring average between \$500,000 and \$800,000 per year, including expenses related to a cooperative monitoring network with USGS (Pizzuto).

Physical and chemical monitoring: Connecticut DEP partners with the USGS to collect physical and chemical water quality data throughout the state. Thirty water quality parameters are collected at 33 sites on 15 rivers approximately eight times per year. Sampling sites are located primarily on large, interstate rivers, waste receiving streams, and selected unimpaired reference sites. The data are used to support trend assessment, determine compliance with water quality standards, and establish reference conditions on minimally impaired streams.

Biological monitoring, which entails an assessment of the structure and health of aquatic communities, by the Bureau of Water Management focuses primarily on the benthic invertebrate community. Sampling is conducted at approximately 50 sites each year, consistent with the rotating basin schedule. Each site is sampled once per year, typically in the fall. Site selection corresponds with the physical and chemical assessment sites. The Bureau also cooperates with the Division of Inland Fisheries within DEP to incorporate fish community data into water quality assessments.

Aquatic toxicology testing is routinely conducted by the Bureau of Water Management on wastewater effluents and surface waters for toxicity to aquatic organisms. Two invertebrate species and one fish species are cultured and tested in the laboratory for both acute and chronic effects. The results are used to evaluate permit compliance for point source discharges and to quantify the assimilative capacity of surface waters to toxic compounds. Testing is concurrent with the basin testing rotations.

Intensive water quality surveys: Intensive surveys are conducted to obtain data at a greater degree of spatial or temporal resolution. Typically, these studies are in support of TMDL development, determination of compliance with water quality classifications, or to evaluate the effects of pollution control measures.

Volunteer monitoring: Connecticut DEP facilitates the involvement of citizen groups by offering volunteers three tiers of participation: observation monitoring, application of rapid bioassessment protocols, or implementation of a specific monitoring plan. Groups are encouraged to report their findings to DEP's Ambient Water Quality Monitoring Program.

Water quality forecasting: Connecticut's land use planning efforts allow for making generalizations pertaining to future water quality relative to economic development and population growth, but the state currently does not have specific models in place to forecast long-term water quality demands.

Florida

Florida Department of Environmental Protection (DEP, Department) is the lead agency for the protection of Florida's water quality; however, the five water management districts have established pollutant reduction goals and impact waste assimilation through minimum flow and level policies for surface water and ground water. Water management districts also issue environmental resource permits.

Water Quality Classification

The state's five water quality classifications are hierarchical and arranged in order of the degree of protection required, from Class I (potable water supplies) to Class V (navigation, utility, and industrial use). Numeric criteria are designed to maintain the minimum conditions necessary to assure the suitability of water for the designated use of each classification.

Specific criteria are established for dissolved oxygen, thermal pollution, and bacterial pollutants. Drinking water systems are not required to monitor for unregulated contaminants, including emerging pollutants.

- Dissolved oxygen levels that are attributable to natural or man-induced conditions that cannot be controlled or abated may be established as alternative dissolved oxygen criteria for a water body or portion of a water body. The alternative criteria, however, may not result in lower levels of dissolved oxygen in the water body or adjacent waters, and may be established only after public notice and hearing.
- For assessing thermal pollution, the state is divided into two general climatological zones below and above 30 degrees N. No discharge may increase the temperature of the water body such that damage is caused to aquatic life or vegetation, and must not interfere with the water body's intended use.
- Domestic wastewater treatment plants are required to test for fecal coliform at intervals that vary from monthly to daily, depending on the capacity of the facility. Surface water quality standards include criteria for bacteriological quality (fecal coliform and total coliform). *Enterococci* and *E. coli* are monitored only in coastal waters at publicly accessible beaches.

In addition to its surface water classification, a water body may also be afforded higher protection with designation as an Outstanding Natural Resource Water. As such, degradation of water quality is to be permitted by Florida DEP only in specific cases specified in the administrative code. These waters are afforded special protection because of exceptional recreational or ecological significance. They generally include waters in state or federally managed parks, wildlife refuges, wilderness areas, or wild and scenic rivers.

Water Quality Monitoring

Florida DEP's Integrated Water Resources Monitoring Program uses a three-tiered approach to monitoring surface water quality, ranging from general to specific. Tier I is used to develop estimates of statewide water quality based on a representative sample. Tier II addresses basin- and stream-specific questions used to verify waterbody

impairment. Tier III includes monitoring associated with regulatory permits, TMDL development, and designation of BMPs.

Tier I monitoring includes data collection from six major water body categories: four for surface water and two for ground water. The categories of surface water bodies are major rivers, streams, large lakes, and small lakes. The sampling protocol is designed around the 29 USGS delineated hydrologic units in Florida, and each year, five or six of the units are monitored. For each water body type, 30 sample sites are selected according to USEPA protocols for random site selection.

The Bureau of Watershed Assessment, within DEP's Division of Water Resources, conducts additional monthly monitoring of 75 sites for ambient or trend analysis of state-wide water quality. In total, Florida's annual ambient surface water quality monitoring expenditures are approximately \$2 million dollars (Sloan).

Water management districts use long-term trend analysis to develop water withdrawal schedules as they affect the assimilative capacities of district water bodies. In lieu of specific predictive models to ensure that streams meet future water quality/quantity needs, the state actively encourages the development of new water resources and the use of lesser quality waters for uses that do not require water of drinking quality.

Bioassessment Tools

Florida DEP has developed two bioassessment tools which are used in to monitor water quality in tiers I-III. The seven-metric Stream Condition Index (SCI) is a composite macroinvertebrate index for use in flowing streams, based on seven metrics describing the taxonomic composition of the macroinvertebrate population. Once calculated, points are assigned for each metric based on bioregionally-specific criteria. There are three bioregions in Florida: the panhandle, peninsula, and northeast. Points from each of the metrics are then summed to rate a site as excellent, good, fair, or poor.

Bioreconnaissance (BioRecon) is used as an initial watershed screening method to determine whether additional resources should be allocated to the area. It is based on three metrics that are a subset of those used in SCI. If a site fails to pass two out of the three criteria, the site is recommended for more intensive study.

Habitat Assessments

A habitat assessment is conducted in conjunction with all macroinvertebrate sampling. These characteristics require the biologist to record a variety of physical and chemical parameters observed in the field for later use in interpreting overall assessment results. Data collected falls into two general categories: riparian zone/instream features or sediment substrate. Each category requires measurement of specific features and conditions.

North Carolina

The North Carolina Division of Water Quality (DWQ) in the Department of Environment and Natural Resources is the agency responsible for statewide regulatory programs for water quality protection. The Environmental Management Commission is responsible for adopting rules for the preservation, protection, and enhancement of the state's air and water resources. The Classification and Standards Unit within the DWQ is responsible for the development and implementation of the state's surface water quality standards and classifications.

Water Quality Classification

All state surface waters in North Carolina have been assigned primary classifications as well as supplemental classifications for certain waters requiring additional protection. North Carolina surface waters can be assigned one or more of twelve primary classifications. Classifications are not exclusive; a water body may be assigned to two or more classes.

- Classes B and C are protected for primary and secondary recreation, respectively. Primary recreation comprises activities that involve human body contact with water, while secondary recreation includes boating, fishing, and other activities in which body contact is infrequent or incidental.
- Water Supply I through IV denote a variety of classes of potable water supplies; Water Supply V denotes waters draining to or upstream potable supplies.
- Five additional primary classes apply to wetlands (WL), tidal salt waters (SC), saltwater wetlands (SWL), surface waters used for shellfishing (SA), and additional surface waters used for primary recreation (SB).

Supplemental classifications include Future Water Supply (FWS), High Quality Waters (HQW), Nutrient Sensitive Waters (NSW), Outstanding Resource Waters (ORW), Swamp Waters (Sw), Trout Waters (Tr), and Unique Wetlands (UWL).

A waterbody's classification may be changed at the request of a local government or a citizen. The North Carolina DWQ reviews each request and conducts an assessment of the waterbody to determine whether reclassification is appropriate. The Department also conducts periodic assessments which may result in a recommendation for reclassification. A formal rule-making process is then required for reclassification to occur.

In addition to primary and supplemental classifications assigned by DWQ, additional classifications are assigned by other agencies:

- The North Carolina Natural and Scenic Rivers Act of 1971 created three river classifications: Natural, Scenic, and Recreational. These designations place no

land use or development restrictions on private lands except on the construction of dams and other water resources projects.

- A state fishery management system administered by the North Carolina Wildlife Resources Commission regulates Designated Public Mountain Trout Waters. (This is not the same classification as DWQ's Tr classification for trout streams.)
- The Division of Coastal Management is responsible for maintaining estuarine Areas of Environmental Concern (AECs) and establishing Specific Use Standards that specify the types of projects and construction methods that may be used in AECs.
- The Shellfish Sanitation and Recreational Water Quality Branch of the Division of Environmental Health classifies saltwaters for their quality and public safety relative to the harvesting of shellfish.

Water Quality Monitoring

North Carolina has two primary programs for monitoring water quality: the Ambient Monitoring Program and the Basin-wide Planning Program, both administered by DWQ.

The Ambient Monitoring Program is designed to monitor water bodies to support the Basinwide Water Quality Management Plan, USEPA reporting requirements, and development of TMDL and NPDES permit limits. A suite of water quality indicators is measured at each of 365 stations, including temperature, specific conductance, turbidity, total suspended residue, dissolved oxygen, metals, fecal coliform, and weather conditions. Additional indicators may be included depending on site conditions. North Carolina's expenditures for fixed-station monitoring average approximately \$1.5 million per year (Overton).

The Basin-wide Planning Program is a non-regulatory, watershed-based approach to restoring and protecting water quality. Plans are prepared for each of the state's 17 major river basins. Part of the planning process involves a Basinwide Assessment, including data collection and analysis from three units:

- The Biological Assessment Unit assesses the biological integrity of streams by examining the structure and health of fish communities, incorporating information about species richness and composition, trophic composition, fish abundance, and fish condition.
- The Aquatic Toxicology Unit conducts aquatic toxicity tests that allow determination of the combined effects of all constituents in a solution. Tests may be conducted on samples of wastewater, individual chemical compounds, or actual stream samples and can be sensitive enough to determine not only lethality but also suppression of reproduction or growth of the test organisms. This program has become a nationally recognized leader in its field.

- The Intensive Survey Unit collects and interprets a variety of biological, chemical, and physical data that are incorporated in the basinwide assessment. Special studies include water quality characterization for model support, sediment evaluations for oxygen demand, nutrient flux, chemical contamination, and a variety of other investigations. These models help to quantify current water quality demands rather attempting to predict long-term water quality characteristics and requirements.

Ohio

As the lead agency for water quality protection, the Ohio Environmental Protection Agency (Ohio EPA, Agency), Division of Surface Water, assigns one or more beneficial use designations to surface waters of the state.

Water Quality Classification

Ohio EPA assigns one or more use designations to surface waters of the state in three separate categories:

- Beneficial Use Designations for the Protection of Aquatic Life
 - Coldwater Habitat: waters that sustain native cold water or cool water species or put-and-take trout stocking.
 - Exceptional Warmwater Habitat: waters that support a unique and diverse assemblage of fish and invertebrates.
 - Seasonal Salmonid Habitat: waters that support lake run steelhead trout fisheries.
 - Warmwater Habitat: waters that support assemblages of fish and invertebrates similar to the least impacted reference conditions.
 - Limited Warmwater Habitat: waters are exempt from certain criteria; this designation is being phased out.
 - Modified Warmwater Habitat: waters that support tolerant species of fish and macroinvertebrates. Often, the water's condition precludes complete recovery.
 - Limited Resource Waters: waters that support fish and macroinvertebrate populations that are severely limited by physical habitat or other irretrievable condition.

- Designations for the Protection of Recreational Activities (The following use designations are in effect only from May 1 to October 15 for most aquatic life designations, and from June 1 to September 30 for salmonid habitat waters)
 - Bathing Waters: waters that, during the recreation season, are suitable for swimming.
 - Primary Contact Recreation: waters that, while not used regularly for swimming, are at a depth that allows full body immersion. These waters are typically close to residential areas.
 - Secondary Contact Recreation: waters that are at depths that preclude full body immersion. These waters are not located in close proximity to residential areas.
- Designations for the Protection of Water Supplies
 - Public Water Supply: waters that are within 500 yards of all public water supply surface water intakes, all publicly owned lakes and reservoirs, all privately owned lakes and reservoirs used as a drinking water source, and all emergency water supplies.
 - Agricultural Water Supply: waters that are used, or potentially used, for livestock watering and irrigation.
 - Industrial Water Supply: waters used for industrial purposes.

Water quality criteria include narrative “free froms” criteria, which state that all waters shall be free from sludge, floating debris, oil and scum, color and odor producing materials, substances that are harmful to human, animal, or aquatic life, and nutrients in concentrations that may cause algal blooms. Much of Ohio’s present strategy regarding water quality based permitting is based on the narrative free from, “no toxics in toxic amounts.”

Ohio also uses numeric criteria and biological evaluation tools to evaluate water quality. Each surface water use designated by Ohio EPA is assigned a unique set of numeric criteria, consisting of chemical criteria, whole effluent toxicity levels, and biological criteria. Chemical criteria are derived from laboratory studies of biological organisms’ sensitivity to specific chemicals or combinations of chemicals. Whole effluent toxicity levels indicate the harmful effects of an effluent on living organisms. Biological criteria are based on aquatic community structure and functional characteristics of an aquatic community.

Ohio EPA reviews and, as appropriate, revises water quality standards at least once every three years. The revision process involves public notification and opportunity for

comment. The Surface Water Division has convened special External Advisory Groups as a means to educate and build consensus on revisions to water quality standards.

Water Quality Monitoring

Each year Ohio EPA conducts surveys in 10 to 15 different study areas with an aggregate total of 300 to 400 sampling sites. Beginning in 1990, Agency initiated a rotating five-year basin approach to water quality monitoring. The state's waters were divided into 25 hydrologic units; within a given year, Ohio EPA monitors five of the units. Annual expenditures for the fixed-site ambient monitoring average approximately \$1 million (DeShon).

Data collected as part of the five-year basin approach are often environmental indicators that can be categorized as *stressor*, *exposure*, and *response* indicators. *Stressor* indicators include activities that impact the environment, including point and nonpoint source loadings, land use changes, and other broad-scale and often anthropogenic influences. *Exposure* indicators include chemical-specific, whole effluent toxicity, tissue residues, and biomarkers. *Response* indicators include the direct measures of the status of use designations. For aquatic life uses, Ohio EPA's biological criteria are the principal response indicators. For recreational uses, fecal bacteria (e.g., *E. Coli*, fecal coliform) are the principal response indicators.

Oregon

The Department of Environmental Quality (DEQ, Department) is the agency responsible for protecting Oregon's surface waters and ground waters. The Department's Water Quality Program accomplishes this by developing water quality standards for Oregon's waters, monitoring water quality in designated river basins, and controlling nonpoint source pollution through statewide management plans.

Water Quality Classification

Oregon's designated uses are established by basin. Each entire basin is assigned as many uses as is appropriate for the surface water body. The designated uses are as follows:

- Public domestic water supply;
- Industrial water supply;
- Irrigation;
- Livestock watering;
- Anadromous fish passage;
- Salmonid fish rearing;

- Salmonid fish spawning;
- Resident fish and aquatic life;
- Wildlife and hunting;
- Fishing;
- Boating;
- Water contact recreation;
- Aesthetic quality;
- Hydro power;
- Commercial navigation; and
- Transportation.

In addition to these use designations, Oregon DEQ may specially designate high quality water bodies as Outstanding Resource Waters to protect the water quality parameters that affect the ecological integrity of critical habitat or special water quality values that are critical to the unique character of those water bodies.

Oregon establishes both numeric and narrative water quality criteria. Numeric criteria assign numbers that represent limits or ranges of chemical concentrations or physical conditions. Narrative criteria describe what Oregon's waters will be "free from," such as oil and scum, color and odor, and other substances. Numeric and narrative criteria are given for all waters of the state in addition to basin-specific criteria necessary to meet the designated uses assigned for each basin.

Water Quality Monitoring

Oregon DEQ uses the Oregon Water Quality Index to track changes in water quality. The index was designed to allow comparison of water quality among different stretches of the same river or between different watersheds. The index benchmark measurement is tied to key indicator sites routinely monitored by DEQ, representing the range of water quality found throughout the state. Eight parameters are used in the index: temperature, dissolved oxygen for percent saturation and concentration, biochemical oxygen demand, pH, total solids, ammonia and nitrates, total phosphorus, and fecal coliform.

Oregon uses multiple programs for monitoring water quality: a rotating basin program, a large river network monitoring program, a reference site monitoring program, toxic/emerging pollutants monitoring, and volunteer monitoring.

To implement the rotating basin program, the Oregon Watershed Enhancement Board has divided Oregon's watersheds into 15 major river basins based on the USGS Hydrologic Unit Classification (HUC) level. Oregon DEQ implements a rotating basin program, assessing waters in three HUCs per year. Each year, 50 random sites are assessed within three HUCs, for a total sampling number of 150 sites. A new set of random sites is sampled within each basin once every five years, resulting in complete state coverage every five years.

The large river monitoring network is a fixed network of 151 sites on more than 50 rivers across the state. These sites cover fourth order and larger rivers, and coverage is approximately one site for every 56 miles of large river in Oregon. Most sites are sampled six times per year for chemical constituents.

Reference site monitoring consists of a network of sites that represent streams or stream segments with minimal human disturbance. These sites are sampled to provide data for evaluating regional conditions relative to water quality standards. Reference sites are sampled on the same timeline as the rotating basin program. Total expenditures for Oregon's network of surface water quality monitoring average approximately \$800,000 per year (Hafele).

South Carolina

South Carolina's Department of Health and Environmental Control (DHEC, Department), Office of Environmental Quality Control (EQC), has authority over the enforcement of federal and state environmental laws and regulations, and for the issuing of permit for activities that may impact the environment. The Bureau of Water within EQC is responsible for activities related to water quality, drinking water, pollution control, and recreational waters.

Water Quality Classification

All of South Carolina's water use classifications are designed to protect a balanced indigenous aquatic community of flora and fauna. Where surface waters are not classified by name, the use classification and numeric standards of the class of the stream to which they are tributary apply. The state has adopted the following classifications:

- Outstanding National Resource Waters (ONRW): water quality conditions are maintained and protected to the extent of the Department's statutory authority.
- Outstanding Resource Waters (ORW): freshwaters or saltwaters which constitute an outstanding recreational or ecological resource or those freshwaters suitable as a source for drinking water supply purposes with treatment levels specified by the Department.

- Trout Waters: the state recognizes three types of trout waters: Natural; Put, Grow, and Take; and Put and Take.
- Freshwaters: freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment; suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora; and suitable for industrial and agricultural uses.
- Shellfish Harvesting Waters: tidal saltwaters protected for shellfish harvesting and uses that fall under Class SA and SB. Suitable for primary and secondary contact recreation, crabbing, and fishing.

Waters where classified uses are not being attained can be reclassified if any of the following conditions apply:

- Natural conditions (including low flow) prevent attainment;
- Human caused conditions that cannot be effectively remedied prevent attainment;
- Dams or other hydrologic modification preclude attainment and restoration is not feasible;
- Physical habitat features of the water body preclude attainment of aquatic life protection uses; or
- Controls more stringent than Sec. 301(b) and 306 of the Clean Water Act would result in widespread economic and social impacts.

If one or more of the above conditions has been demonstrated, DHEC may grant a variance to an individual discharger for a specific pollutant or parameter. Any variance must be reviewed every three years and will not be granted without notice and opportunity for a public hearing.

Water Quality Monitoring

The biological, water quality, and shellfish monitoring program are conducted by the Aquatic Biology Section, the Water Quality Monitoring Section, and the Shellfish Sanitation Section within DHEC's Bureau of Water, respectively. Within the Water Quality Monitoring Section, two of the major programs are the Ambient Surface Water Monitoring and Aquatic Toxicology Programs. The Ambient Surface Water Monitoring Program coordinates a network of monitoring stations located across South Carolina. In addition to physical parameters measured at each station, surface water and sediment samples are collected and analyzed for chemical specific parameters on a periodic basis. The Aquatic Toxicology Program is responsible for monitoring to ensure that those holding discharge permits are in compliance with acute and chronic toxicity limits.

The Aquatic Biology Section (ABS) uses a variety of biological and chemical parameters and biological methods to assess streams, rivers, lakes and estuaries. The various biological programs collect data as part of both the Ambient Surface Water Monitoring and the Watershed Water Quality Management Strategy.

Ambient Surface Water Monitoring

In an effort to evaluate the State's water quality, DHEC collects data from a statewide network of fixed stations and rotating watershed monitoring stations. The ambient monitoring network is directed toward determining long-term water quality trends, assessing attainment of water quality standards, identifying locations in need of additional attention, and providing background data for planning and evaluating stream classifications and standards.

The ambient monitoring network includes integrator sites and special purpose sites. Integrator sites are a network of 313 permanent monitoring sites which are sampled once per month, year round, over an extended period of time. Sites are typically at the most downstream access of each of 320 Natural Resource Conservation Service designated watershed unit. Special purpose sites are sampled with equal regularity as integrator sites but target points of interest to DHEC such as locations of remediation activities, TMDL development sites, among others.

Watershed Water Quality Management Strategy

Administered by DHEC, the Watershed Water Quality Management Strategy provides for watershed monitoring on the eight major basins. Sites are sampled once per month, for full year, every five years. These sites target locations listed as impaired on the 303(d) list and locations where there is history of extensive monitoring in order to compare present to historic conditions. Significant trends in water quality and support of waterbody uses are identified and published in Watershed Water Quality Assessment document. Assessments are published once every five years for each basin.

Watershed Management Planning Program

The South Carolina Department of Natural Resources' River Conservation Program administers the Watershed Management Planning program. The goal of the program is to enable the creation of a community-based management plan that balances the interests of economic development and conservation of natural and cultural resources. Management plans address such issues as riparian zone management, water quality, recreation, wildlife management, agricultural and forestry practices, and the economic development needs of the community.

Summary

The states surveyed for this report vary tremendously in the number and types of freshwater classifications, ranging from four to 13 classes. Instead of having specific

classifications, Oregon assigns as many designated uses as are appropriate from a list of 16 possible uses. All six of the states surveyed have a special designation and more stringent water quality criteria for exceptionally high quality waters. Most states have both numeric and narrative criteria that include physical, chemical, and biological parameters. Most of these states also have a tiered and rotating approach for monitoring water quality that help ensure that as many water bodies as possible are monitored on an annual basis. Among the states surveyed, expenditures for ambient surface water quality monitoring average between \$500,000 per year to \$2 million per year, generally not including additional monitoring to establish TMDLs. (Georgia currently spends \$1.4 million to \$1.6 million to conduct its ambient surface water monitoring program. This figure includes TMDL monitoring.)

This collection of states was also surveyed regarding whether proactive approaches are being implemented to prevent future water quality problems. Although the states surveyed conduct a variety of modeling programs (e.g., flow models, pollutant and nutrient fate and transport models, mixing zone models, exposure assessment models), none of the states surveyed conduct modeling designed to forecast long-term future demands as they specifically relate to water quality protection. In Western states, water quality protection and water use allocations tend to take place in different state agencies, making coordination of quantity and quality policies more difficult. All of the states implement land use planning that is designed to be protective of water quality given future population growth and economic expansion; however, resources are generally being devoted to the recognition and resolution of current water quality challenges. An informal survey of water professionals produced similar findings: although water planning professionals tend to agree on the value of long-range forecasting models, these are generally not yet being implemented in the U.S. This is an area that may warrant further investigation, as such models would need to account for a variety of complexities involved with protection of water as it flows through differing political subdivisions.

Although long-term water quality forecasting has apparently not yet been implemented by state water planning agencies, the Chesapeake Bay Program launched an effort in 2005 to forecast water quality conditions on a short-term basis. It develops an “ecological forecast” for the following year by examining relationships between past environmental conditions and their causes and by applying a combination of current and historic data. Using this information, researchers are able to determine conditions that will likely appear in coming months. In 2005, the effort focused on a dissolved oxygen forecast and a harmful algal bloom forecast by comparing 20 years of historical data with recent weather conditions, nutrient levels, and river flow rates. The Chesapeake Bay Program may provide methodological insight for use in long-term forecasting models.

Chapter 5

STORMWATER MANAGEMENT

The Clean Water Act did much to improve water quality in the United States, but by the mid-1980s it became clear that there were still problems. The primary cause was traced to nonpoint source pollutants, particularly stormwater flows from industrial, municipal, and agricultural sources. The 1987 amendments to the Clean Water Act required USEPA to establish a program to address stormwater discharges and lead to the development of NPDES stormwater regulations and establishment of TMDLs.

A major threat to water quality today is urban development and the resultant nonpoint source pollution that enters waterways. Even relatively low levels of urbanization have been linked with changes in stream hydrology, geomorphology, and aquatic communities (Walters et al.). Three types of hydrologic changes of ecological significance are likely to result from urban development: increased frequency of high flows, redistribution of water from periods of base flow to periods of storm flow, and increased daily variation in stream flow (Konrad, et al.). Urban development also brings additional pollutants from runoff, and land-disturbing activities contribute to erosion and sedimentation, which can clog rivers and streams and carry a variety of contaminants into a waterway. Based on a 1997 study, USEPA identified specific documented impacts to receiving waters associated with urbanization and increased stormwater discharges:

- Increase in the number of bankfull events and increased peak flow rates;
- Sedimentation and increased sediment transport;
- Frequent flooding;
- Stream bed scouring and habitat degradation;
- Shoreline erosion and stream bank widening;
- Decreased baseflow;
- Loss of fish populations and loss of sensitive aquatic species;
- Aesthetic degradation;
- Changes in stream morphology; and
- Increased [water] temperatures. (USEPA 1999, stormwater)

Sediment impacts alone can cause profound changes in habitat by covering rocky substrates, increasing turbidity, and reducing light penetration. Prey capture for sight feeding predators is reduced, gills and filters of fish and aquatic invertebrates can be clogged, and spawning and juvenile fish survival can be affected (Ibid).

In addition, urbanization can affect ground water recharge. Both shallow and deep infiltration decrease as watersheds undergo development and urbanization. Ground water recharge is reduced along with a lowering of the water table (Ibid).

Pollutants contained in urban runoff that are potentially harmful to receiving waters include the following:

- Solids;
- Oxygen-demanding substances;
- Nitrogen and phosphorus;
- Pathogens;
- Petroleum hydrocarbons;
- Metals; and
- Synthetic organics.

Preventive measures can minimize the need for treatment and thus can produce significant long-term savings. According to USEPA, the costs of treating contaminated ground water supplies were, on average, 30 to 40 times greater than preventing their contamination. The Trust for Public Land and the American Water Works Association also found in a 2002 survey of 27 water suppliers that the more forest cover in a watershed, the lower the costs of treatment (TPL 2005). In terms of controlling nonpoint sources of pollution, land use and water quality are inextricably linked.

Natural protection areas serve a major function in terms of preventing pollution from nonpoint sources, as pointed out by the Trust for Public Land in its *Source Protection Handbook: Using Land Conservation to Protect Drinking Water Supplies*:

- *Small streams* constitute up to 85 percent of total stream length in a watershed and collect most of the water and pollutants from the land. Small streams are critical to maintaining water quality in large drainages because of their large surface-to-volume ratio. Small streams have been shown to remove nitrogen at the rate of eight times that of large streams. Headwater streams typically remove more than half of the nitrogen from their watersheds. However, because of their size, small streams are often ignored on planning maps, and this makes them all the more vulnerable to diversion, channelization, and elimination.

- *Riparian forests* reduce the pollutant loads that reach streams, prevent erosion and flooding, support the vast majority of wildlife species, and protect water supplies. Depending on the width, slope, soil type, and other factors, riparian buffers have been shown to remove 50 to 90 percent of nutrients and pesticides, 60 to 96 percent of pathogens, and 75 to 95 percent of sediments. The ideal width of a buffer depends on its purpose and function. If the purpose of the buffer is to trap sediment, it can be as narrow as seven meters. If it is expected to remove soluble pollutants, such as nitrate and pesticides, it should be 30 to 50 meters wide. If its purpose is to protect habitat and provide recreational opportunities and flood control, the entire riparian area should be protected.
- *Forested land* absorbs rain, traps and filters pollutants, refills underground aquifers, slows storm runoff, sustains late season flows, reduces flooding, maintains watershed sustainability and resilience, and provides critical habitat for wildlife. Studies show that the percentage of forested land in a watershed is one of the most important factors in determining water quality.
- *Wetlands* act as living filters by removing pollution from waters flowing through them. Studies of 14 different manmade and restored wetlands around the country showed average removal rates of 82 percent of sediment, 61 percent of total nitrogen, 62 percent of phosphorus, and 79 percent of metals (e.g., lead, zinc, and iron). Wetlands are also invaluable for the protection of fish and wildlife. Almost 43 percent of threatened and endangered animal species, as well as many plant species, are dependent on wetlands for survival, and coastal wetlands provide 60 to 90 percent of commercial fisheries spawning grounds.
- *Floodplains* play a critical role in filtering pollutants, recharging ground water, and minimizing the damaging impacts of floods. Rivers flood two to three times per year on average, and because flood waters carry heavy loads of pollutants and organic matter to water sources, floods comprise one of the greatest threats to water quality. In watersheds affected by development, less water infiltrates the soil, resulting in faster, stronger, and more frequent floods that cover a wider range (Ibid).

Stormwater strategies range from wide-scale land use management to site design measures and small-scale, site-specific controls. Large-scale strategies tend to focus on reducing overall imperviousness so that natural absorption can take place, while smaller-scale strategies focus on detaining stormwater in a way that filters out pollutants. The following suite of strategies was compiled by the Natural Resources Defense Council in *Stormwater Strategies: Community Responses to Runoff Pollution* (1999):

- *Area-wide measures* and nonstructural runoff control strategies have been found to be “crucial in the prevention of adverse environmental and economic impacts associated with urbanization.”

- *Growth management*: Concentrating development in certain areas creates less impervious surface overall, but locally, heavily urbanized areas require structural management measures.
- *Transportation-oriented design*: Concentrating development near transportation and commercial services results in fewer roads and vehicle miles traveled. This minimizes two components of stormwater runoff: impervious cover and pollutant discharge.
- *Watershed planning*: Effective watershed planning focuses on the relationship between land use and water quality, with planning informed by desired conditions in water bodies.
- *Conservation and performance zoning*: Under performance zoning, a municipality sets performance standards for open space preservation, impervious surfaces, maximum pollution emissions, and other criteria.
- *Buffers and open space protection*: Many local governments have achieved great success with a buffer system of protected natural areas around water bodies, sensitive areas, or steep slopes. An average buffer width of 100 feet can reduce imperviousness by up to five percent in a watershed.
- *Brownfield development and infill redevelopment*: Redevelopment and new infill development allows municipalities to take advantage of existing municipal infrastructure and reduces pressure to develop currently natural areas.

➤ Site design measures

- *Conservation design*: Conservation development concentrates homes on a limited percentage of the land comprising a residential subdivision, while leaving the rest of the land as open space. This optimizes infrastructure and reduces the amount of impervious surface.
- *Traditional neighborhood design*: Traditional neighborhood developments are based on principles of mixed use, with stores, offices, and schools within a short walk of homes. Like other high-density urban development, these create large areas of impervious surface, but they minimize its cover over the broader landscape.

➤ Site-specific/structural runoff control and treatment best management practices

- *Detention practices*: Detention ponds temporarily store runoff, then discharge it through a pipe or other outlet into streams or other water bodies. The purpose is to reduce peak flows and to improve water quality

by allowing stormwater sediments to settle out prior to entering waterways.

- *Biofiltration and bioretention practices*: Bioretention areas, also called rain gardens, use constructed vegetated areas to collect and filter stormwater. Infiltration through these areas enhances pollutant and sediment removal and allows runoff water to be cooled.
- *Infiltration practices*: Like detention basins, “retention” basins collect stormwater, except that these basins have no outlet. Instead, stormwater infiltrates through the bottom of the basin.
- *Filtration practices*: Stormwater collects in a basin and then is released through a filter system, often consisting of sand, peat, compost, or synthetic filter materials. Over time, these can clog and lose their effectiveness; siting, monitoring, and maintenance are therefore important.

Watershed Planning

Improvement of water quality is often addressed on a regional or watershed basis, as land use decisions can be key to the introduction of nonpoint source pollutants. In its *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (2005), USEPA identified six specific steps and associated activities for the watershed planning and implementation process:

1. Build partnerships

- Identify key stakeholders
- Identify issues of concern
- Set preliminary goals
- Develop indicators
- Conduct public outreach

2. Characterize the watershed

- Gather existing data and create a watershed inventory
- Identify data gaps and collect additional data if needed
- Analyze data
- Identify causes and sources of pollution that need to be controlled

- Estimate pollutant loads
3. Finalize goals and identify solutions
 - Set overall goals and management objectives
 - Develop indicators/targets
 - Determine load reductions needed
 - Identify critical areas
 - Develop management measures to achieve goals
 4. Design an implementation program
 - Develop implementation schedule
 - Develop interim milestones to track implementation of management measures
 - Develop criteria to measure progress toward meeting watershed goals
 - Develop monitoring component
 - Develop information/education component
 - Develop evaluation process
 - Identify technical and financial assistance needed to implement plan
 - Assign responsibility for reviewing and revising plan
 5. Implement watershed plan
 - Implement management strategies
 - Conduct monitoring
 - Conduct informational/educational activities
 6. Measure progress and make adjustments

- Review and evaluate information
- Share results
- Prepare annual work plans
- Report back to stakeholders and others
- Make adjustments to program

In some areas of the U.S., communities (e.g., Santa Fe, New Mexico and Seattle, Washington) have begun to manage stormwater as a resource instead of as a waste removal problem. By capturing stormwater in vegetated swales and other water harvesting techniques, beautiful landscapes can be supported while conserving potable water, preventing erosion and flooding, improving water quality, and increasing ground water recharge.

Stormwater and Nonpoint Source Pollution Prevention Policies in Other States

Please note that more detailed summaries of water quality policies in other states are provided in Appendix B through E. References for these appendices are provided by state in the Reference section.

Florida

Florida's Nonpoint Source Management Programs are implemented cooperatively by the Florida Department of Environmental Protection (DEP), Florida's five regional water management districts, other state agencies (i.e., Department of Agriculture and Consumer Services, Department of Health), local governments, and the public. Statutory authority for these activities is found in Chapter 403.061(32) and 403.0891, F.S.

Surface Water Improvement and Management Program

The Surface Water Improvement and Management (SWIM) program is the centerpiece of Florida's nonpoint source water pollution control effort. It was created in 1987 with the enactment of the Surface Water Improvement and Management Act (Chapter 373, Part IV, F.S.). The Act requires each management district to identify and maintain a priority list of water bodies of regional or statewide significance and to develop plans and programs for the improvement of those water bodies. Today, twenty-nine water bodies are now on the SWIM waterbody priority list.

SWIM is the only program in Florida that uses a watershed approach to pollution control. The state's five water management districts and Florida DEP are directly responsible for the SWIM program; they work with partners at all scales of government as well as the private sector.

Initially, money for SWIM came from state general revenues, matched by funds raised by the water management districts. However, the legislature's original commitment of \$15 million a year began to erode by 1990. In many cases, SWIM's shrinking funding has meant that water management districts have had to increase their share of dollars to continue successful protection and restoration programs. Several water management districts have put more resources in SWIM than they receive from the state, and SWIM dollars have been used as a match to secure federal grants.

As an example of program activities, the St. Johns River Water Management District initiated the Northern Coastal Basin project in 1995 in response to water quality concerns and the closure of shellfish harvesting areas. The SWIM plan for the Northern Coastal Basin is organized around five major initiatives: water quality (including flow), watershed master planning, stormwater retrofit and master plan implementation, compliance and rules enforcement for permitted stormwater treatment systems, and resource assessment, protection, and restoration.

State Stormwater Regulation

In Florida, the NPDES stormwater permitting program is separate from the state's stormwater/environmental resource permitting programs and local stormwater or water quality programs. Statutory authority for the state's stormwater program lies predominantly in Chapter 403, F.S. 403.0891, which establishes the institutional roles of Florida DEP, the regional water management districts, and local governments in implementing the stormwater program. This section also requires the Florida Department of Transportation to inventory and map primary stormwater management systems that it builds, operates, or maintains. Florida DEP, in coordination and cooperation with the districts and local governments, is to conduct a continuing review of the costs of stormwater management systems and the effects on water quality and quantity, and fish and wildlife values.

In addition, Section 403.0893 authorizes local governments to create stormwater utilities and stormwater management system benefit areas. Section 403.0896 requires the development of training and assistance programs for persons responsible for designing, building, inspecting, or operating and maintaining stormwater management systems.

Florida Section 319 Grant Program

The Nonpoint Source Management Section administers grant money it receives from USEPA through Section 319(h) of the Clean Water Act. These grant funds can be used to implement projects or programs that will help reduce nonpoint sources of pollution. Projects or programs must be conducted within the state's nonpoint source priority watershed, which are the state's SWIM watersheds and National Estuary Program waters. All projects must include at least a 40 percent nonfederal match. Examples of funded projects include demonstration and evaluation of BMPs; nonpoint pollution reduction in priority watersheds; and public education programs on nonpoint source management.

Florida Stormwater, Erosion, and Sedimentation Control Inspector Training and Certification Program

Florida DEP's Nonpoint Source Management Section implements the Florida Stormwater, Erosion, and Sedimentation Control Inspector Training Program to increase the proper design, construction, and maintenance of erosion and sediment controls during construction. The training also serves to assure proper long-term operation and maintenance of stormwater systems after construction is completed. The program provides training to private and public employees, primarily inspectors and contractors. Since 1997, over 6500 inspectors have been certified.

The program curriculum was developed to educate the inspector on proper installation, inspection and maintenance of BMPs for use during and after construction to minimize erosion and sedimentation and to properly manage runoff for both stormwater quantity and quality. The class follows the curriculum provided in the Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual.

Agricultural Industry Programs

Within DEP, agricultural nonpoint source pollution issues are primarily addressed by a non-regulatory agricultural engineer. However, the Department works with the Florida Department of Agriculture and Consumer Services, researchers at the University of Florida and Florida Agricultural and Mechanical University, county extension offices, the Natural Resources Conservation Service, and various agricultural groups throughout the state toward reducing adverse environmental impacts on the environment while sustaining a vigorous and profitable agricultural industry. This is accomplished through development and dissemination of BMPs, cost-share funding of demonstration projects using Federal 319 grant funds, and consultation and discussion with the agricultural community. Special emphasis is given to the management of golf courses industry which are considered as intensively managed turf grass farms.

Maine

The Bureau of Land and Water Quality within the Maine Department of Environmental Protection (DEP) is the lead agency for both enforceable and voluntary nonpoint source pollution control activities. Maine DEP administers the nonpoint source pollution program in coordination with other state, federal, and local governmental agencies as well as non-governmental stakeholder organizations. The Maine Departments of Agriculture Food and Rural Resources; Conservation, Maine Forest Service; Transportation; Economic and Community Development; Human Services, Division of Health Engineering; Marine Resources, and the State Planning Office all share responsibility for implementing the nonpoint source pollution program.

Nonpoint Source Control Program

In 1991, the Maine Legislature enacted a Nonpoint Source Water Pollution Management Program statute (38 M.R.S.A. §410-I) to restore and protect water resources from

nonpoint source pollution. The basic program objective is to prompt use of agency-approved BMPs to prevent water pollution.

The overall aims of the state's Nonpoint Source Water Pollution Control Program are to:

- Prevent, control, or abate water pollution caused by nonpoint sources so that beneficial uses of water resources are maintained or restored;
- Widely implement BMPs in all Maine's watersheds to minimize transport of pollutants or excessive runoff;
- Support and enable local community awareness and citizen action that results in commitment to maintaining or improving the condition of local water resources; and
- Ensure compliance with existing state and federal laws and rules regulating nonpoint source pollution.

Maine prioritizes educational and technical assistance in promoting Nonpoint source pollution control, with an emphasis on BMPs. However, statewide regulatory programs also implement several laws that control nonpoint source pollution including the Stormwater Management Law; the Site Location of Development Law; Subdivision Laws; the Erosion and Sedimentation Control law; the State Subsurface Wastewater Disposal Rules; the Natural Resources Protection Act; Land Use Regulation in Unorganized Territories; Pesticide Control laws; the Mandatory Shoreland Zoning Law; the Nutrient Management Act, Forest Practices Act and others.

Municipalities play a significant role in setting, promoting compliance with and enforcing nonpoint source pollution laws. The Mandatory Shoreland Zoning Act requires municipalities to adopt a local ordinance no less stringent than state standards. The Growth Management Law allows municipalities to adopt a growth management program and relevant ordinances to implement the program. Communities have utilized these provisions to draft phosphorus control ordinances. Municipalities are also authorized to join together to form watershed districts that can serve as planning bodies and can implement municipal ordinances to protect water quality.

Program resources are assigned to support efforts both statewide and in specific watersheds, as well as to improve waters that are threatened or impaired due to nonpoint source pollution. Maine DEP administers a Nonpoint Source Pollution Training and Resource Center that provides information and technical training on usage of BMPs.

Stream Team Program

The Maine Stream Team Program has been established to facilitate working partnerships among those who care about Maine's waters and provide assistance to teams. A stream team is a group of people, such as school groups or watershed councils, who are working

together on protecting their local stream. The program links groups with similar goals, provides information and training, and offers technical assistance to stream teams to perform stream habitat surveys, orchestrate stream "clean-ups", plant trees in riparian zones, and monitor water quality.

Stormwater Program

Maine DEP's Bureau of Land and Water Quality also implements the Maine Stormwater Program. In addition to its federal responsibilities under the Clean Water Act, the program regulates stormwater under the authority of three core state laws: the Site Location of Development Law (Site Law), the Stormwater Management Law, and the Waste Discharge Law.

The Site Law requires review of developments that may have a substantial effect upon the environment. These types of development have been identified by the Maine Legislature, and include developments such as projects occupying more than 20 acres, mineral exploration projects, large structures and subdivisions, and oil terminal facilities. A permit is issued if the project meets applicable standards addressing issues such as stormwater management, groundwater protection, infrastructure, wildlife and fisheries, noise, and unusual natural areas.

Maine's Stormwater Management Law provides stormwater standards for projects located in organized areas that include one acre or more of disturbed area. The wastewater discharge law requires that a license be obtained for the discharge of pollutants to a stream, river, or lake of the state, or to the ocean. Typical discharges include sanitary wastewater and process water from industrial or commercial activities. The requirements of these laws mirror those required as part of the federal NPDES program.

Section 319 Grant Program

Maine DEP administers the Section 319 Nonpoint Source Grant program to provide funding for efforts to curb nonpoint source pollution. A 1998 State Bond appropriation and USEPA fund the nearly \$5 million program. Funds may be used to demonstrate BMPs, establish TMDLs, or restore impaired streams. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 monies.

North Carolina

The North Carolina Division of Water Quality's (DWQ, Division) Nonpoint Source Planning Unit within the North Carolina Department of Environment and Natural Resources (DENR) is the lead state agency responsible for the control of nonpoint source pollution in North Carolina. This Unit sits within the Planning Branch of the Water Quality Section in DWQ. The Governor of North Carolina has designated responsibility for activities relating to particular sources of nonpoint source pollution to individual state agencies. The Division is responsible for coordinating and facilitating the nonpoint source pollution control activities of those agencies:

- The Environmental Management Commission for general water quality, urban runoff, wetlands and groundwater;
- The Soil and Water Conservation Commission for agriculture;
- The Sedimentation Commission for construction;
- The Mining Commission for mining;
- The Division of Environmental Health for on-site wastewater treatment and solid waste disposal;
- The Division of Forest Resources for forestry;
- The Department of Transportation for transportation; and
- The North Carolina Cooperative Extension Service for Education.

Use Restoration Waters Program

The North Carolina DWQ has established the Use Restoration Waters Program to restore the beneficial uses of the over 700 nonpoint source-impaired water segments statewide. The program pursues three main goals: 1) prioritizing waters for restoration, 2) promoting and supporting restoration initiatives, and 3) improving documentation of restoration efforts. Priority waters are those with the best data coverage and the most local involvement. The program functions as enabler and facilitator to the many groups around the state that can carry out restoration efforts. The Division also coordinates with various agency programs, both internal and external, to locate and improve documentation of the restoration efforts that have been completed or are underway in impaired watersheds.

State Stormwater Management Program

North Carolina's stormwater management program was established in 1988 by the North Carolina Environmental Management Commission and Section 143-214.7 N.C.G.C. The program applies to development activities that require an Erosion of Sediment Control Plan (defined as disturbance of one or more acre) or a Coastal and Aquatic Managed Area permit within one of North Carolina's 20 coastal counties, or development draining to a waterbody classified as either Outstanding Resource Waters or High Quality Waters.

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintain vegetative buffers, and transporting runoff through vegetative conveyances. Low-density development thresholds vary from 12 to 30 percent impervious surface, depending on the classification of the receiving stream. If low-density design criteria cannot be met, then high-density development requires the installation of structural BMPs to collect and treat

stormwater runoff from the project. High-density BMPs must control the runoff from the 1 or 1.5 inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Section 319 Grant Program

North Carolina DWQ administers the Section 319 Nonpoint Source Grant program to provide funding for efforts to curb nonpoint source pollution. Funds may be used to demonstrate best management practices, establish TMDLs, or restore impaired streams. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 monies.

Basin-specific Nonpoint Source Pollution Control Strategy

North Carolina has dedicated many resources to the control of nonpoint source pollution within several of its most prominent watersheds. The North Carolina Environmental Management Commission (Commission) has passed regulations (15A NCAC 2B .0202-0240) that dictate land use standards throughout the basins with the goal of increasing water quality through the control of nonpoint source pollution. Thus far, specific regulations have been passed for the Neuse, Tar-Pamlico, and Catawba basins.

Neuse Nutrient Strategy

The Neuse River basin was listed as impaired by nitrogen on North Carolina's 303(d) list in 1993. In 1997, the Commission adopted a mandatory plan to control both point and nonpoint sources of pollution in the basin and a set of permanent rules to support implementation of the plan. The General Assembly adopted the rules the following year. Elements of the plan include adoption of the following rules:

- The riparian area rule (15A NCAC 2B.0233) applies to all perennial and intermittent streams, lakes, ponds, and estuaries in the Neuse River basin. The rule protects forest vegetation in the first 30 feet of land directly adjacent to a waterbody, known as Zone 1. A limited amount of harvesting is allowed in the outer 20 feet of Zone 1 but the 10 feet closest to the waterbody must remain essentially undisturbed. An additional 20 feet to the outside of Zone 1, known as Zone 2, must have dense plant cover. New development is not allowed in either zone.
- The agricultural rule (15A NCAC 2B.0236 and .0238) provides farmers in the Neuse River basin two options. The first is to participate in a local nitrogen reduction strategy that includes specific plans for each farm that would collectively meet the nitrogen reduction goal. Alternatively, a farmer may implement standard best management practices such as buffers, water control structures, or nutrient management plans within four years.

- The stormwater rule (15A NCAC 2B.0235) applies to the largest and fastest-growing localities in the Neuse River basin. The rule establishes a broad set of objectives for reducing nitrogen runoff from urban areas.
- The nutrient management rule (15A NCAC 2B.0239) applies to persons who apply fertilizer to 50 or more acres of cropland, golf course, recreational lands, and lawns or gardens. Each person affected by this rule must either complete training and continuing education in nutrient management or develop a written nutrient management plan for all property where nutrients are applied.
- The wastewater discharge rule applies to point sources of nutrient discharge that hold permits from DWQ.

Tar-Pamlico Nutrient Strategy

After the classification of the Tar-Pamlico basin as a Nutrient Sensitive Water in 1989, the Commission approved, in 1992, an implementation strategy that established the framework for a nutrient reduction trading program between point and nonpoint sources of pollution.

Phase I of the strategy covered the period from 1990 to 1994. It established discharge conditions to be met by an association of dischargers known as the Tar-Pamlico Basin Association.

Phase II, covering January 1995 to December 2004, built upon models created during Phase I to establish an overall performance goal of a 30 percent reduction in nitrogen loading relative to 1991. By 2003, nitrogen loads to the river had been reduced 45 percent and phosphorous loads by 60 percent relative to 1990 levels. Phase II also established instream nutrient goals for nonpoint sources through implementation of rules similar to those in place in the Neuse basin.

Phase III continues the structure established in Phase II through December 2014. In addition it sets 10-year estuary performance objectives and alternative management options.

Catawba River Basin Riparian Buffer Protection Rules

In response to nutrient-related water quality problems in three lakes along the mainstem of the Catawba River, the Commission adopted temporary riparian buffer rules in 2001, which were replaced by permanent rules in 2004. The Catawba Riparian Protection Rules afford special protections with regard to riparian buffers along the lakes and the river mainstem. These rules call for a two-zone buffer: zone one is a 30-foot undisturbed buffer adjacent to the shoreline, and zone two, upslope from zone one, is a 20-foot managed zone consisting of grass or other vegetation. The footprints of all existing uses are exempt for continuance of that use.

Oregon

The Watershed Management Section within the Oregon Department of Environmental Quality's (DEQ, Department) Water Quality Division has the responsibility of overseeing and implementing the state's nonpoint source pollution management program by coordinating with many local, state and federal agencies and organizations. The program began in 1978 as a 'stand alone' effort within the Department. However, each component of the Department's water quality program now includes nonpoint source concerns.

Nonpoint Source Control Program

Oregon DEQ's program is built around the following ten program elements:

1. *Standards*: Defining the desirable conditions necessary to support sensitive beneficial uses (see description of Oregon's water quality standards);
2. *Assessment*: Condition assessment of the watershed as a whole, focusing on established standards.
3. *Coordinated Watershed Planning*: Evaluation by all stakeholders of needs and opportunities for sound watershed management resulting in the production of an action plan.
4. *Education*: Delivery of information about watershed management to land managers and the general public.
5. *Demonstration Projects*: Small-scale projects designed to develop sound watershed management techniques.
6. *Technical Assistance*: Field-based experts and literature resources provided to help land managers implement best management practices.
7. *Cost-Share Assistance*: Financial assistance and incentives for implementation of watershed enhancement practices on private lands.
8. *Stewardship*: The adoption of responsibility for the condition of their watershed resources by local groups.
9. *Watershed Enhancement Projects*: Coordinated enhancement and protection projects covering whole watersheds and sustained over a number of years.
10. *Enforcement*: The field-based capability to investigate and remedy the violation of applicable standards or regulations.

Oregon DEQ is currently completing an inventory of nonpoint source pollution control programs and capabilities in all state and federal agencies using the list of ten program

elements as a framework for evaluation. The nonpoint source pollution management program objectives for the next several years will be designed in part to fill gaps that are identified by that inventory.

Oregon Plan for Salmon and Watersheds (Oregon Plan)

The Oregon Plan is the centerpiece of Oregon's nonpoint source program. The Oregon Plan was adopted in 1997 for the purpose of restoring the healthy functions of Oregon's natural aquatic systems and the native fish populations they support. The Oregon Plan also facilitates the creation of local watershed councils in each basin. It requires all government agency actions that could potentially impact aquatic systems to coordinate their activities and ensure that they are consistent with watershed restoration efforts. The Oregon Plan attempts to utilize both science and local decision-making as well as regulatory and voluntary actions.

Agricultural Water Quality Act

This 1993 law authorized the Oregon Department of Agriculture to designate areas to be governed by a water quality management plan and to adopt rules that require landowners in the affected area to implement the plan. In practice, watersheds listed as impaired on USEPA's Section 303(d) list are those where Agricultural Water Quality Management Plans have been developed. Once a plan is implemented, all agricultural activities, including pesticide use, grazing, and irrigation, are subject to the rules of the plan. The plans are developed through a public process within each watershed. The Department of Agriculture now has adopted plans and rules for all 39 regions of Oregon where plans were needed.

Oregon Forest Practices Act

The Oregon Forest Practices Act requires the Oregon Board of Forestry to establish BMPs for forest operations. Forest operators are required to comply with these BMPs unless they demonstrate alternative methods will yield better results. If forest operators comply with BMPs, they are given safe harbor from enforcement and are assumed to be in compliance with water quality standards. In addition, forest operators must notify the State Forester of all proposed operations, particularly chemical applications and operation in close proximity to known habitat of endangered species.

Statewide Comprehensive Land Use Planning

Oregon's land use planning laws allow for the protection of environmentally sensitive areas in local development plans. In addition, the Department of Land Conservation and Development has the authority to designate "areas of critical concern" that must also be taken into account during the planning process.

South Carolina

South Carolina's Department of Health and Environmental Control (DHEC) is the lead agency for the nonpoint source program in the state but program success relies heavily on partnerships with all levels of government, private sector stakeholders, and citizens. South Carolina DHEC may also delegate responsibilities for stormwater management and sediment control to local governments or conservation districts. With all of these partners, DHEC is in the process of developing watershed master plans for designated watersheds that have regulatory requirements for land disturbing activities within the watershed clearly specified including nonpoint source pollution control, stormwater management, and flood control components. The Department also develops and implements educational programs in stormwater management and sediment control for state and local government officials, persons engaged in land disturbing activities, interested citizen groups, and others.

The South Carolina nonpoint source management program includes 17 long-term goals for reducing or preventing nonpoint source pollution. The long-term goals will be met by five-year action strategies with annual milestones leading to the attainment of the action strategies. The goals are two-pronged; focusing on reducing nonpoint source impacts in priority watersheds, and implementing activities statewide in order to prevent nonpoint source pollution. Components include both regulatory and voluntary approaches.

Nine categories of nonpoint source pollution are identified for management under the program: agriculture, forestry, urban areas, marinas and recreational boating, mining, hydrologic modification, wetlands disturbance, land disposal/groundwater impacts, and atmospheric deposition. Management measures addressing each category have been identified.

Nonpoint Source Monitoring Program

The Aquatic Biology Section, within the Division of Environmental Quality Control of DEHC, monitors nonpoint source activity through a variety of efforts, including water quality and biological assessments. The team monitors the effectiveness of BMPs in an effort to determine which practices yield the most effective reduction in nonpoint source pollution. Most BMPs are implemented on agricultural and silvicultural lands, and two to four years of monitoring is conducted prior to BMP implementation to determine before and after differences in water quality.

The team works also closely with the Bureau of Water Enforcement Section in complaint investigations and enforcement referrals. Professional judgment and biological assessments are utilized to determine cause and degree of impact to watersheds effected by nonpoint source pollution and recommend any needed enforcement action. The Aquatic Biology Section also focuses on water bodies deemed impaired by nonpoint sources.

319 Nonpoint Source Pollution Grants

South Carolina receives an annual 319 grant allocation from USEPA to implement the nonpoint source abatement strategies as described in the state's Nonpoint Source Management Program. A portion of these funds is passed on through a competitive grant process to stakeholder groups, government entities, or other agencies interested in conducting projects that reduce or prevent nonpoint source water pollution through the implementation of an approved TMDL.

Stormwater

In South Carolina, the federal NPDES permitting process has largely replaced stormwater control activities previously implemented under statutes such as the Stormwater Management and Sediment Reduction Act of 1991.

Regulation 72-300 sets standards for sediment and erosion control for land disturbing activities regulated under the 1991 Act. Regulation 61-9 describes rules for implementing the federal NPDES program. At this time, despite the duplication in the regulations, permits are required under each for any land disturbing activity greater than two acres.

Wisconsin

Wisconsin has a relatively long history with nonpoint source pollution management. The Wisconsin Department of Natural Resources (DNR, Department) has been implementing a nonpoint source pollution program since 1978. The program revolves principally around providing technical and financial assistance to landowners who implement BMPs on their land. Resources were targeted at state-determined "priority watersheds" for the first 20 years of the program. As that program is phased out, resources are now concentrated on urban basins and other watershed that have not been served in the first 30 years of the program's history.

Wisconsin DNR's Bureau of Watershed Management has primary authority for administering the Wisconsin's nonpoint source pollution program. The Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) shares responsibility with DNR, particularly with respect to nonpoint pollution from agricultural sources. The Land and Conservation Board provides oversight of both agencies and their nonpoint source programs.

Nonpoint Source Pollution Management Program

Wisconsin's nonpoint source pollution management program began in 1978, primarily to administer grants to landowners for voluntarily implementing BMPs. An enforcement element was added to the program in 1987, when DNR received authority to issue Nonpoint Source Abatement Orders. If DNR deems pollution to be significant, an order can be issued for all types of nonpoint source pollution except for animal waste.

Significant pollution is defined as causing violation of water quality standards, impairing aquatic habitat or organisms, restricting navigation, or endangering human health.

In cases where water quality monitoring shows that animal waste is the source of pollution, DNR has the authority to issue a Notice of Discharge which requires correction of the problem. A specific regulatory program for the handling, storage, and utilization of manure was developed by DNR in 1984 in Chapter NR 243 of the Wisconsin Administrative Code. The rule creates criteria and standards to be used in issuing permits to agricultural feeding operations as well as establishing procedures for investigating water quality problems. If the landowner does not comply, DNR may require NPDES permitting.

Wisconsin counties, and to a lesser extent, municipalities, play a substantial role in nonpoint source pollution control. Land Conservation Commissions provide funding and cost share assistance to counties for the development of water resource management plans and ordinances that address sources of nonpoint source pollution. Wisconsin's efforts emphasize allowing local governments control over implementing projects to meet state standards.

Priority Watershed Program

From 1978 to 1997, DNR and the agriculture department ranked all watersheds of the state to assist in targeting resources for nonpoint source pollution abatement. Once the priority watersheds were determined, the departments and the relevant local government developed a watershed plan to guide cost-share assistance and other nonpoint source abatement activities. A planning committee composed of farmers, riparian landowners, and others served in an advisory capacity. During the planning process, "critical sites" were identified and defined as sites that, due to the amount of pollution generated and/or location in the watershed, must be addressed in order for the plan to achieve its water quality objectives. Upon county approval of the plan, DNR was required to provide cost-sharing grants to local governments and individual landowners for the installment of best management practices.

Amendments to the program authorized by the legislature in 1997, known collectively as Act 27, implemented a multi-year phase out of the priority watershed program, to be complete in 2009. With the phase out of the priority watershed program, a significant portion of Wisconsin's nonpoint efforts will be shifted to the entire state, not just priority watersheds. Each county must prepare a land and water resources management plan to develop and implement performance standards for nonpoint source pollution. A \$7.2 million cost share program is available to aid counties.

Standards for BMPs

Act 27 required DNR to undergo formal rulemaking to develop performance standards for BMPs designed to meet water quality standards. Technical specifications to achieve these standards are defined in Chapter NR 154, Wisconsin Administrative Code.

Targeted Runoff Management Program

Targeted Runoff Management (TRM) grants are provided to control nonpoint polluted runoff from high-priority urban and rural sites. Projects funded by TRM grants are site-specific and serve areas generally smaller in size than a subwatershed. Municipalities, regional planning commissions, counties, tribal governments, and lake, sewerage or sanitary districts may apply for the grants. TRM grants can fund the construction of rural and urban BMPs. Examples of eligible BMPs include some cropland protection, detention ponds, livestock waste management practices, stream bank protection projects and wetland construction.

Urban Nonpoint Source & Stormwater Management Program

Urban Nonpoint Source and Stormwater Management Program grant funds are used to control polluted runoff in urban project areas. Funds are awarded for either planning or construction projects. Projects funded by these grants are site-specific and must meet special criteria. Planning grants can be used for activities such as stormwater management planning, related information and education activities, ordinance and utility development and enforcement. Construction grants may fund such projects as stormwater detention ponds, filtration and infiltration practices, streambank stabilization, and shoreline stabilization. Municipalities, regional planning commissions, counties, tribal governments, and sewerage or sanitary districts may apply for the grants.

Watershed Based Pollutant Trading

Wisconsin DNR has implemented pollutant trading pilot projects for four years. There has been no actual trading to date, but detailed annual reports for each year of the project have resulted in a greater understanding of the best design framework for a trading program and what requirements are needed to make the program successful.

Stormwater

To meet the requirements of the federal Clean Water Act, the DNR developed the Wisconsin Pollutant Discharge Elimination System (WPDES) Stormwater Discharge Permit Program. As part of the federal NPDES program, the state program regulates discharge of stormwater in Wisconsin from construction sites, industrial facilities, and selected municipalities.

Beyond regulatory stormwater management, the Department also supports a wide variety of voluntary stormwater management activities. These include projects funded through the Urban Nonpoint Source and Stormwater and Targeted Runoff Management Grant Programs. The University of Wisconsin Extension Service provides additional information about stormwater management from the scale of a residential rain garden through construction site erosion control plans for multi-acre construction sites.

Additional State-level Nonpoint Source Water Pollution Controls

In 1997, the Environmental Law Institute published a report summarizing a comprehensive study of state-level nonpoint source pollution programs. The following excerpts from the report provide a revealing depiction of nonpoint source pollution programs as a whole:

It is fair to say that no state is entirely without any enforceable authority relevant to nonpoint source discharges. While some states have few such authorities, others have adopted a bewildering array of enforceable tools applicable to specific watersheds, specific activities, and specific effects on the environment. These are frequently paired with equally bewildering arrays of exemptions and exclusions.

The task of understanding state enforceable controls is quite difficult because no two states have adopted anything like the same set of laws. And even when the laws appear to be quite similar, they often have varying definitions, enforcement mechanisms, and procedures.

This extreme variability also has another lesson for the policymaker: state programs can only be understood whole. The mere compilation of a list of authorities does not reveal their interconnection, how they can be used in practice given institutional and procedural constraints, or how programs delegated to counties, localities, or watershed districts can be evaluated in relation to apparently similar state programs that are not so decentralized. As a result, even this study – looking at numerous authorities across all of the states – necessarily gives an incomplete picture of the individual capacity of any one state.

The same report categorizes nonpoint source pollution programs into discharge prohibitions and operational requirements. Each has associated laws and standards that are generally implemented at the state level:

Discharge Prohibitions

Discharge prohibitions include policies for the types of discharges that must be permitted. States generally either prohibit discharges that have (or are projected to have) adverse effects on receiving waters, or prohibit certain types of discharges without requiring demonstration of any effects on receiving waters. Discharge prohibitions are generally enforceable by administrative orders, civil injunctions, civil penalties (usually \$10,000-\$25,000), criminal sanctions, and other sanctions.

Nuisance laws also help control nonpoint source pollution by prohibiting pollution that impairs the usefulness of waters, adversely affects human health, or impairs the rights of others. State statutes generally address two types of nuisance laws. Most important are provisions declaring water pollution to be a nuisance, and these generally limit the need to prove particular harm caused by the pollution. Second are state provisions that prevent conditions that are dangerous to public health or “otherwise noxious or offensive to the

senses.” Virtually all states have enacted “right-to-farm laws that exempt agricultural activities from certain nuisance claims. These laws vary in the extent of the exemption, and some states specifically do not protect agricultural operations from nuisance claims based on water pollution.

Operational Requirements

Operational requirements entail the use of BMPs and other operational programs, whether voluntary or required by statute, regulation, or ordinance.

Erosion and Sedimentation Laws

Many states have enacted erosion and sediment control laws. Some are linked specifically to urban and industrial NPDES programs. A limited number of states have laws that are broad in scope to cover an array of conduct, from agriculture to urban construction activities. Many states exempt agriculture and forestry from such laws, or impose certain requirements, such as the use of BMPs. Much of the current legislation applies on a watershed basis, allowing coordination between river basin organizations, wild and scenic river programs, wetland programs, and others.

Some programs explicitly target water resources of particular value or concern. (For example, Virginia and Maryland have adopted Chesapeake Bay protection laws that require local land use regulations, buffer zones, and other controls in areas close to the bay.) South Carolina provides for special protection under its Stormwater Management and Sediment Reduction Act: “In addition to the other regulatory requirements in this chapter, designated watersheds shall have the regulatory requirements for land disturbing activities with the watershed clearly specified through a watershed management plan which includes nonpoint source pollution control, stormwater management, and flood control components” (S.C. Code 48-14-130).

Some states integrate sediment and erosion control into broad state planning requirements that local governments must adopt and enforce. Massachusetts, Vermont, Rhode Island, Georgia, Washington, Oregon, and California are among the states with such mandates.

Forest Practice Laws

Forest practice laws are most frequently found in states that regulate forest practices on private lands, notably those on the west coast and in New England. Maine’s Forest Practices Act, for example, imposes requirements for clearcuts that must provide for protection of water quality and minimization of erosion (12 Maine Rev. Statutes 8867-8869). Oregon law requires forest operators to comply with BMPs unless they can demonstrate that alternative practices will achieve a better result (Ore. Rev. Statutes 527.724, 527.765). The law requires detailed plans for forestry operations under certain conditions, including within 100 feet of streams, notice of chemical use, and other practices (Ore. Rev. Statutes 527.670).

In many states, forestry practices are regulated only when they are within wetlands, specific watersheds, or within a fixed distance of a waterbody. Michigan law, for instance, provides for BMPs and enforceable standards within regions that have been designated as “forestry improvement districts” (Mich. Code L. 324.50101).

Some states (e.g., Maine, Indiana, Wisconsin, and Missouri) have granted tax breaks based on the adoption and implementation of forestry management plans. Typically, however, the only consequence of violating a plan or ceasing to carry it out is loss of the tax break.

“Bad actor” laws are also used in a few states to impose obligations on forestry operators who have taken actions that cause pollution. In New Hampshire, for instance, the Division of Forests and Lands has the power to issue cease and desist orders to “temporarily suspend logging or other operations in forest areas when the director determines that such actions have resulted in, or are likely to result in, pollution of surface water or ground water” (N.H. Rev. Stat. Ann 227-J:II(d)).

Agricultural Requirements

Several states have adopted enforceable requirements for control of erosion from agricultural activities:

- Vermont prescribes “accepted agricultural practices,” which provide a baseline standard that must be implemented across the state (Vt. Stat. Ann. 4810).
- Ohio requires all of its soil and water conservation districts to adopt regulatory BMPs and enforceable plans for agriculture to control erosion and sedimentation (Ohio Rev. Stat. 1511.02).
- Kentucky requires the development of “statewide water quality plans to address identifiable water pollution problems from agriculture[al] operations” of 10 acres or more. The prescribed requirements must be implemented by farmers within five years (Ky. Rev. Stat. 224-71-100 to -145).

Bad actor laws are sometimes applied to agricultural activities. In Virginia, a 1997 law authorizes the state to investigate and if “substantial evidence exists to prove that an agricultural activity is creating or will create pollution,” then the Commissioner of Agriculture and Consumer Services must notify the operator and require an “agricultural stewardship plan” to be submitted within 60 days.

Most states have recognized soil and water conservation districts, and while most of these districts have the power to adopt only voluntary programs, a few states allow the districts to adopt binding and enforceable land use regulations that prevent soil erosion.

Agricultural nutrients are controlled in a variety of ways. Some states have adopted “accepted agricultural practice” requirements or nutrient regulations that are enforceable.

Nutrient management plans are generally required of confined feeding operations, and several states have siting requirements that help protect water quality.

Summary

Stormwater management in the states surveyed is closely related and often entwined with broader nonpoint source water pollution abatement programs. Of the four focus issues of this report, stormwater management approaches are the most varied, with technical assistance and education among the most common tools. Most of the states rely heavily on voluntary programs for encouraging structural and nonstructural best management practices. Some states designate priority watersheds and provide targeted funding for program planning and implementation.

Chapter 6

ON-SITE WASTEWATER MANAGEMENT

Management and treatment of domestic wastewater is important for preventing excessive amounts of nutrients and pollutants from entering water bodies. Nutrients are not pollutants in the normal use of the term because they are naturally occurring and essential to life. However, excess nitrogen and phosphorus can disrupt the ecological balance of lakes, rivers, streams, wetlands, and coastal waters. Domestic wastewater can also contain a variety of pollutants and pathogens, such as bacteria, viruses, oils, detergents, and a variety of household chemicals. Ground water and/or surface water contamination by fecal coliform bacteria is one of the most prominent concerns related to wastewater treatment failures.

Domestic wastewater treatment options include sewers and centralized treatment plants; on-site or decentralized treatment (generally septic); or alternative treatment systems. Sewer systems and centralized water treatment plants are expensive and often impractical in areas where residential development is sparse and/or lot sizes are large. The alternative to such sewer systems is a decentralized system, which may consist of a wide range of on-site and cluster treatment systems that process household and commercial sewage. Similar in design, cluster systems allow the collection of wastewater from two or more homes or buildings. Under some form of common ownership, these systems convey wastewater to a treatment and dispersal system near the homes or buildings.

On-site wastewater systems have been in use across the U.S. since the mid-1800s. The 1990 census conducted by the U.S. Department of Commerce, Economics, and Statistics Administration, U.S. Census Bureau, reported that 23.42 percent of all housing units in the U.S. use a conventional on-site system or cesspool for sewage disposal (Knowles). (The construction of new cesspools, or dry wells for the collection of wastewater, were banned in 1999, and existing large cesspools serving 20 or more persons were required to be replaced by sewer connections or on-site treatment systems by 2005 (USEPA 2003e)). Estimates by USEPA suggest that 60 million people in the U.S. rely on decentralized systems. Alternative technologies, such as mound systems, composting toilet systems, low-pressure pipe systems, and evapotranspiration systems, may be used where conventional septic systems are undesirable or unacceptable.

The number of septic systems in Georgia increased from about 32 percent in 1970 to nearly 37 percent in 1990 (U.S. Census Bureau 2004). Obtaining an accurate number of septic systems per county historically or presently is difficult because many counties did not keep records prior to 1998, when most, but not all, counties began to use a computer based record-keeping system. Also, many counties have not recorded when septic systems were taken out of service or homes were connected to sewer system (MNGWPD).

According to USEPA, decentralized systems offer a number of benefits, including the following:

- *Protection of property values:* Well-managed, properly designed on-site or cluster systems can provide sewage treatment equivalent to a centralized plant, often at a lower cost.
- *Water conservation:* Decentralized systems can help recharge ground water aquifers and maintain dry season flow in streams.
- *Preservation of the tax base:* Decentralized systems can be installed on an as-needed basis, thus avoiding the large up-front capital costs of centralized treatment plants.
- *Life-cycle cost savings:* Proper management can result in lower replacement and repair costs, increased property values, enhanced economic development, and improved quality of life.
- *Effective planning:* Decentralized systems provide flexible wastewater options and help achieve land use objectives (USEPA 2005c).

Decentralized systems are not without problems, however. Careful management is needed to assure that public health and water quality goals are met.

On-site sewage management systems may exist in a number of forms, the most common of which is a septic system. In rural and semi-rural areas where lot sizes are large and houses are spaced widely apart, they are generally more economical than centralized sewer systems. Septic systems are simple in design and use natural processes to treat wastewater on-site, usually in a homeowner's back yard.

A septic system consists of two main parts: a septic tank and a drainfield. The septic tank is a watertight box, usually made of concrete or fiberglass. Wastewater flows from the home into the septic tank through an inlet pipe and is held in the septic tank long enough (at least 24 hours) for solids and liquids to separate. Oil and grease rise to the top, forming a layer of scum, while solids heavier than water settle at the bottom, forming sludge. This separation leaves a middle layer of clarified wastewater, which flows from the septic tank through an outlet pipe into a drainfield (also called a leachfield, disposal field, or soil absorption system) one to three feet below the ground surface, where gravel and soil act as biological filters as the wastewater slowly flow through. The scum and sludge are broken down by natural bacteria in the tank, and the material that cannot be broken down, referred to as septage, remains in the tank until it is pumped (NESC(b)).

To keep the septic system functioning properly, it should be pumped periodically; with the frequency depending on water use and accumulated solids and also preferably on an inspection by qualified persons. Pumping costs vary from one area to another and average from \$150 to \$300; however, repairing failing systems can cost as much as \$2,500 and replacing an entire system can cost five to ten times that amount (USEPA 1999a).

Septic system failures have been categorized into four classes, based generally on the evidence of failure:

- Class I: Raw sewage in the bathroom floor. Classic failure occurs when raw sewage is completely rejected by the septic system.
- Class II: Sewage in the yard. Untreated or partially treated sewage is surfacing in the yard, ditches, or neighbor's yard.
- Class III: Decline in water quality. A research team, using monitoring devices, ground water tracers, or other scientific techniques, demonstrates ground water or surface water degradation.
- Class IV: Long-term, gradual environmental degradation. Computer modeling or long-term monitoring indicates that gradual degradation is occurring in a neighborhood or region. This problem is difficult to firmly link to septic system inadequacies because other environmental factors may be included. (Brown 1992)

Water use efficiency can improve the operation of the septic system and reduce the risk of system failure. (Please refer to the companion report, *Water Conservation, Efficiency and Reuse*.) If an excessive amount of water is used relative to the size of the septic tank, overflow can saturate the groundwater with waste faster than it can safely filter the water. The number of bedrooms in a house is often used as an indicator of water use and the size of the tank needed. Lot size is key to the effectiveness of septic systems because there must be adequate room for siting the system where soil permeability is adequate and for installing a drainfield (and eventually a secondary drainfield) of adequate length.

Age is also an issue for septic systems because a natural aging process causes the drainfield to become less permeable because of the formation of a biomat, a jelly-like substance that forms along the bottom and sidewalls of the drainfield trench. If the biomat becomes too thick, wastewater is not transmitted properly into the soil. When a septic system is properly sited, designed, and maintained, the life expectancy of the drainfield is typically 20 to 30 years. After that time, a new drainfield may be needed (MNGWPD).

Residuals management is important in considering management of onsite wastewater treatment systems because chemical contaminants and pathogens may be present in septage, posing possible dangers to human health and the environment. Approximately 67 percent of the estimated 12.4 billion gallons of septage produced annually in the U.S. is hauled to wastewater treatment facilities other facilities for treatment, while the remaining 33 percent is land applied (USEPA 2005c).

Septage can be land applied by either surface or subsurface application. Surface application involves spreading septage from hauler trucks, specially designed land application vehicles, or using a variety of irrigation equipment. Subsurface application places untreated septage just below the soil surface. This can be accomplished by

discharging septage into a furrow and covering the furrow by a second plow (“plow furrow cover”) or injecting liquid septage in a narrow cavity created by a tillage tool (“subsurface injection”). Subsurface injection reduces the odors and health/environmental risks of land application (Small Flows Clearinghouse).

A recent guidance document published by USEPA succinctly assesses the challenges related to on-site wastewater management:

A review of current state and local on-site regulatory and management approaches reveals that many programs rely on homeowners to assume full responsibility for the operation and maintenance of individual treatment systems. Many of these programs, however, do not provide the information and trained service providers that homeowners need to accomplish this job. Local regulators often lack the legal authority to hold homeowners accountable for properly maintaining their systems. Without proper training, they can actually risk injury or death from exposure to hydrogen sulfide and other gases generated in the tank. As communities grow, many new rural and suburban residents move to unsewered areas unaware of their system location and the need for periodic maintenance. In this “unmanaged” condition, septic systems will not perform adequately and many will ultimately have problems.

In order to enhance management of decentralized wastewater treatment systems, state and local governments should develop a well-thought-out strategy that considers a number of factors, including design options, site conditions, operation and maintenance requirements, periodic inspections, monitoring, and financial support. Central to this strategy is ensuring that legal authority is in place to carry out program requirements (USEPA 2005c).

Elements of an On-Site Wastewater Management Program

In a 2005 publication, *Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (USEPA 2005c), USEPA enumerates the program elements involved in effectively managing on-site wastewater treatment. The program elements are divided into three categories: administration, installation, and operation and maintenance. Each of these categories entails specific activities, as follows:

Administration

- *Performance requirements*: Link treatment standards an relative risk to health and water resource goals.
- *Planning*: Consider site and regional conditions and long-term effects on watershed and public health.
- *Record-keeping, inventory, and reporting*: Create inventory of systems and operation and maintenance logs, and planning and reporting to oversight agencies.

- *Financial assistance and funding:* Provide financial and legal support for management program.
- *Public education and participation:* Maximize public involvement while developing a management program.

Installation

- *Site evaluation:* Assess system site and relationship to other features (ground water and surface water).
- *System design:* Ensure that system is appropriate for site, watershed and wastewater characteristics.
- *Construction:* Ensure installation as designed: record as-built drawings.

Operation and Compliance

- *Operation and maintenance:* Ensure that systems perform as designed.
- *Inspections and monitoring:* Document provider performance, functioning of systems, and impacts.
- *Residuals management:* Remove and treat residuals; minimize health or environmental risks from residuals handling, use, and dispersal.
- *Training and certification/licensing:* Promote excellence in site evaluation, design, installation, O&M, and other service provider areas.
- *Corrective actions and enforcement:* Ensure timely compliance with applicable codes and performance requirements.

On-site Wastewater Treatment Policy Options Identified by USEPA

Also in its 2005 Handbook, USEPA identified a number of specific options in 13 policy categories. These options, provided in Appendix A, may be useful in considering both local and state-wide approaches to on-site wastewater management.

Additional Resources

Additional information on managing on-site wastewater treatment programs is available from a number of sources, including the following:

- National Small Flows Clearinghouse
www.nesc.wvu.edu

- Rural Community Assistance Program
www.rcap.org
- National Onsite Wastewater Recycling Association, Inc.
www.nowra.org
- Georgia Onsite Wastewater Association
www.onsitewastewater.org

On-site Wastewater Management in Other States

Please note that more detailed summaries of water quality policies in other states are provided in Appendix B through E. References for these appendices are provided by state in the Reference section.

Florida

In Florida, the Bureau of Onsite Sewage Programs (Bureau) in the Florida Department of Health (DOH) and the environmental health section of the County Health Departments regulate the use of Onsite Sewage Treatment and Disposal Systems (OSTDS) through Chapter 381, Florida Statutes and Chapter 64E-6, F.A.C. The Bureau of Onsite Sewage Programs' mission is to protect the public health and environment by developing and promoting a comprehensive onsite sewage program. The DOH shares jurisdiction with DEP in some cases where estimated sewage flow is above the DOH jurisdictional flow or where there is a possible discharge of toxic, hazardous or industrial wastewater. An interagency agreement details coordination between the agencies.

The Bureau develops statewide rules and provides training and standardization for County Health Department employees responsible for permitting the installation and repair of onsite sewage treatment and disposal systems within the state. It also licenses septic tank contractors, approves continuing education courses and course providers for septic tank contractors, funds a hands-on training center, and mediates on-site wastewater contracting complaints. In addition, the bureau manages a state funded research program, prepares research grants, and reviews and approves innovative products and septic tank designs.

The state does not encourage the use of onsite sewage treatment and disposal systems (which generally take the form of septic tanks and drain fields). Both the state statutes and DOH rules require the use of public or investor-owned sewage systems in areas where they are available.

Alternative Technologies

Department of Health rules give the individual county health departments, as part of the DOH, the authority to approve alternative onsite systems such as composting toilets,

mounds, gravity sewers, low pressure pipe, and other systems, if no adverse effects are anticipated. However, any approvals of alternate systems must comply with applicable rule and law. The county health department may require submission of plans prepared by an engineer registered in the State of Florida prior to considering the use of any alternative system. If a technology is not listed in the current State Code, statute allows DOH to approve a limited number of innovative systems where there is compelling evidence that the system will function properly and reliably to meet the requirements of law and rule.

Permitting and Inspection of On-site Sewage Management Systems

No portion of an onsite sewage treatment and disposal system shall be installed, repaired, altered, modified, abandoned, or replaced until an “Onsite Sewage Treatment and Disposal Construction Permit” has been issued from the appropriate county health department. The suitability of a lot, property, subdivision or building for the use of onsite sewage treatment shall be determined from an evaluation of lot size, sewage flow, soil and water table conditions, soil drainage, and topography. Site investigations and tests must be performed by a registered engineer or septic tank contractor.

Monitoring

Florida’s rules require maintenance and management contracts for aerobic treatment units (ATUs), performance-based treatment systems, commercial wastewater systems, and systems in industrial/manufacturing zoning or use. Traditional systems do not have a regulated monitoring program.

Maintenance

The owner of the property is responsible for maintenance and upkeep of the system. It is important to note that an onsite sewage treatment and disposal system must be operated under the terms of the rule and permit under which it was approved. The owner may not make any changes to the structure or to the system or increase sewage flow without approval from the local health department. Under DOH rules, the owner should have the level of the tank checked a minimum of once every three years by a licensed septic tank contractor. A licensed contractor should also perform any necessary maintenance to the system. If garbage grinders or commercial sewage are being discharged into a tank, the owner needs to have the system inspected by a licensed septic tank contractor or pumper once a year. The use of organic chemical solvents, toxic or hazardous chemicals, or petroleum products to degrease or de-clog the system are prohibited. A licensed contractor must be issued an annual service permit prior to the removal of septage from any onsite sewage treatment and disposal system.

Location

Septic tanks must be installed with minimum setbacks as follows (Ch. 64E-6.005 F.A.C.). No septic tank may be installed:

- Less than five feet from a property line;
- Less than 75 feet from surface waters;
- Less than 15 feet from wetlands;
- Less than 75 feet from a private well; or
- Less than five feet from a dwelling or structure.

Failure

In Florida, a system failure is defined as a condition existing within an onsite sewage treatment and disposal system that prohibits the system from functioning in a sanitary manner and which results in the discharge of untreated or partially treated wastewater onto ground surface, into surface water, into groundwater, or which results in the failure of building plumbing to discharge properly. If a system is failing or has already failed, permitting and inspection are required.

Septage Disposal

Florida regulations require permitting for both the handling and disposal of septage by the Department of Health and Rehabilitative Services of each county. Regulations specify that only septage which has been properly treated by lime stabilization may be land applied and that it may not be spread on land where frequent public access is likely to occur. Several stipulations exist for use of septage in agricultural settings to protect food crops. In addition, the following restrictions on septage application are designed to protect water quality:

- Septage may not be land applied within 3000 feet of any Class I waterbody or Outstanding Florida Water. For surface waters of lesser quality, a buffer zone of 200 feet must be maintained. No buffer is required around irrigation waters that are located entirely on the land application site and that do not flow off the site.
- Septage may not be land applied within 500 feet of any shallow public water supply wells, nor closer than 300 feet to any private drinking water supply well.
- At the time of septage application, a minimum of 24 inches of unsaturated soil above the ground water table must be present.
- Septage may not be applied during rain events when runoff might occur.
- The septage application area must have buffer zones and stormwater management structures with a capacity to hold runoff during flash floods.
- The slope of the land application area may not be more than eight percent.

- Land used for septage application may not contain any hole or channel which would allow septage to contaminate ground water.
- Septage may not be applied within 300 feet of any dwelling, or within 75 feet of the property boundary or any drainage ditches.

Massachusetts

Massachusetts has a well-developed process for integrating innovative and alternative septic technologies into its on-site wastewater management program. The state considers on-site wastewater disposal systems those that treat less than 10,000 gallons per day. Title 5 of the State Environmental Code contains regulations for siting, construction, upgrade, and maintenance of on-site systems. Local Boards of Health are the primary regulatory authorities. However, the Massachusetts Department of Environmental Protection (DEP) approves the use of innovative and alternative technologies and is responsible for overseeing local implementation of Title 5.

Massachusetts DEP has designated parts of the state as “Nitrogen Sensitive Areas.” These areas are particularly sensitive to pollution from nitrogen in sewage because of their proximity to drinking water supplies. Title 5 contains special requirements for repairing failed and constructing new systems in Nitrogen Sensitive Areas.

Innovative/ Alternative Technologies

The Department encourages the development of innovative or alternative (I/A) technologies that have superior performance to conventional systems, and has developed a three-tiered approval process for these technologies: piloting, provisional use, and general use.

Currently, there are 50 I/A technologies that have been approved at one of the three tiers. Once such technologies have been approved for use in Massachusetts, they still must be reviewed and approved for actual installation at a specific site. Alternative systems may include:

- Humus or composting toilets;
- Alternative mounded systems (such as the Wisconsin mound) designed to overcome limiting site conditions;
- Any system designed to chemically or mechanically aerate, separate, or pump the liquid, semi-solid or solid constituents in the systems; or
- Any system designed specifically to reduce, convert, or remove nitrogenous compounds, phosphorus, or pathogenic organisms by biological, chemical, or physical means.

Piloting involves the installation, field testing, and technical evaluation to demonstrate that the technology can function effectively under the physical and climatological conditions at the pilot sites and provide environmental protection equivalent to a conventional Title 5 system.

Provisional use approvals are intended to evaluate whether an I/A technology can provide environmental protection at least equivalent to a conventional system under actual field conditions and with a broader range of uses than in the controlled environment of piloting.

When an I/A technology has successfully completed the Provisional Use stage, it receives Certification for General Use. I/A systems certified for General Use can be installed at any site where a conventional Title 5 system can be installed. Additional monitoring and reporting is generally not required, although DEP has the option of requiring monitoring as part of its Certification.

Massachusetts Alternative Septic System Test Center

The Massachusetts Alternative Septic System Test Center (Center) was constructed by the Buzzards Bay National Estuary Program (BBP), a unit of the Massachusetts Office of Coastal Zone Management, in collaboration with Massachusetts Department of Environmental Protection (DEP), Barnstable County Department of Health and the Environment (BCDHE), and the University of Massachusetts' Dartmouth School for Marine Science and Technology (SMSAT). The Center was initially funded with a grant from USEPA (Environmental Technology Initiative), with subsequent funding received from the Massachusetts Environmental Trust, the Massachusetts Office of Coastal Zone Management, the Massachusetts Department of Environmental Protection, and USEPA Region I.

The mission of the Center is to evaluate the performance and operation costs of new and innovative wastewater disposal technologies in a carefully controlled and unbiased manner and provide this information to regulators and consumers and assist vendors in getting their technologies approved for use more quickly and at a lesser cost.

Permitting and Inspection of On-site Sewage Management Systems

Every location proposed for the construction, upgrade, or expansion of an on-site subsurface sewage disposal system must be evaluated based upon an analysis of all site characteristics which may affect system function and performance. The field evaluation includes a soil percolation test as well as the landscape position and hydrogeologic properties of the site. Hydrogeologic properties include such items as direction of ground water flow, ground water table elevation, depth to bedrock, and location of public and private water supplies.

Design and Construction

Every system shall be designed by a Massachusetts Registered Professional Engineer or a Registered Sanitarian and their signature must accompany any plan submitted for approval. Each design plan must include particular site specifications.

Monitoring

A monitoring program requires regular monitoring for treatment systems in single family homes that use innovative or alternative technologies treating less than 2000 gpd. More than 2000 of these systems have been installed since the enactment of Title 5. The Department requires annual inspections of these systems, and data indicate that they are producing a higher quality effluent than required by regulation. Beginning in Jan, 2006, new monitoring rules require a field test that includes: visual examination, pH of effluent, dissolved oxygen, and turbidity. If the effluent does not pass all of the field tests, the operator will be required to collect a sample for laboratory analysis. Monitoring will occur twice a year for remedial systems and once a year for general use systems. No monitoring program exists for traditional systems.

Maintenance

Pumping of traditional septic systems is required when sludge or solid layers reach a certain level. Pumping is typically necessary at least once every three years. Homeowners are encouraged to maintain their system according to these rules, but no enforcement mechanism is currently implemented.

Location

Septic tanks must be located within specified minimum setbacks from property lines, surface waters including streams, reservoirs, marshes, and wetlands, tributaries to surface water supplies, and private water supply wells.

Failure

A system is considered failing if there is backup of sewage into the facility served by the system, if there is discharge of effluent to the surface, if the liquid level in the distribution box is above the level of the outlet, or if a septic tank requires pumping more than four times a year.

Septage Disposal

Sludge and septage is classified in Massachusetts as either:

- Type I, which may be sold or distributed on any site without approval by the Department and which may be used for growing vegetation;

- Type II, which may be offered or distributed only with approval of the Department and may be used for growing vegetation; or
- Type III, which may be sold or distributed only with approval of the Department, and which may be used for growing any vegetation not including direct food chain crops, and whose land application to a site must be recorded in the registry of deeds in the chain of title for such site.

Specific and detailed specifications exist for land application of each type of sludge or septage, including requirements for soil texture and drainage, depth to ground water, soil pH, slope, proximity to public water supplies and other surface and ground waters, public access, and agricultural activities (310 C.M.R. 32).

Financial Assistance for Homeowners

Massachusetts offers special funding programs for homeowners who have septic systems:

- *Community Septic Management Program:* The Department's Bureau of Resource Protection and Division of Municipal Services developed, in collaboration with other state offices, the Community Septic Management Program (CSMP) to provide funds and assistance to homeowners for compliance with Title 5. Communities may apply for funds on a community-wide basis or for targeted sensitive areas or areas with high failure rates. Communities may also apply for funds to address known or suspected failures.
- *The Homeowner Septic Loan Program* was designed to meet the demand for funds by homeowners whose systems will not pass Title 5 inspection. The program provides below market rate loans to homeowners for upgrading systems.
- *Tax Credit:* The Department of Revenue allows homeowners to claim up to \$6,000 in tax credits for septic upgrades. The credit cannot exceed \$1,500 in any year and may be spread over four years. The tax credit is limited to work done on a primary residence.

Minnesota

Minnesota's state agencies responsible for the management of on-site wastewater systems delegate many of the tasks associated with enforcement and implementation of relevant statutes to counties and local communities. On-site wastewater regulations are split between several agencies. The Minnesota Pollution Control Agency (MPCA) writes and interprets rules, administers state licensing program, reviews and approves septic designs with average design flows greater than 10,000 gallons per day. The Minnesota Department of Health (MDH) reviews and approves plumbing systems, including the septic system, for facilities serving the public and those that are designed for less than 10,000 gallons per day. The Department of Natural Resources (DNR) is responsible for administering the Shoreland Management Act, requiring septic systems to be inspected

when any permit or variance is requested for the property. Implementation of the act is done on a local basis.

All counties are required to have an Individual Sewage Treatment System (ISTS) ordinance, but it can be either more or less restrictive than state code. Local authorities are not required to seek approval from the state to create more stringent codes.

Two processes are in place for allowing new technologies to be used in the state. First, performance standards allow any technology to be used if the local government specifically adopts that portion of the rule, issues renewable operating permits on the system, and reviews and approves monitoring and mitigation plans. Second, the MPCA can designate a new technology as an “alternative” system (has research data) or “standard” system (has proven itself over time and location).

Permitting and Inspections

Permitting of septic tanks is divided into two parts in Minnesota. Phase I consists of a site field evaluation, while Phase II requires a detailed report on the design of the system.

Phase I site evaluations consist of preliminary and field evaluations that must include specific elements such as slope, soil percolation, vegetation type, landscape position.

In Phase II, design reports are completed, including drawings, design flows, system component sizings and calculations, hydraulic and organic loading rates, setbacks, construction considerations, and, as applicable, maintenance contracts, operational requirements, monitoring, and mitigation plans.

Permits are issued for new construction of onsite systems and generally for the repair, upgrade, or modification of existing onsite systems. Inspections may be performed by local permitting authority staff, or a homeowner may hire a licensed inspector. All onsite inspectors must be licensed and complete training, pass exams, and have the first 15 inspections supervised. Site evaluations before an onsite system is installed or approved must be conducted by licensed designer.

Maintenance

Septic tanks are required by to be checked for sludge and scum levels by the owner every three years. Local ordinances may have additional requirements. Minimum maintenance standards require that homeowners do a visual assessment of the tank and its components for leakage and measurement of scum and sludge depths. Septage must be removed from tanks when the top sludge layer is at a certain level. When these requirements are exceeded, a state-licensed pumper must remove accumulated septage.

The Metropolitan Council (Minneapolis-St. Paul area) requires all local governments within its seven-county jurisdiction to have maintenance programs. In addition, many lake associations, homeowner associations, sanitary sewer districts, etc., have created and implemented effective management programs.

Location

Septic tanks must be located within specified minimum setbacks from dwellings, private wells, surface water, and property lines.

Septic System Failure

A failed system is one in which a tank that obviously leaks below the designed operating depth, any system with less than the required vertical separation, or any situation with the potential to immediately and adversely affect or threaten public health or safety, including ground surface or surface water discharges and sewage backups. Minnesota's revolving loan program provides loans to municipalities for planning, design, and construction of eligible wastewater treatment projects.

Septage Disposal

Minnesota's land application of septage does not require permitting, but the Minnesota Pollution Control Agency issued a document entitled *Land Application of Septage*, which explains the state's guidelines. This document contains the following controls for land application:

- Setbacks vary with the method of applying the septage, the time of the year, the slope of the application site, and whether the septage was stabilized with alkali treatment. Setbacks are included for surface waters, drainage tile inlets, and sinkholes.
- Slope restrictions vary based on the method used to apply the septage and whether the soil is frozen.
- Several characteristics for soil characteristics are specified.
- Several harvesting and food crop limitations prevent contamination of food crops or food chain crops.
- Application rates are based on nitrogen inputs relative to other sources of nitrogen. Septage may not be applied when it is raining.

North Carolina

The strength of North Carolina's on-site management program is the variety of programs at the state level that work to assist local health departments in providing a comprehensive program for control of sub-surface on-site wastewater treatment in their communities. The On-Site Wastewater Section (OSWS) within the North Carolina Department of Environment and Natural Resources' (DENR) Division of Environmental Health, in a joint effort among the local health departments, is responsible for providing a

comprehensive program for control of sub-surface on-site wastewater treatment and disposal. North Carolina Rules are adopted by the Commission for Health Service (CHS) and are mandatory throughout North Carolina. Local boards of health may adopt more stringent rules along with adoption of the CHS rules and this agency's approval. Currently only two of 100 counties have state approved local rules.

Program Improvement Team

The Program Improvement Team within OSWS assists local level on-site wastewater programs in improving the quality and efficiency of their work. The team conducts local program evaluations and works closely with each local on-site specialist to assess their field performance and provide rule interpretation and documentation detail. The team also undertakes special projects such as system performance surveys to improve the OSWS regulations.

Permitting and Inspection of On-site Sewage Management Systems

A permit issued by the local health department is needed before any septic system is installed or repaired. Applications for an Improvement Permit, Construction Authorization, or Operation Permit shall be submitted to the local health department for each site prior to any construction. The application for a Construction Authorization must contain the locations of the proposed facility and the system showing setbacks to property lines and fixed reference points as well as details of the proposed system.

A county Environmental Health Specialist must visit the site to evaluate the soil and site conditions prior to issuance of a permit. The Environmental Health Specialist must also approve the installation before the system is put into use. The investigation of each proposed site shall include the evaluation of topography and landscape position; soil morphology, wetness, and depth; restrictive soil horizons; and available space.

Maintenance and Monitoring

Maintenance is required by the state for a subset of systems. North Carolina code requires maintenance contracts for pressure dosed systems, systems with two or more pumps, systems with a design flow greater than 3000 gallons/day, and all treatment systems beyond primary treatment. The state requires perpetual maintenance on mechanical systems that have surface discharge to surface water, but not for discharge to ground surface. Traditional septic tanks do not fall under this category and no regularly reported maintenance is required by the state.

Location

Septic tanks must be located with minimum setbacks of property lines, surface waters including wetlands, and public and private wells.

Failure

North Carolina State Code defines a failed system as one that fails to meet one or more of specified requirements, either continuously or intermittently, or if it is necessary to remove the contents of the tank at a frequency greater than once per month in order to satisfy the required conditions.

Septage Disposal

North Carolina treats septage as solid waste and allows any of three septage disposal methods: treatment at a wastewater treatment plant, treatment at an independent septage treatment plant, or land application. For land application, the state places restrictions on application to food or food chain crops, requires lime stabilization to reduce pathogens and vectors, requires nutrient management plans for agricultural application, and mandates that land application rates are based on the nitrogen rate required to produce a realistic yield for the crop grown. Borders and setbacks are required to protect human health and the environment, including setbacks from residences, wells, springs, streams, public road right of way, food crops, and wetlands.

Non Point Source Pollution Management

The On-Site Wastewater Section takes an active role in the prevention of non point source pollution from on-site septic systems by:

- Evaluating appropriate innovative and alternative systems from both public health and water quality perspectives;
- Documenting potential effects of on-site wastewater systems and community wastewater systems on coastal water quality;
- Evaluating the extent of water quality impacts from high-density on-site wastewater systems and designing measures to mitigate water quality impacts; and
- Coordinating education and technology transfer to government agencies and the public.

Wastewater Discharge Elimination Program

The Wastewater Discharge Elimination Program (WaDE) Program was established to identify and eliminate discharges from straight pipes, which discharge sewage directly to surface waters, and failing septic systems. The program assists counties in initiating door to door surveys to identify straight pipes and failing septic systems. North Carolina DENR has established a self-reporting policy for the WaDE program that allows home and business owners who self report on-site violations to be exempt from related legal action as long as there is reasonable progress towards correcting the violation. The program also assists counties in enabling homeowners to access financial assistance

programs for loans or grants to repair onsite systems. Funds appropriated by the North Carolina General Assembly support the program. Additional financial support has been secured through grants from the N.C. Clean Water Management Trust Fund (CWMTF) and the EPA's 319 Nonpoint Source Program.

South Carolina

The Onsite Wastewater Management Division (OMWD) of the Bureau of Environmental Health within the South Carolina Department of Health and Environmental Control (DHEC) provides program management through DHEC's eight regions and forty-six county health offices. The division develops regulations that establish minimum site and soil conditions as well as system design and construction. It also administers a licensing program for septic system contractors and septage haulers as described in S.C.R. 61-56.1. Program quality is evaluated by residents and permit holders through region and county program surveys. In addition, the Division implements public education initiatives that emphasize the importance of routine maintenance (S.C.R. 61-56.1, SC DHEC 2006).

Permitting and Inspections

It is the responsibility of the property owner to ensure that a permit to construct an on-site sewage disposal system is obtained from DHEC prior to construction of the system. The property owner must furnish all information required for permit application as well as a boundary plat or deed specifying the lot size and its boundaries. The Department must perform a site evaluation prior to the issuance of a permit.

Once a permit is issued, the on-site sewage disposal system must be constructed in accordance with the specifications stated in the permit. Soil texture, depth of soil to rock, and maximum seasonal high water table shall meet minimum standards as required by DHEC (S.C. R. 61-65).

Maintenance

No water quality testing procedure is currently in place, but regulations require that systems are installed in a manner that will not violate laws governing pollution (S.C. R. 61-65).

Location

Minimum setback/separation distances are required from property lines, impounded or natural surface waters, and private wells.

Septic System Failure

In South Carolina, a failed system is one that is discharging onto the surface or is backing up into the dwelling. If a system is considered to be failed, an official notice from DHEC will be issued to the homeowner. This notice states that the homeowner is in violation of

Regulation 61-56, and must repair the system within ten days. If the homeowner does not cooperate, legal action will be taken through the local magistrate's office.

No funding or financing options are available to individual homeowners for the repair or replacement of failing or malfunctioning systems or for new construction (NESC 2001).

Septage Disposal

South Carolina DHEC issues individual land application permits, which may contain:

- Effluent limitations on pollutants of concern;
- Pollutant monitoring frequencies;
- Ground water monitoring;
- Reporting requirements;
- Schedules of compliance;
- Operating conditions;
- Best management practices; and
- Administrative requirements.

Vermont

In Vermont, 55 percent of households use some form of on-site wastewater system. The Wastewater Management Division (WMD) of Vermont's Department of Environmental Conservation (DEC) has primary oversight of these systems. The five regional offices of WMD issue permits for wastewater, small potable water supply systems, and water/sewer connections. All rules apply state-wide, but can be made more stringent on the local level without state approval.

Vermont's small-scale wastewater rules apply to the subdivision of land, the construction, modification, or change in use of a building or structure or campground and their associated soil-based wastewater disposal systems with design flows of less than 6500 gallons per day. Those technologies approved for onsite wastewater treatment and disposal include trenches, beds, Wisconsin mounds, at-grade systems, sand filters, and the Advantex system. The rules include a protocol for review of experimental, pilot, and general use systems.

Permitting and Inspections

Permits are issued by the state for construction of new systems and repair, modification, or upgrade of existing systems. All plans for wastewater systems submitted for approval shall be prepared by a designer. Designers have to be licensed engineers or certified site technicians. Site evaluations are conducted by licensed designer who prepares the design and submits it to the state for review. Percolation test and soil characteristic tests are required as part of the site evaluation. The state operates a licensing/certification program for onsite wastewater professionals.

Design and Construction

All new and replacement septic systems must be constructed according to the technical standards found in VT Ch. 1 § 1-501.

Location

Septic tanks must be located with minimum setbacks from dwellings or structures, surface water bodies, property lines, or water wells. There is no minimum lot size required for the placement and use of onsite wastewater systems by the state.

Maintenance

At least once a year, the depth of sludge and scum in the septic tank should be measured. The tank should be pumped if the sludge is 12 inches or less to the outlet or the scum is closer than three inches to the outlet. Following pumping, tanks over 5,000 gallons should be inspected for leaks and cracks. The burden to complete this maintenance falls on the homeowner. Vermont code does not include an enforcement mechanism to address situations where maintenance requirements are not met, unless system failure results.

Vermont Code does not require management districts to monitor and maintain on-site systems or individual liquid waste systems. Periodic inspections are required by the state only for innovative systems or systems of more than 6,500 gallons per day.

Septic System Failure

A failed system is one that is functioning in a manner that allows wastewater to be exposed to the open air, pool on the surface of the ground, discharge directly to surface water, or back up into a building or structure, unless these instances are approved in the design of the system. A system is also considered failed if it renders a potable water supply contaminated or presents a threat to human health (VT Ch. §1-201 (26)). Most failed systems are thought to be those that were not designed based on the current rules.

No funding program exists to assist homeowners either replacing failing systems or installing new ones, but legislation has been proposed. A State Revolving Fund may be

available. Currently, there are no programs in Vermont that offer the homeowner insurance policies on the onsite systems.

Septage Disposal

Of the nearly 22 million gallons of septage pumped annually in Vermont, more than half (59 percent) is transported to wastewater treatment facilities. The remaining 42 percent is land applied after being stabilized with lime. Septage is regulated under the state's Solid Waste Management Rules, which include provisions for land application, or "diffuse disposal." Land application is prohibited for food and food chain crops, and for non-food crops, application must include consideration of crop nutrient requirements and must meet soil pH requirements. Prior to application, all wastes must be sampled and analyzed for toxicity. In addition, the following restrictions apply:

- Provisions for controlling public access shall be established and maintained for the duration of disposal and for 12 months beyond the last disposal episode;
- Application is prohibited within the 100 year flood plain unless incorporated within 48 hours;
- Application is prohibited in a watershed for a Class A stream or stream segment;
- Application is prohibited when ground water is within three feet of the zone of incorporation; and
- Application is prohibited in Class I and Class II ground water areas.

Summary

Requirements for permitting and inspection of on-site wastewater systems in the states surveyed were similar, with somewhat predictable guidelines for site evaluations (e.g., soil percolation and setbacks from dwellings and water bodies). The most significant differences are found in the rules regarding authorizing alternative technologies and for ongoing monitoring and maintenance of on-site systems. Most of the states have specific maintenance expectations of homeowners, but funding and enforcement of homeowner maintenance is largely lacking.

Chapter 7

INFRASTRUCTURE FINANCING

Water and wastewater infrastructure costs can comprise a significant share of a community's budget. Upgrading existing treatment plants and service lines is costly, as is new construction for communities that do not already have public facilities.

During the 1970s and 1980s, the federal Construction Grants Program was a major source of funds for publicly-owned wastewater treatment projects. These projects included sewage treatment plants, pumping stations, collection and interceptor sewers, rehabilitation of sewer systems, and control of combined sewer overflows (USEPA (Infrastructure)). This has been replaced by a revolving fund program, which, in Georgia, is administered by the Georgia Environmental Facilities Authority (GEFA).

With the passage of the Safe Drinking Water Act amendments in 1997, the Construction Grants Program was phased out and a similar program allowed USEPA to assume greater responsibility for financing local drinking water facilities through State Revolving Fund programs. Now, every four years, USEPA in cooperation with states, develops Needs Surveys of the costs to construct improvements to water quality and drinking water facilities needed to meet water quality and drinking water standards (Ibid).

Federal Financing Programs

Several funding programs offer assistance for local infrastructure projects, including the Clean Water State Revolving Loan Fund; the Drinking Water State Revolving Fund; the Community Development Block Grant Program; the U.S. Department of Agriculture Rural Utilities Service; the Public Works and Development Facilities Program; and the Targeted Watershed Grants Program.

Clean Water State Revolving Loan Fund

The Clean Water State Revolving Loan Fund (CWSRF) is a federal loan program that offers funding for a wide variety of wastewater infrastructure projects, including the following:

- Constructing new wastewater treatment plants;
- Expanding wastewater treatment plants;
- Installing sewer lines and sewer rehabilitation projects;
- Correcting infiltration/inflow problems and/or combined sewer overflow problems;
- Constructing and rehabilitating municipal storm sewer systems;

- Purchasing street and storm sewer cleaning equipment;
- Acquisition of buffer zones and/or wetlands; and
- Constructing stormwater control structures such as detention and retention ponds (particularly on a regional basis), and restoring streambanks.

States are required to provide 20 percent matching funds in order to receive CWSRF loans.

Drinking Water State Revolving Fund

The Drinking Water State Revolving Loan Fund (DWSRF) offers financial assistance for drinking water infrastructure projects. These include a wide variety of public health related water supply projects such as:

- Implementation of security measures such as fencing, surveillance equipment, backflow prevention devices, and enhanced filtration/disinfection treatment;
- Maintaining compliance with existing or proposed standards and regulations;
- Rehabilitating or replacing aging infrastructure;
- Rehabilitating or developing sources to replace contaminated sources of drinking water, including replacing contaminated private wells with public drinking water supply;
- Installing or upgrading treatment facilities to improve drinking water quality;
- Installing or upgrading storage facilities to prevent microbiological contaminants from entering the system; and
- Installing or replacing transmission and distribution pipes to prevent contamination.

A variety of other federal funding programs offer assistance for water and wastewater infrastructure, particularly for rural communities and those that are economically disadvantaged. Following are examples of such programs.

Community Development Block Grant Program

Administered through the U.S. Department of Housing and Urban Development (HUD) since 1974, the Community Development Block Grant (CDBG) Program provides annual grants on a formula basis to states and units of local governments. HUD may directly administer the CDBG program for certain communities, and states may award grants to

smaller units of government to carry out community development activities, which may include water and wastewater infrastructure projects. Such state-administered funding is referred to as the Small Cities CDBG Program. HUD determines the amount of each grant by using a formula comprised of several measures of community need, including the extent of poverty, population, housing overcrowding, age of housing, and population growth lag in relationship to other metropolitan areas (HUD).

U.S. Department of Agriculture (USDA) Rural Utilities Service

The USDA Rural Utilities Service helps rural utilities expand and keep their technology up to date. Through its Water and Waste Disposal Systems for Rural Communities, it provides monies to meet basic needs of rural communities and promote growth by providing funds for installation, repair, or improvement of water and wastewater.

Public Works and Development Facilities Program

Administered by the Economic Development Administration (EDA) of the U.S. Department of Commerce, the Public Works and Development Program helps distressed communities attract industries and business by giving infrastructure financing assistance, including water and wastewater infrastructure. EDA will provide Public Works investments to support the construction or rehabilitation of essential public infrastructure and facilities necessary to generate or retain private sector jobs and investments, attract private sector capital, and promote regional competitiveness (EDA).

Targeted Watershed Grants Program

USEPA selects up to 12 watershed organizations annually to receive Targeted Watershed Grants for watershed-based implementation projects and up to five training and education organizations. The grants require a 25 percent match and are available to municipal and county governments, nonprofit organizations, and watershed protection groups.

Advantages and Disadvantages of Various Funding Sources

Funding is available from a variety of federal, state, and private sources for communities to replace or improve existing infrastructure. The following information was adapted from Table 7, in *Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (USEPA, December, 2005). Although its focus is on wastewater treatment, it is equally applicable for other water infrastructure capital needs.

Loans – Money lent with interest; can be obtained from federal, state, and commercial lending institutions.

Advantages: State and federal agencies can often issue low-interest loans with a long repayment period. Loans can be used for short-term financing while waiting for bonds or grants.

Disadvantages: Loans must be repaid with interest. Lending agency might require certain provisions to ensure repayment of the debt. Commercial loans typically are available at high interest rates and might be difficult to obtain without adequate collateral.

Grants – Funds awarded to pay for some or all of a community project.

Advantages: Funds do not need to be repaid. Small communities might be eligible for many different grants to build or upgrade their facilities.

Disadvantages: Requires time and money to manage. Wage standards may apply increasing project expense. Might require use of material/design requirements that exceed local standards, resulting in higher costs.

General obligation bonds – Bonds backed by the full faith and credit of the issuing entity. Secured by the taxing powers of the issuing entity. Used by local governments.

Advantages: Interest rates are usually lower than those of other bonds. Offers considerable flexibility to local governments.

Disadvantages: Community debt limitations might restrict use. Voters must often approve of using these bonds. Usually used for facilities that do not generate revenues.

Revenue bonds – Bonds repaid by the revenue of the facility.

Advantages: Can be used to circumvent local debt limitation.

Disadvantages: Do not have full faith and credit of the local government. Interest rates can be higher than those of general obligation bonds.

Special assessment bonds – Bonds payable only from collection of special assessments.

Advantages: Removes financial burden from local government. Useful when direct benefits can be applied.

Disadvantages: Might be costly to some landowners and inappropriate in areas with nonuniform lot sizes. Interest rate can be high.

Bondbank monies – States use taxing power to secure a large-issue bond that can be divided among communities.

Advantages: States can secure bond at a lower rate. The state may issue the bond in anticipation of community need.

Disadvantages: Many communities compete for limited amount of bond bank funds.

Certificates of participation (COPs) – Certificate that may be issued by a community to several lenders that participate in the same loan.

Advantages: Costs and risks spread out over several lenders. In some cases COPs may be issued when bonds would exceed debt limitations.

Disadvantages: Involve complicated agreements among participating lenders.

Note – A written promise to pay a debt.

Advantages: Method of short-term financing while a community is waiting for a grant or bond.

Disadvantages: Community must be certain of receipt of the grant money. Notes are risky because voters must approve general obligation bonds before they are issued.

Property assessment – Direct fees or taxes on property. May include grant and bond anticipation notes. Sometimes referred to as an improvement fee.

Advantages: Useful when benefits from capital improvements are identifiable. May be used to reduce local-share debt requirements for financing. May be used to establish a fund for future capital investments.

Disadvantages: Initial lump sum payment of assessment might be a significant burden on individual property owners. Some states and localities restrict the allowable burden on individuals.

Connection fees – Charges assessed for connection to existing system.

Advantages: Connection funded by beneficiary. All connection costs might be paid.

Disadvantages: Might discourage development. Can be restricted by state and local laws.

Impact fees – Fees charged to developers.

Advantages: Paid for by only those who profit. Funds may be used to offset costs.

Disadvantages: Might reduce potential for development. Can be restricted by state and local laws.

Infrastructure Financing in Other States

Please note that more detailed summaries of water quality policies in other states are provided in Appendix B through E. References for these appendices are provided by state in the Reference section.

California

California's infrastructure financing programs are unique in the fact that they primarily rely on voter-approved state bond monies. The State Water Resources Control Boards' Division of Financial Assistance administers all of the programs. Several of the programs fund infrastructure as part of a broader nonpoint source pollution control program.

The Division of Financial Assistance (DFA) within the State Water Resources Control Boards administers financial assistance programs, which include loan and grant funding for construction of municipal sewage and water recycling facilities, remediation for underground storage tank releases, watershed protection projects, and nonpoint source pollution control projects.

Integrated Regional Water Management Grant Program

The Integrated Regional Water Management grant program, funded by Proposition 50, Chapter 8, will provide approximately \$380 million between 2005 and 2007 for competitive grants for projects to protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water. Funding for the program is administered jointly between the State Water Resources Control Board and the Department of Water Resources. Both planning and implementation grants are awarded.

Small Community Wastewater Grant Program

The Small Community Wastewater Grant program, funded by Proposition 40 and Proposition 50, provides grant assistance for the construction of publicly owned wastewater treatment and collection facilities. Grants are available for small communities with financial hardships. Communities must have a population less than 20,000 and annual median household income of less than \$37,994 to qualify for funding under the program. Funding is provided only to local public agencies.

State Revolving Fund Loan Program

The Division of Financial Assistance administers the State Revolving Fund loan program, a low-interest loan program that funds construction of publicly-owned wastewater treatment facilities, local sewers, sewer interceptors, and water reclamation facilities, as well as expanded use projects such as implementation of nonpoint source projects or programs, development and implementation of estuary Comprehensive Conservation and

Management Plans, and stormwater treatment. Currently, \$200-\$300 million is available annually, and funds come from federal appropriations, state funds, and revenue bond sale.

Urban Stormwater Grant Program

The Urban Stormwater Grant Program, also administered by DFA, is under development. Funded by Proposition 40, it is estimated that the urban stormwater grant program will award up to \$14.25 annually to local public agencies for projects designed to implement stormwater pollution reduction and prevention programs. Eligible projects include those to divert dry weather flows to publicly owned treatment facilities, acquisition and development of constructed wetlands, and the implementation of approved stormwater BMPs.

Florida

The bulk of Florida's infrastructure financing programs target rural and disadvantaged communities. Two semi-private entities, Enterprise Florida, Inc. and the Florida Rural Water Association, both administer loan and grant programs to communities on behalf of the state. The five regional water management districts are responsible for maintaining wastewater infrastructure in municipalities under their jurisdictions.

Enterprise Florida

Enterprise Florida, Inc. (EFI) is a public-private partnership responsible for leading Florida's statewide economic development efforts. EFI administers the Rural Infrastructure Fund, which provides financial assistance to enable rural communities to better access other infrastructure programs, including those offered by the federal government that require matching funds.

The Rural Community Development Revolving Loan Program, also administered by EFI, provides financial assistance to local governments in the form of either a loan or loan guarantee. The program's purpose is to provide financial assistance for a specific project that will lead to the creation of new jobs and increased economic vitality in rural Florida.

Florida Rural Water Association

The Florida Rural Water Association Loan Program was created to help communities obtain financing for construction projects. The program provides a loan program for communities that have received a permanent loan commitment from the USDA Rural Development or the Department of Environmental Protection's State Revolving Fund programs, yet still need construction funds.

Disadvantaged Small Community Wastewater Grant Program

The Bureau of Water Facilities Funding implements this grant-in-aid program that assists small communities in planning, designing, and constructing wastewater management

facilities. In order to participate, a community must have a maximum population of 7,500 and a per capita income below the Florida average. The program provides funding for new wastewater management facilities such as sewers, treatment plants, effluent disposal systems, and reclaimed water reuse facilities. The program also provides funding for the renovation of existing wastewater management facilities. A partial match of local funds is required.

Federal Funds Available in Florida

Clean Water State Revolving Fund (CWSRF)

In Florida, CWSRF funds, which provide low-interest loans to local governments to plan, design, or build wastewater, stormwater, and nonpoint source pollution prevention projects, are made available by the Bureau of Water Facilities Funding within the Florida Department of Environmental Protection. It is by far Florida's largest financial assistance program for water infrastructure. The drinking water State Revolving Fund program is also implemented by the Bureau of Water Facilities Funding.

Community Development Block Grants

The Florida Department of Community Affairs administers the Small Cities Community Development Block Grant Program. About \$11 million is available annually for water and sewer projects, primarily benefiting low and moderate income persons. Approximately \$9 million in additional funds are also available annually for Economic Development water and wastewater projects required to serve a job-creating entity. The majority of jobs created must be for low and moderate income persons.

North Carolina

North Carolina has a relatively robust collection of financial programs. Many loan and grant programs focus on North Carolina's rural communities, particularly those in the mountainous western part of the state. The Clean Water Management Trust Fund was created in 1996 by the General Assembly of North Carolina to make grants to local governments, state agencies, and conservation non-profits to help finance projects that specifically address water pollution problems. Infrastructure projects are eligible for these funds. The North Carolina Rural Economic Development Center is a private, non-profit organization that administers three programs designed specifically to help rural communities develop the water and sewer systems they need to support local economic growth and ensure a reliable supply of clean water.

North Carolina Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. More than \$595.8 million have been appropriated by the General Assembly, and those funds have leveraged an additional

\$906 million in private and other public funds. Forty-four percent of these grants were made to municipalities, counties, or other local government agencies. Examples of projects funded include improvements to wastewater treatment and collection systems, stormwater management, repair of septic tanks and removal of straight-pipes, wetlands, riparian buffer, and stream restoration, acquisition of buffers and greenways, and agricultural BMPs. Wastewater and stormwater projects represent 29 percent of the total grants made.

North Carolina Revolving Loan and Grant Program

In 1987, the North Carolina General Assembly created the North Carolina Revolving Loan and Grant Program to provide state financing for the construction of wastewater facilities. Funding for this program is dependent upon legislative appropriations and may not be available at all times. The program is administered by the Construction Grants & Loans Section, a non-regulatory section that operates as both a financial and technical resource for publicly-owned wastewater treatment facilities, with the Department of the Environment and Natural Resources (DENR).

Eligible applicants are limited to units of local government who may apply for funding from any of three available funds:

1. Low Interest Revolving Loans at one-half of the market rate for wastewater collection and treatment facilities for up to a maximum of 20 years, with a maximum loan amount of \$8,000,000.
2. Low Interest Emergency Revolving Loans for certified water quality or public health emergencies associated with existing facilities.
3. High-Unit Cost Grants for up to \$3,000,000 per applicant over three fiscal years. These funds allow local governments to make projects more affordable by keeping user fees at a reasonable level.

The North Carolina Rural Economic Development Center

The North Carolina Rural Economic Development Center (REDC) is a private, non-profit organization, funded by both public and private sources and led by a 50-member board of directors. The Center administers three programs, described below, that are designed specifically to help rural communities develop the water and sewer systems they need to support local economic growth and ensure a reliable supply of clean water. Local governments and non-profit organizations located in rural counties are eligible to apply.

- The Supplemental Grants Program: Local governments and qualified non-profit corporations may apply for funds to address public health, environmental, and/or economic development needs. The maximum grant amount for this program is now \$400,000.

- Capacity Building Grants Program: Local governments may apply for funds to undertake planning efforts that support strategic investments in water and sewer facilities. Funds typically are used to prepare preliminary engineering reports, master water/sewer plans, capital improvement plans, water/sewer feasibility studies, rate studies, and grant applications. The maximum grant amount for this program is generally \$40,000. This program is open to all counties.
- The Unsewered Communities Grants Program provides funding for the planning and construction of new central, publicly owned sewer systems. Qualified communities must be unserved by wastewater collection or treatment systems. Grants are designed to cover 90 percent of the total cost of a project, but will not exceed \$3 million.

Since the programs began in 1994, the Rural Center has awarded nearly 500 communities and counties more than \$64 million to plan, install, expand, and improve their water and sewer systems. The programs are made possible through appropriations from the North Carolina General Assembly and through proceeds from the Clean Water Bonds.

Federal Funds Available in North Carolina

Clean Water State Revolving Fund (CWSRF)

In North Carolina, Clean Water State Revolving Fund Program (CWSRF) funds are made available to units of local government at one-half of the market interest rate for a period of up to 20 years. The actual term of the loan is determined by the State Treasurer's Office. The program is administered by the Construction Grants & Loans Section, a non-regulatory section that operates as both a financial and technical resource for publicly owned wastewater treatment facilities, with DENR.

Community Development Block Grants

The Division of Community Assistance (DCA) is a division of the North Carolina Department of Commerce. The Division provides assistance through the Small Cities Community Development Block Grant (CDBG) program. The primary objective of the CDBG Program is the development of viable urban communities by providing decent housing, a suitable living environment, and expanding economic opportunities, principally for persons of low and moderate income. The program has an "infrastructure bias" toward water and wastewater projects.

USDA Rural Utilities Service

Funds provided by the USDA Rural Utilities Service are used for community water, sewer, storm sewer, and solid waste. Loan and grant funds may be used to construct, repair, modify, expand or otherwise improve water supply and distribution systems. These funds are distributed through USDA offices throughout North Carolina.

Clean Water Act Section 319 Grants

These grants are administered in North Carolina by the Division of Water Quality within DENR for projects that address nonpoint source pollution. Projects to repair failing septic or other onsite sewage treatment systems are eligible.

Ohio

Ohio's Water Pollution Control Loan Fund has been recognized by USEPA for its innovation and effectiveness at achieving performance and protection through the Clean Water State Revolving Fund. Of particular note is the Ohio Environmental Protection Agency's (Ohio EPA, Agency) Water Resource Restoration Sponsor Program. The program offers communities an interest rate reduction on their point source loan if they agree to sponsor a non-point source project. Many of these projects address infrastructure construction and repair. Other programs target Ohio's rural and low-income communities.

Water Pollution Control Loan Fund

The Water Pollution Control Loan Fund (WPCLF) provides below-market interest rate loans and technical assistance for a wide variety of projects to protect or improve the quality of Ohio's rivers, streams, lakes, and other water resources. Planning, design, and construction assistance is available for both public and private applicants. The program is administered by Ohio EPA's Division of Environmental and Financial Assistance. The fund was created by the Ohio legislature in 1989 and is financed by federal State Revolving Funds.

Loan Fund assistance is available for wastewater treatment projects such as wastewater treatment plant improvements or expansion; new or replacement sewers; facilities for unsewered areas; and combined sewer overflow correction. Projects fulfilling NPDES stormwater requirements for Phases I and II also qualify. Water quality-based activities to reduce or avoid nonpoint source water pollution, including agricultural or sivicultural BMPs, wellhead protection, landfill closure, stream corridor restoration, or hazardous waste cleanup (brownfields), are also qualified to receive funds.

In general, WPCLF loans for wastewater collection and treatment activities and stormwater activities are available to public entities such as villages, cities, counties, and sewer districts. Loans for nonpoint source are available to both public entities and private entities (e.g, non-profit organizations, private companies, individuals, etc.).

The "linked deposit" program of WPCLF is available to private organizations and individuals for nonpoint source projects such as agriculture best management practices, urban stormwater runoff control, stream corridor restoration, or home sewage treatment system replacements. Linked deposits are different than loans for nonpoint source activities in that instead of borrowing directly from WPCLF, a linked deposit loan is made to the applicant by a private lending institution at a below-market interest rate. The

interest rate for the loan is supported by a WPCLF-funded certificate of deposit with the lender.

The Water Resource Restoration Sponsor Program (WRRSP) provides an opportunity for WPCLF funding recipients to finance planning and implementation of additional projects that address nonpoint source pollution. The WRRSP offers communities very low interest rates on loans for wastewater treatment plant improvements if the communities also sponsor projects that protect or restore surface water resources. WPCLF recipients can initiate projects themselves or sponsor approved projects planned by another group, such as a land trust, park district or other entity with the ability to protect and manage such resources.

Since October 2000, Ohio EPA has provided more than \$35 million to projects that have protected or restored approximately 38 miles of stream corridors and 4,000 acres of wetlands.

Village Capital Improvement Fund

The Village Capital Improvement Fund provides loans up to \$25,000 for planning and \$50,000 for the design of water supply and wastewater treatment projects. The fund is administered jointly by Ohio EPA's Division of Environmental and Financial Assistance and the Ohio Water Development Authority.

Village Capital Improvement Fund projects for sewer systems include sewage disposal works, treatment plants and pumping stations. Water supply projects include wells, well-head protection, dams, reservoirs, intakes, water mains, pumping stations, and purification works. Separate applications are required for wastewater and water supply loans, as well as for each planning phase. These monies can be used for engineering plans, feasibility studies, and legal costs incurred for planning phases of a project.

Only Ohio villages with a population of 500 or less or with a population over 500 and a median household income of \$37,134 or less are eligible to apply for VCIF loans. Applying villages are prioritized by evaluating six socioeconomic indicators of need: median household income, unemployment rate, population change (1990-2000), income below poverty, children in poverty and senior citizens in poverty.

Local Economic Development Fund

The Ohio Department of Development recommends to the OWDA local governments in need of loans for water and wastewater projects based upon expected economic development benefits. The limit is a maximum of \$5,000,000 to any local government for any one project. Loans are funded by the Ohio Water Development Authority (OWDA) revenue bonds surplus. The rate of interest is determined by the Ohio Department of Development.

Privately-owned facilities may be eligible for tax-exempt financing. OWDA approves

issuance of private activity bonds for sewage facilities, solid waste facilities, facilities that furnish potable water, and facilities for the disposal of hazardous waste.

Community Assistance

Local government agencies may qualify for low-interest financing under OWDA two-percent Community Assistance Loan Program. The program is designed to help communities maintain affordable water and wastewater rates. To be eligible, the project can be either a water or wastewater project causing an economic hardship to the community. A maximum of \$3,000,000 per project is the maximum loan available. To be eligible, communities should have a population under 5,000 or 2,000 residential users. The projected annual cost per user must be above 1.1 percent of the community's median household income for drinking water projects, and above 1.5 percent of the community's median household income for wastewater projects.

Federal Funds Available in Ohio

Small Cities Community Development Block Grants

Small Cities Community Development Block Grants (CDBGs) are administered in Ohio by the Office of Housing and Community Partnerships in the Community Development Division of the Ohio Department of Development.

Clean Water Act Section 319 Grants

The Division of Surface Water within Ohio EPA is the designated water quality agency in Ohio for administering the Section 319 Grants program.

South Carolina

The primary infrastructure financing program currently available in South Carolina relies on USEPA-funded State Clean Water Revolving Fund.

State Revolving Fund

Financing assistance for wastewater and drinking water infrastructure is limited to EPA-funded loans through the State Revolving Fund. Municipalities and counties can apply for low-interest loans offered by the state. The Department of Health and Environmental Control (DHEC) and the South Carolina Budget and Control Board share implementation duties for the program.

Wisconsin

Wisconsin's financing of wastewater treatment facilities shifted in 1987 from grants to loans and placed an increased emphasis on preventive maintenance. Toward that end, the Wisconsin Clean Water Fund makes low interest loans and hardship grants to

municipalities and counties. Wisconsin's Private Onsite Wastewater Treatment System (POWTS) Replacement or Rehabilitation Financial Assistance Program focuses funding on assisting homeowners in the repair or replacement of failing individual septic systems.

Clean Water Fund Program

The Bureau of Community Financial Assistance within the Wisconsin Department of Natural Resources makes low interest loans and hardship grants to municipalities, counties, sewerage districts, or tribes to construct or modify municipal wastewater systems, or for implementing urban stormwater BMPs. Enacted in 1987, Act 399 shifted Wisconsin's financing of wastewater treatment facilities from grants to loans and placed an increased emphasis on preventative maintenance. The Clean Water Fund includes federal state revolving fund monies as well as state revenue bonds.

Currently, \$150 million is available annually for loans. In addition, \$6.5 million per year in hardship grants is available. Grants may be awarded for up to 70 percent of total costs. To be eligible for a hardship grant, municipalities must have a median household income that is 80 percent or less of the state average, and the estimated residential user charge relating to wastewater treatment must exceed two percent of the median household income.

Private Onsite Wastewater Treatment System Replacement or Rehabilitation Financial Assistance Program

Since its inception in 1978, the Private Onsite Wastewater Treatment System (POWTS) Replacement or Rehabilitation Financial Assistance Program has awarded over \$77 million in grants for nearly 34,300 residences. Wisconsin counties, Indian tribes, and selected municipalities may apply to assist eligible owners in rehabilitating or replacing a failing system. Funds are appropriated by the state legislature. The Safety and Business (S&B) Division of the Department of Commerce works in conjunction with county government officials who assist individuals in eligibility considerations and preparation of grant applications. Eligibility depends on income, residence in an area not served by a municipal sewer system, and verification that the applicant has a failing system. A portion of the funds is set aside for funding experimental systems, with the goal of identifying additional choices for people faced with replacing a failing system.

State Trust Fund Loan Program

The Board of Commissioners of Public Lands and Wisconsin DNR award low interest loans to any municipality for wastewater and stormwater BMPs. The state trust fund was originally derived from the sale of public lands granted to the state. The majority of the trust fund principal is invested in loans to Wisconsin school districts and municipalities.

Community Development Block Grants (CDBGs)

The Bureau of Community Finance within the Wisconsin Department of Commerce awards approximately \$4-5 million annually in CDBGs for public facilities grants to communities. Grants with a required match are made for the installation, upgrade, or expansion of municipal drinking water and wastewater systems.

The Division of Housing & Community Development within the Department of Commerce administers the Small Cities CDBG program that provides grants to communities and zero-percent loans to homeowners for water and wastewater hookups or well and septic repair or replacement. Approximately \$6.5 million is available for this program annually in Wisconsin, with a limit of \$600,000 per community.

Summary

Financing for water and wastewater infrastructure projects is provided in a variety of ways in the states surveyed, including block grants and revolving loan and grant programs administered through public or public-private entities. In several of the states, emphasis is placed on providing financial assistance to small and/or rural communities, especially those with low income levels.

Chapter 8

CONCLUSIONS

Georgia enjoys a relatively plentiful water supply, yet the availability of our water resources varies both seasonally and regionally. When our natural water complexity is considered with regard to increasing water demands, it becomes apparent that Georgia must approach water management in a thoughtful, comprehensive and coordinated manner based on the best science we have.

The legal foundation upon which water management in Georgia rests is the set of statutes enacted by Congress and the Georgia General Assembly. Collectively, this body of law has set two general water-related goals for us to meet:

Protect public health and environmental quality; and

Meet future needs while protecting aquifers, instream uses and downstream users.

We face significant challenges, however, in meeting these goals. First, inconsistencies and lack of coordination can hamper meeting at least some of our goals. Laws are passed by different legislative bodies at different times, with different motivations, and for different purposes. They are implemented by federal and state agencies with varying degrees of financial, technical, and managerial capacity. Specific water-related decisions reflecting policies and programs are made by local government officials, private sector institutions, and the general public. Assuring coordination and avoiding inconsistencies in such a situation may be desirable but rarely occurs, at least to the extent necessary to fully meet the goals of the statutes.

A second challenge in meeting our water goals is that laws are not static. They reflect the values we attribute to water resources at a particular point in time. These laws also reflect the world as we know it—or can reasonably expect it to become—at the point in time when we conceive them. Congress and the General Assembly can amend these statutes, but they do not always change in lock step with a shift in citizens' goals, aspirations, perceptions, activities, and knowledge related to water resources.

To better address the water challenges we face, the Comprehensive State-wide Water Management Planning Act was passed by the Georgia General Assembly during the 2004 legislative session. This law directs the Environmental Protection Division of the Georgia Department of Natural Resources to develop a comprehensive state water management plan and creates the Georgia Water Council composed of legislators, legislative appointees and agency heads with water-related responsibilities to oversee the development of the plan. The plan is to be provided to the Council in July 2007 for its review and adoption and presented to the General Assembly for consideration in the 2008 legislative session.

The first iteration of the comprehensive water management plan will focus on four key policy objectives:

- Minimizing withdrawals of water by increasing conservation, efficiency, and reuse;
- Maximizing returns to the basin through reducing interbasin transfers and limiting use of septic tanks and land application of treated wastewater where water quantity is limited;
- Meeting instream and offstream water demands through storage, aquifer management and reducing water demands; and
- Protecting water quality by reducing wastewater discharges and runoff from land to below the assimilative capacity of the streams.

This report is the fourth of four policy documents to focus on these objectives. The previous three reports in the series addressed issues specific to water quantity. Those issues greatly impact the policies adopted relative to water quality, however, because water quantity and quality are interrelated in many ways. Most significantly, water withdrawals from both surface water sources and ground water sources affect the waters' ability to assimilate waste. Surface water withdrawals have an obvious effect in this regard, but ground water withdrawals and ground water contamination can also impact surface water quality. Surficial aquifers provide base-flow discharges to surface water bodies, and their overpumping reduces stream flows and affects surface water quality. Interconnections between ground and surface waters can also mean interchange of pollutants between the two sources, with surface water contamination entering ground water and vice versa.

Long-term sustainability of our water resources will require a holistic approach that considers the natural flow regimes, withdrawals, and storage of surface water as well as ground water withdrawal, ground water-surface water interactions, and conjunctive use of ground and surface water sources. Combined with conservation practices, thoughtful management and storage of ground and surface water resources will ensure that human needs are met while natural systems are kept healthy and continue to provide crucial environmental services.

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Appendix A

ON-SITE WASTEWATER TREATMENT POLICY OPTIONS IDENTIFIED BY USEPA

In its 2005 publication, *Handbook for Managing Onsite and Clustered (Decentralized) Wastewater Treatment Systems* (USEPA 2005c), USEPA identified a number of specific options in 13 policy categories, enumerated in the following excerpts from the Handbook:

1. Public Education and Participation

Decentralized wastewater treatment systems depend on public awareness, support, and understanding of the need for management.

Basic

- Promote public awareness of management program development and rule revisions.
- Distribute multimedia materials in basic system operation and maintenance needs.
- Reminders sent to owners when operation and maintenance should be scheduled.

Intermediate

- Public involvement in program development and annual program reviews.
- Develop locally specific educational materials including information on watershed impacts.
- Provide users with lists of approved service providers.
- Provide information through workshops, fairs, schools, and other events to educate system owners on operation and maintenance, health and environmental impacts, causes of malfunction, and program procedures.

Advanced

- Involve public in program development, annual program reviews, and public education and outreach efforts.
- Educate homeowners about management program advisory boards, variance and compliant review panels.

- Work with homeowners in system design phase and during inspections to optimize management program performance and acceptability.
- Conduct outreach programs at civic, school, and other events to answer questions and obtain feedback.

2. Planning

Planning is the foundation for many program elements and can be used to integrate management strategies for areas served by both on-site and centralized treatment systems.

Basic

- Work with local and regional planning agencies to access and utilize information such as soils data and planning requirements.

Intermediate

- Assess vulnerabilities of receiving waters.
- Identify treatment standards based on health and water resource risks.

Advanced

- Establish overlay treatment zones based on environmental sensitivity and potential health impacts.
- Identify cluster system opportunities for existing and new developments.

3. Performance Requirements

Performance requirements specify objectives based on potential health and environmental risks and the pollutant/nutrient loading limits required to minimize risks.

Basic

- Prevent direct and indirect contact with wastewater through prescribed site requirements, hydraulic loading restrictions, and separation distances.
- Designate specific and acceptable system designs.

Intermediate

- Specify alternative technologies for certain sites or conditions that do not meet prescribed requirements.

- Establish inspection and maintenance reporting requirements based on system type and performance desired.

Advanced

- Identify water resource uses and characterize surface and ground water quality.
- Evaluate cumulative impacts/allotments for all sources of critical pollutants.
- Establish numeric and narrative performance requirements for onsite/decentralized systems based on water quality criteria and assimilative capacity of land and water resources.
- Develop protocols and frequencies for measuring (monitoring/inspections) compliance.

4. Recordkeeping, Inventories, and Reporting

Data collection and inventories provide information used in all program elements and are essential for on-site management.

Basic

- Maintain system inventory, site evaluation, construction permit, and inspection files.
- Conduct maintenance reminder and public education programs.

Intermediate

- Develop reporting approaches to collect operation and maintenance information from service providers and from inspections, in addition to system inventory.
- Institute electronic reporting and database system for operating permit program actions.

Advanced

- Provide system inventory and tracking system as an intermediate approach with watershed characterization information and data to assist staff and state agency.
- Develop interactive, real-time information tracking programs to maximize productivity.
- Track watershed and ground water trends.

- Facilitate reporting to oversight agencies and maximize public education/involvement.

5. Financial Assistance and Funding

Program funding is essential to develop, implement, and maintain an on-site wastewater management program.

Basic

- State/local governments provide necessary legal and administrative support to conduct all aspects of the management program.

Intermediate

- State/local funds support basic administrative and other costs.
- Work with state, tribal, or local governments and local lending institutions to develop low interest loan programs.
- Provide guidance to help owners seek funding for system upgrades or replacement.

Advanced

- State/local funds support basic administrative and other costs.
- Grants, cost-share funds, low-interest loans, or other programs help low income owners pay for system repairs or replacement.
- User fees cover inspections, repair, replacement, operation and maintenance costs, and a sinking fund to cover future infrastructure needs.

6. Site Evaluation

Site evaluations are used to make permitting decisions based on soils, slopes, water tables, surface hydrology, overall system densities, and other features used in system design.

Basic

- Require assessment of site hydraulic acceptance and other physical features, including slope and vertical and horizontal setbacks for soil-based systems to determine compliance with prescriptive rules.
- Require licensed/certified evaluators.

Intermediate

- Prescribe a broader set of site conditions to permit prescribed alternative technologies.
- Require third-party licensed/certified evaluators.
- Designate alternative systems for sites not meeting conditions prescribed for conventional systems.

Advanced

- Provide supplemental protocols for assessing site assimilative and treatment capacity keyed to local hydrogeology and critical pollutants.
- Characterize critical design and performance requirements and system boundaries.
- Provide supplemental certification/licensing training for site evaluators to meet local needs.

7. System Design

System design requirements focus on protection of public health and water resources and are based on site evaluations, performance requirements, and planning-level considerations.

Basic

- Design only conventional septic tank/gravity flow soil treatment systems on sites meeting code-described prescriptive criteria.
- Require state-certified/licensed designers.

Intermediate

- Allow limited number of alternative designs on certain code-specified non-compliant sites.
- Require state certified designers; provide potential for engineered alternative designs for larger and cluster systems.

Advanced

- Institute protocols for use of risk-based designs based on site evaluation results, specific wastewater sources, planning considerations, and receiving water uses.
- Provide supplemental training and licensing/certification for designers based on specific needs of local water resources.

8. Construction/Installation

Poor installation can adversely affect performance of both conventional and advanced systems that rely on soil dispersion and treatment. Performance problems linked to installation/construction are typically related to soil moisture conditions during construction, operation of heavy equipment on soil infiltration areas, use of unapproved construction materials, and overall construction practices.

Basic

- Construction permit based on code-compliant site evaluation and system design.
- Installation by trained professionals.
- Inspection of system prior to backfilling to confirm installation complies with design.

Intermediate

- Use of more proactive measures such as pre-construction meeting at site with owner, installer during all phases of construction.
- Maintain certification/licensing and training requirements for installers.

Advanced

- Provide extensive construction oversight for all critical steps such as field verification and staking of system components; inspections after backfilling and installation are complete.
- Supplemental training for installers on difficult sites and new technologies.
- Verification and database entry of as-built drawings and other installation information.

9. Operation and Maintenance

System designs are developed by certified professionals or the regulatory authority. Requirements focus on protection of public health and water resources.

Basic

- Design only conventional septic tank/gravity flow soil treatment systems on sites meeting code-described prescriptive criteria.
- Require state certified/licensed designers.

Intermediate

- Allow limited number of alternative designs on certain code-specified non-compliant sites.
- Require state certified designers; provide potential for engineered alternative designs for larger and cluster systems.

Advanced

- Institute protocols for use of risk-based designs based on site evaluation results, specific wastewater sources, planning considerations, and receiving water uses.
- Provide supplemental training and licensing/certification for designers based on specific needs of local water resources.

10. Residuals Management

The primary objective for septage management is to establish procedures for handling and dispersing the material in a manner that protects public health and water resources and complies with applicable laws. Federal regulations and state/local codes strive to minimize exposure of humans, animals, and the environment to chemical contaminants and pathogens that may be present in sewage.

Basic

- Assure that residuals are being reused or managed in compliance with applicable federal, state, and local requirements.
- Educate and remind owners of the need to inspect and/or pump tanks.
- Require only state-certified/licensed O/M residuals handlers using approved sites and management practices.

Intermediate

- Require homeowners and licensed/certified service providers to report when tanks are inspected, residuals are removed, and how the residuals are managed in order to renew operating permit.
- Maintain and disseminate list of acceptable O&M service providers.

Advanced

- Create and administer tracking, inspection, and monitoring plan for all aspects of tank inspections, residuals removal, hauling, treatment, and reuse/disposal.
- Provide any necessary supplemental training and registration/licensing programs for local O&M providers or arrange it with training centers and universities.
- Develop contingency plans for alternative management practices or disposal sites.
- Employ only approved service providers.

11. Training and Certification Licensing

A variety of professionals and technicians including planners, regulators, designers, installers, operators, pumpers, and inspectors, are all involved in some aspect of a decentralized wastewater management program. Training, along with certification or registration, provide system owners and users with competent service providers and “raises the bar” in promoting professionalism among the industry.

Basic

- Require homeowners to use only state or tribal certified/licensed service providers.
- Track and investigate system owner complaints.

Intermediate

- Support more comprehensive state/tribal training requirements for certificate or license.
- Create and disseminate lists of acceptable service providers contingent on their accuracy of reporting and service complaint investigations.

Advanced

- Develop an inspection program and performance reviews for approval of service providers in district.
- Implement supplemental training programs for service providers seeking to perform services based on local protocols, system variations, and other specifications.

12. Inspection and Monitoring

Perhaps the most significant shortcoming in existing management programs is the lack of regular inspections and performance monitoring. Inspections and monitoring can be implemented by regulatory authority personnel, a responsible management entity, or third-party inspectors.

Basic

- Educate homeowners on how and when to conduct basic walkover inspections.
- Require comprehensive inspections by licensed/certified persons at time of property transfer, change in system use, and complaint investigation.
- Require only trained inspectors.

Intermediate

- Specify regular operating inspections of all systems as part of operating permits.
- Develop inspection reporting program with O&M provider/homeowner inputs.
- Permit only licensed/certified inspectors to perform comprehensive inspections.

Advanced

- Conduct aquifer or watershed and pretreatment system effluent monitoring.
- Regularly evaluate monitoring data and permit requirement to determine if any program adjustments are needed.
- Develop supplemental training programs specific to local needs for approved inspectors.
- Formalize comprehensive system construction inspections.

13. Corrective Actions and Enforcement

A decentralized wastewater management program should be enforceable in order to ensure compliance with laws and to protect public health and the environment.

Basic

- Issue Notice of Violation (NOV) and negotiate compliance schedules for problems.
- Administer enforcement program with fines or penalties for malfunctions.
- Comply with requirements in a timely manner.

Intermediate

- Develop revocable operating permit program to assure corrective actions through required inspections and enforcement.
- Create electronic reporting system to track corrective measures with real-time input from staff and service providers.

Advanced

- Implement public education and involvement programs that promote the economic and health/environmental protection benefits of code compliance.
- Responsible management entity (RME) implements corrective actions with power to compel compliance by imposing property liens or other enforcement instruments.

Appendix B

WATER QUALITY STANDARDS AND MONITORING IN OTHER STATES

Note: Chapter 3 contains a summary of Georgia's water quality standards and monitoring policies. Chapter 4 contains condensed forms of the following descriptions of standards and monitoring programs in other states.

Connecticut

Connecticut has established surface water classifications to describe uses designated for each waterbody and establish narrative and numerical factors. Each stream or river is given a single classification. Of particular note are the GIS-based maps of the surface and ground water classifications for the entire state. They depict the goal for each waterbody and can serve as a blueprint for restoration efforts. The Connecticut Department of Environmental Protection (DEP, Department) uses a rotating basin approach to monitoring and assessment and collects data reflecting physical, chemical, biological, and toxicity-related parameters.

Regulatory Agencies

The Planning and Standards Division of the Bureau of Water Management within Connecticut DEP is responsible for the management of Connecticut's surface water in accordance with the directives provided by Section 22a-426 of the Connecticut General Statutes. Section 22a-426 requires that the Commissioner of DEP adopt standards of water quality consistent with the federal Clean Water Act.

Connecticut's water quality standards establish a goal of restoring and maintaining the chemical, physical, and biological integrity of Connecticut's surface waters, and wherever attainable providing for the propagation of fish, shellfish, and wildlife and provide for recreation in and on the water (CDEPa 2006).

Classification of Surface Waters

The surface water classifications describe the uses that DEP has designated for each waterbody and establish narrative and numerical factors used by DEP to determine whether goals established in the standard are being met. Classes C, D, SC, and SD, described below, are never acceptable goals but are used to reflect water bodies with particular problems.

For each class there is an associated set of narrative and numeric criteria including parameters such as dissolved oxygen concentrations, aesthetics, color, indicator bacteria concentrations, chemical constituent concentrations, and the taxonomic composition of benthic macroinvertebrates (CWQS, CDEPa).

Freshwater Classifications

Class AA: Designated uses include existing or proposed drinking water supply; fish and wildlife habitat; recreational use (may be restricted); or agricultural and industrial supply. Discharges into a Class AA waterbody are restricted to discharges from drinking water treatment systems, dredging and dewatering, or emergency and clean water discharges.

Class A: Designated uses include potential drinking water supply; fish and wildlife habitat; recreational use; agricultural and industrial supply or other legitimate uses including navigation. Discharges into a Class A waterbody are the same as allowed into a Class AA waterbody.

Class B: Designated uses include recreational uses; fish and wildlife habitat; agricultural and industrial supply; or other legitimate uses including navigation. Discharges are restricted to those allowed into Class AA plus cooling water and discharges from industrial and municipal wastewater treatment facilities.

Class C: This classification indicates a waterbody with unacceptable water quality. Designated uses are the same as for Class B. A designation as Class C indicates that one or more of the Class B uses are not fully supported due to problems that can and will be corrected by normal DEP programs.

Class D: Similar to the characteristics of Class C surface waters except that one or more of the designated uses for Class B is not fully supported due to an intractable or very difficult pollution problem. Discharges into a Class D waterbody are the same as allowed into a Class B waterbody (CWQS).

Coastal and Marine Waters Classification

Class SA: Designated uses include marine fish, shellfish and wildlife habitat; shell fish harvesting for direct human consumption; recreation and all other legitimate uses including navigation. Discharges are restricted to the same as allowed for Class AA or Class A fresh waters.

Class SB: Designated uses include marine fish, shellfish and wildlife habitat; shellfish harvesting for transfer to approved areas for purification prior to human consumption; recreation; industrial use; and other legitimate uses including navigation. Discharges are restricted to the same as allowed for Class B fresh surface waters

Classes SC or SD: This classification indicates marine or coastal waters with unacceptable water quality. Designated uses and discharge restrictions are the same as for Classes C or D surface waters (CWQS).

Outstanding National Resource Waters

The Commissioner of the CDEP may designate a high quality surface water as an Outstanding National Resource Water according to 40 CFR 131.12(a). The lowering of water quality is prohibited for such surface waters except where activities will cause only temporary and insignificant changes in water quality (CWQS).

Classification Maps

The CDEP produces and maintains GIS-based maps of the surface and ground water classifications for the entire state. They depict the goal for each waterbody and in that manner provide a blueprint for restoration efforts (Ibid).

Reclassification

Section 22a-426 CTGS provides specific procedures for any revision of the standards, criteria or classification maps. In each case the reclassification process is subject to public notice requirements and a public hearing. Notice is printed in the Connecticut Law Journal, in newspapers of general circulation in the affected areas, and is sent to the chief executive officer of any affected municipality.

Any person requesting a change in classification must demonstrate that the proposed new classification is consistent with all existing or designated uses of the waterbody (Ibid).

Water Quality Criteria

Site-specific Criteria

Connecticut's water quality criteria do not apply to certain conditions brought about by natural hydrologic and geologic causes. Conditions that exist in the surface water, in part due to normal uses of land, may be considered natural, provided best management practices are used (CWQS).

Assessment of Coliform

Total coliform is measured in waters that are part of an existing or proposed drinking water supply. *E. coli* are measured in freshwaters with designated uses that include swimming and other recreational uses. Fecal coliform and enterococci are used as indicators only in saltwaters with the designated uses of shellfish consumption and swimming respectively (Ibid).

Water Quality Monitoring

Ambient Monitoring Strategy

Connecticut DEP has organized surface waters of the state into a hierarchical system of natural drainage basins comprised of four levels. Major basins represent the greatest level of magnitude and are divided into three categories of subbasins: regional basins, subregional basins, and local basins. In Connecticut, there are eight major basins, 45 regional basins, 336 subregional basins, and 2,893 local basins.

The Department uses a rotating basin approach to monitoring and assessment. The eight major basins are divided into five hydrologic assessment units. Monitoring and assessment efforts concentrate on one unit each year for a five-year period. Prior to implementation of the rotating basin strategy, approximately 10 percent of the stream miles in Connecticut were monitored. One year after implementation of the strategy, this percentage increased to an average of 20 percent of miles within each targeted basin (CDEP 1999).

Physical and Chemical Monitoring

The Department partners with USGS to collect physical and chemical water quality data throughout the state. This collaborative effort dates back to the early 1970's. Thirty water quality parameters are collected at 33 sites on 15 rivers approximately eight times a year. Sampling sites are located primarily on large, interstate rivers, waste receiving streams, and selected unimpaired reference sites. The data are used to support trend assessment, determine compliance with water quality standards, and establish reference conditions on minimally impaired streams.

An additional set of sites are monitored by the Bureau of Water Management and analyzed but the Connecticut Department of Public Health. These sites are intended to supplement the primary network and are sampled quarterly for one year consistent with the rotating basin schedule. Conventional water quality parameters, toxic metals, and indicator bacteria are measured by means of grab samples (CDEP 1999).

Biological Monitoring

Biological monitoring by the Bureau of Water Management focuses primarily on the benthic invertebrate community. Sampling is conducted at approximately 50 sites each year consistent with the rotating basin schedule. Each site is sampled once per year, typically in the fall. Site selection corresponds with the physical and chemical assessment sites. The Bureau cooperates with the Division of Inland Fisheries within Connecticut DEP to incorporate fish community data into water quality assessments (Ibid).

Aquatic Toxicity Testing

The Aquatic Toxicity Program within the Bureau of Water Management routinely tests wastewater effluents and surface waters for toxicity to aquatic organisms. Two invertebrate species and one fish species are currently cultured and tested for both acute and chronic effects in the laboratory. The results are used to evaluate permit compliance for point source discharges but also to quantify the assimilative capacity of surface waters to toxic compounds. Testing is concurrent with monitoring as part of the rotating basin assessment strategy (Ibid).

Intensive Water Quality Surveys

Intensive surveys are conducted to obtain data at a greater degree of spatial or temporal resolution. Typically these studies are in support of TMDL development, determination of compliance with water quality classifications, or to evaluate the effects of pollution control measures (Ibid).

Volunteer Monitoring

The Department facilitates the involvement of volunteer citizen groups in monitoring many surface waters throughout the state. Groups are encouraged to perform monitoring to accepted standards and report their findings to DEP's Ambient Water Quality Monitoring program. Three tiers of participation are offered to volunteers: observation monitoring, application of rapid bioassessment protocols, or implementation of a specific monitoring plan (CDEP(b)).

Florida

Florida's surface water quality classifications are hierarchical and arranged in order of the degree of protection required. Numeric criteria applicable to each classification are designed to maintain the minimum conditions necessary to assure the suitability of water for the designated use of each classification. Special criteria exist for water bodies where dissolved oxygen levels exist that are attributable to natural background or man-induced conditions and cannot be controlled or abated.

The Florida Department of Environmental Protection's (DEP, Department) Integrated Water Resources Monitoring program uses a three-tiered approach to monitor surface water quality ranging from the general to the specific. The five regional water management districts serve varying roles in assisting the state's water quality monitoring programs.

Regulatory Agency

The Florida Department of Environmental Protection (DEP, Department) is the lead agency for the protection of Florida's water quality; however, the five water management districts have established pollutant reduction goals and impact waste assimilation through

minimum flow and level policies for surface water and ground water. Water management districts also issue environmental resource permits.

Statutory Authority

Article II, Section 7 of the Florida Constitution requires abatement of water pollution and conservation and protection of Florida's natural resources and scenic beauty (62.302.300 F.A.C.).

The Air and Water Pollution Control Act (Title XIX, Chapter 403, Part 1, F.S.) provides the statutory basis for regulation of most aspects of water quality in Florida. The Act provides a definition of pollution, identifies pollution activities that require permits, and authorizes Florida DEP's regulatory programs. It provides DEP with broad authority to protect water quality and regulate pollution throughout the state. This authority includes the power to classify surface water bodies according to their beneficial uses and establish criteria for various parameters of water quality specific to each classification (FCES 2000).

The federal Clean Water Act also provides the statutory basis for state water quality standards (40 CFR 131). States are responsible for reviewing, establishing, and revising water quality standards. The components of this system are classification of rivers and streams, criteria within each classification for various parameters of water quality, an anti-degradation policy, and special protection of certain waters (FDEP(a)).

Classification of Surface Waters

Water quality classifications are arranged in order of the degree of protection required, with Class I having the most stringent water quality and Class V the least. The surface waters of Florida are classified as Class III, Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife, unless otherwise noted in 62-302.400 (12) F.A.C.

Class I - Potable Water Supplies: Fourteen general areas throughout the state including: impoundments and associated tributaries, certain lakes, rivers, or portions of rivers, used as a drinking water supply.

Class II - Shellfish Propagation or Harvesting: Generally coastal waters where shellfish harvesting occurs.

Class III - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife: The surface waters of the state are Class III unless described in rule 62-302.400 F.A.C.

Class IV - Agricultural Water Supplies: Generally located in agriculture areas around Lake Okeechobee.

Class V - Navigation, Utility and Industrial Use: Currently, there are not any designated Class V bodies of water (62-302.400 F.A.C.).

Outstanding Florida Waters

In addition to its surface water classification, a waterbody may also be afforded the highest protection under section 62-302.700, F.A.C. by designation as Outstanding Florida Waters of Outstanding Natural Resource Waters. Degradation of water quality is to be permitted by Florida DEP only in very specific cases as cited in 62-4.242 (2), F.A.C.

An Outstanding Florida Water is a waterbody designated worthy of special protection because of its exceptional recreational or ecological significance. Outstanding Florida Waters generally include waters that are state or federally managed as parks, wildlife refuges, wilderness areas, or scenic and wild rivers (FDEP(c)).

Reclassification

Any person regulated by the Department or having a substantial interest in this chapter may seek reclassification of waters of the State by filing a petition with the Secretary in the form required by Rule 62-103.040 F.A.C. The petition shall include all information necessary to support the reclassification. After public notice and public hearing, the Environmental Regulation Commission shall agree to reclassification only if it will establish the present and future most beneficial uses of the waters and if the reclassification is in the public interest.

If the reclassification petition establishes more stringent criteria than presently established only if DEP determines that the designated use is attainable, upon consideration of the environmental, technological, social, economic, and institutional factors (62-302.400 (6-9) F.A.C.).

Water Quality Criteria

Numeric criteria applicable to each classification are designed to maintain the minimum conditions necessary to assure the suitability of water for the designated use of each classification.

Dissolved Oxygen and Site Specific Alternative Criteria

Dissolved Oxygen (DO) levels that are attributable to natural background or man-induced conditions that cannot be controlled or abated may be established as alternative DO criteria for a waterbody or portion of a waterbody. However, the alternative criteria shall not result in lower levels of dissolved oxygen in the waterbody or adjacent waters. The site-specific alternative criteria may be established by the Secretary or a Director of District Management only upon petition by an affected person or upon the initiation of the Department and after public notice and hearing.

This process is currently underway for the Everglades protection area where the adoption of a site-specific alternative criterion for dissolved oxygen will allow the differentiation between impacted and background conditions (62-302.500 (2)(f) and 62-302.800, F.A.C.).

Thermal Pollution

The consequences of any discharge or proposed discharge of heated water into state-controlled receiving bodies of water shall be assessed. For the purposes of assessing impacts of thermal pollution, the State shall be divided into two general climatological zones below and above 30 degrees N. No discharge shall increase the temperature of the waterbody such that damage is caused to aquatic life or vegetation and does not interfere with the water bodies intended beneficial use (32-302.520, F.A.C.).

Fecal Coliform and Other Bacterial Pollutants

Testing for fecal coliform is required for domestic wastewater treatment plants at intervals varying from monthly to daily depending on the capacity of the treatment facility (62-601 Figure 2, F.A.C.).

Florida DEP's surface water quality standards include criteria for bacteriological quality in the form of fecal coliform alone as well as total coliform (62.02.500, F.A.C.).

Enterococci and *e. coli* are monitored only in coastal waters at publicly accessible beaches according to the federal Beach Environmental Assessment and Coastal Health (BEACH) Act implemented by USEPA (62-302.530, F.A.C. and FDEP 2000).

Emerging Pollutants/ Unregulated Organic Compounds

Effective August, 2000, the State of Florida and USEPA no longer require water systems (drinking water providers) to monitor for unregulated contaminants under the Unregulated Organic Contaminants program. A new program has been developed between USEPA and drinking water providers. This program pertains only to drinking water sources and there is no monitoring for unregulated organic compounds in surface waters. Florida DEP and the Department of Health are not involved in the program at this time (FDEP(b)).

Department employees acknowledge the importance of monitoring for emerging pollutants but direct testing at all samples sites is cost prohibitive at this time. Instead, they look for responses in biota that cannot be unexplained by traditional water quality parameters or habitat alteration. If such cases are identified, further testing for unregulated organic compounds is pursued (Sloane).

Additional Water Quality Monitoring

Florida has multi-faceted water quality monitoring, including state-wide programs and programs specific to the five water management districts.

Monitoring for Clean Water Act Requirements

Section 305(b) of the Clean Water Act requires states to submit biennial water quality reports to USEPA. In addition, Section 305(d) of the Act mandates that states develop a list of waters not meeting water quality standards or not supporting their designated uses that states. Furthermore, Total Maximum Daily Loads (TMDLs) are required for the waters determined to be impaired. To meet these requirements, Florida has been working to develop biological criteria and nutrient criteria for fresh waters and estuaries.

The Watershed Management Program within Florida DEP was created in 1999 to implement the provisions of the Florida Watershed Restoration Act, Section 403.076, Florida Statutes. Florida DEP's Integrated Water Resources Monitoring program uses a three-tiered approach to monitor surface water quality ranging from the general to the specific. Tier I is used to develop estimates of statewide water quality based on a representative sample. Tier II addresses basin and stream-specific questions used to verify waterbody impairment while Tier III includes monitoring associated with regulatory permits, TMDL development, and designation of Best Management Practices (FDEP(d)).

Tier I monitoring includes data collection from six major categories of waterbody; four surface water types and two ground water types. The categories of surface water are major rivers, streams, large lakes, and small lakes. The sampling protocol is designed around the 29 USGS delineated hydrologic units in the State of Florida. Each year, five or six of the units are monitored. Thirty sample sites are selected for each waterbody type (total N=120/hydrologic unit) according to USEPA protocols for random site selection. Results from this monitoring are compared with each waterbody's designated use and are used to determine sites requiring Tier II monitoring and potential development of TMDLs.

In addition to Tier I to monitor statewide water quality, the Department also monitors 75 sites statewide on a monthly basis for trend analysis.

This monitoring is done within DEP in the Division of Water Resources by the Bureau of Watershed Assessment. The Bureau of Environmental Assessment assists in the development of the biocriteria and indices used in the monitoring. Each program employs a quality assurance officer and utilizes a central lab. The quality assurance officer provides both field and laboratory audits as well as training courses for all those responsible for collecting data within the state, both state employees and employees of the Regional Water Management Districts (Sloan).

Florida DEP's Bureau of Watershed Assessment uses the following indices and tools to monitor water quality in Tiers I-III. Although water quality monitoring has historically

relied on water chemistry, DEP has developed two bioassessment tools to assess the quality of aquatic life. The seven-metric Stream Condition Index (SCI) and the three-metric Bioreconnaissance (BioRecon) method were both developed for this purpose. BioRecon differs from the SCI in that it is used as an initial watershed screening method to determine whether or not additional resources should be allocated to the area, such as sampling using the SCI method. The BioRecon is thus seen as a cost-saving procedure to make the most efficient use of monitoring resource for the agency in a wide variety of programs. The SCI is the primary indicator of stream ecosystem health, identifying impairment with respect to the reference (natural) condition.

The SCI is a composite macroinvertebrate index for use in flowing streams based on seven metrics describing the taxonomic composition of the macroinvertebrate population. Once calculated, points are assigned for each metric based on bioregionally-specific criteria. There are three bioregions in Florida; the panhandle, peninsula, and northeast. Points from each of the metrics are then summed to rate a site as excellent, good, fair or poor.

BioRecon is based on three metrics that are a subset of those used in the SCI. Rapid collection and identification in the field yields pass/fail scores for each of the three metrics. If a site fails to “pass” two out of the three criteria, the site is recommended for more intensive study (FDEP(e)).

Habitat Assessments

A habitat assessment is conducted in conjunction with all macroinvertebrate sampling. These characterizations require the biologist to record a variety of physical and chemical parameters observed in the field for later use in interpreting overall assessment results. Data collected falls into two categories: Riparian Zone/Instream Features and Sediment Substrate.

Riparian Zone/Instream Features:

- Predominant land-use in watershed;
- Local watershed erosion;
- Local watershed nonpoint source pollution;
- Stream depth and velocity profiles; and
- Elevation of high water level marks.

Sediment Substrate section parameters include:

- Types of sediment odors present (normal, sewage, petroleum, chemical, anaerobic, etc.);

- Extent of presence of sediment oils;
- Types of sediment deposition on site (sludge, sand, silt, etc.);
- Extent of coverage of stream bed by different substrate types (woody debris, leaf packs or mats, aquatic vegetation, rock or shell rubble, undercut banks/roots, sand, mud/muck/silt, etc.) and the number of times each of these substrates was sampled;
- Water quality parameters (temperature, pH, dissolved oxygen, conductivity, salinity, Secchi depth) at top, middle and bottom depths;
- Types of water odors present (normal, sewage, petroleum, chemical, etc.);
- Types of water surface oils present (sheen, globs, slick, etc.);
- Water color and clarity;
- Abundance of periphyton, fish, aquatic macrophytes, and iron/sulfur bacteria; and
- Weather conditions. (FDEP 2005)

Water Quality Monitoring by Florida's Water Management Districts

Because Florida's water management districts take a more active role in water resource management than regional organizations in most states, it is useful to explore examples of additional programs in selected districts.

South Florida Water Management District

The majority of the South Florida Management District's (SFWMD) water quality monitoring programs provide data for legal mandates, such as the Everglades Forever Act and the Lake Okeechobee Protection Plan, and memoranda of agreement with other agencies and public groups. The District monitors surface water in a variety of locations, including canals, pumping stations, agricultural discharges, and many other types of aquatic environments. The District also collects data on a variety of pollutants, including nutrients, trace metals and pesticides, from sediments and fish (SFWMD(a)).

In addition, SFWMD is rarely exempt from obtaining permits for the construction and operation of its works and projects and must conduct water quality monitoring to comply with terms and conditions of those permits. The District complies with a multitude of permit-required monitoring and assessment work for biological, hydraulic, hydrologic, hydrogeologic, and water quality parameters (SFWMD(b)).

St. Johns River Water Management District

Because Florida relies in large part on water management districts to implement state-wide regulations, it is instructive to consider examples of district-level programs. In the St. Johns Water Management District, a surface water quality monitoring program maintains an ambient surface water quality monitoring network of 73 stations located throughout the District. Fourteen of these stations are sites used as part of Florida DEP's trend analyses. The remaining 59 stations are sampled 6 times a year. Data generated under the program are used by DEP for Florida's biennial 305(b) report to EPA, development of TMDLs, and DEP's Tier I monitoring strategy.

Data collection includes monitoring of sediments for priority pollutants and benthic community sampling. The program produces a biennial district-wide assessment of surface water quality status and trends, sediments, and benthic community health (SJRWMD(a)).

Southwest Florida Water Management District

The Southwest Florida Water Management District (SWFWMD) tests a wide variety of surface water features including lakes, rivers, creeks and coastal waterways. When testing indicates declining water quality, the District contacts the appropriate government agency to inform them of the problem.

Long-term water monitoring also helps us plan and implement SWFWMD's programs. For example, testing turned up serious declines in water quality in Shell, Prairie and Joshua creeks in Punta Gorda. Deep wells used to irrigate citrus groves in the area pulled up poor water from the lower aquifer. When applied to crops, the high chlorides in the water seeped into the creeks. The District partnered with local residents and government agencies and instituted a well back-plugging program. As a result of the program, recent water quality tests have begun to show improvement in the creeks (SWFWMD).

North Carolina

All state surface waters in North Carolina have been assigned primary classifications as well as supplemental classifications for certain waters requiring additional protection. A specific supplemental classification exists denoted as Swamp Waters. This classification applies to waters that generally have naturally occurring very low velocities, low pH and low dissolved oxygen. Numeric water quality criteria pertain to each primary and supplemental classification unit.

The North Carolina Department of Environment and Natural Resources implements both ambient monitoring and basin-wide water quality planning programs. The ambient monitoring program's objectives include monitoring water bodies of interest for comparison with a subset of water quality standards and action levels and identification of long-term temporal or spatial patterns. Basin-wide water quality planning is a non-

regulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters.

Regulatory Agencies

The North Carolina Division of Water Quality (DWQ, Division) in the Department of Environment and Natural Resources (DENR) is the agency responsible for statewide regulatory programs in groundwater and surface water protection. The Division's mission is to preserve, protect and enhance North Carolina's water and groundwater resources through quality monitoring programs, efficient permitting, responsible management, fair and effective enforcement and excellence in public service.

The Environmental Management Commission is responsible for adopting rules for the protection, preservation and enhancement of the State's air and water resources. The Commission oversees and adopts rules for several divisions of the Department of Environment and Natural Resources, including the Divisions of Air Quality, Land Resources, Water Quality, and Water Resources.

Statutory Authority

The North Carolina Environmental Policy Act of 1971 declares a state policy of, “wise, productive, and beneficial use of the natural resources of the State without damage to the the environment.....and to provide means to implement these purposes” (Ch. 113A, Art. 1, NCGS).

Article 21 declares the public policy of North Carolina is to provide for the conservation of its water and air resources as well as to maintain, protect, and enhance water quality within North Carolina. This Article created the Department of Environment and Natural Resources to administer a complete program of air and water conservation. Including the designation of water and air quality standards to protect human health, prevent injury to plant and animal life,....and to secure.... the beneficial uses of the State’s natural resources.

The Environmental Management Commission is directed to develop and adopt a series of waterbody classifications and standards applicable to each classification which will be appropriate for the purpose of classifying each of the waters of the state. The Commission is further directed to assign a classification to each identified waterbody (Ch. 143, Art. 21, NCGS).

Surface Water Classification

The Classification and Standards Unit within North Carolina DWQ is responsible for development and implementation of the state's surface water quality standards (numeric and narrative) and surface waterbody classifications. All state surface waters have been assigned primary classifications and supplemental classifications for certain waters requiring additional protection. All waters must at least meet the standards for Class C (fishable/ swimmable) waters.

Primary Classifications

Class C: Waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner.

Class B: Waters used for primary recreation and other uses suitable for Class C. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

Water Supply I (WS-I): Waters used as sources of water supply for drinking, culinary, or food processing purposes for those users desiring maximum protection for their water supplies. These waters are also protected for Class C uses. WS-I waters are those within *natural and undeveloped* watersheds in public ownership with no permitted point source (wastewater) discharges.

Water Supply II (WS-II): Waters used as sources of potable water where a WS-I classification is not feasible. These waters are also protected for Class C uses. WS-II waters are generally in *predominantly undeveloped* watersheds and only general permits for discharges are allowed.

Water Supply III (WS-III): Waters used as sources of potable water where a more protective WS-I or II classification is not feasible. These waters are also protected for Class C uses. WS-III waters are generally in *low to moderately developed* watersheds. General discharge permits only are allowed near the water supply intake whereas domestic and limited industrial discharges are allowed in the rest of the water supply watershed.

Water Supply IV (WS-IV): Waters used as sources of potable water where a WS-I, II or III classification is not feasible. These waters are also protected for Class C uses. WS-IV waters are generally in *moderately to highly developed* watersheds or Protected Areas, and involve no categorical restrictions on discharges.

Water Supply V (WS-V): Waters protected as water supplies which are generally upstream and draining to Class WS-IV waters or waters used by industry to supply their employees with drinking water or as waters formerly used as water supply. These waters are also protected for Class C uses. WS-V has no categorical restrictions on watershed development or wastewater discharges unlike other WS classifications and local governments are *not* required to adopt watershed protection ordinances.

Class WL: Freshwater Wetlands are a subset of all wetlands, which in turn are waters that support vegetation that is adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. These waters are protected for storm

and flood water storage, aquatic life, wildlife, hydrologic functions, filtration and shoreline protection. Although there are no restrictions on watershed development or types of wastewater discharge in wetlands, impacts from these actions must be justified, minimized, and often mitigated. No water bodies in the state currently carry the Class WL designation.

Class SC: All tidal salt waters protected for secondary recreation such as fishing, boating and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife.

Class SB: Surface waters that are used for primary recreation, including frequent or organized swimming and all SC uses.

Class SA: Surface waters that are used for shellfishing or marketing purposes and all SC and SB uses.

Class SWL: These are saltwater wetlands located landward of the mean high water line or contiguous with estuarine waters. There are no water bodies in the state that currently have this classification

Supplemental Classifications

Supplemental classifications are sometimes added by North Carolina DWQ to the primary classifications to provide additional protection to waters with special uses or values.

Future Water Supply (FWS): Supplemental classification for waters intended as a future drinking water source. The “Future Water Supply” classification would be applied to one of the primary water supply classifications (WS-I, WS-II, WS-III, or WS-IV). State permitting requirements applicable to the primary water supply classification become effective upon reclassification. However, local government water supply protection ordinances are not required until after the FWS supplemental classification is removed. Currently no water bodies in the state carry this designation.

High Quality Waters (HQW): Supplemental classification intended to protect waters with quality higher than state water quality standards. In general, there are two means by which a waterbody may be classified as HQW. They may be HQW by definition or they may be supplementally classified as such through the rule-making process. The following are HQW by definition:

- WS-I;
- WS-II;
- SA (shellfishing);
- ORW;
- Waters designated as Primary Nursery Areas or other functional nursery areas by the Marine Fisheries Commission; or
- Native and special native (wild) trout waters as designated by the Wildlife Resources Commission.

The following waters can qualify for supplemental HQW designation:

- Waters for which DWQ has received a petition for reclassification to either WS-I or WS-II, or
- Waters rated as Excellent by DWQ.

Nutrient Sensitive Waters (NSW): Waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. In general, management strategies for point and nonpoint source pollution control require control of nutrients (nitrogen and/or phosphorus usually) such that excessive growths of vegetation are reduced or prevented and there is no increase in nutrients over target levels.

Outstanding Resource Waters (ORW): Waters having excellent water quality and being of exceptional state or national ecological or recreational significance. To qualify, waters must be rated Excellent by North Carolina DWQ *and* have one of the following outstanding resource values:

- Outstanding fish habitat or fisheries,
- Unusually high level of water-based recreation;
- Some special designation such as North Carolina or National Wild/Scenic/Natural/Recreational River, National Wildlife Refuge;
- Important component of state or national park or forest; or
- Special ecological or scientific significance (rare or endangered species habitat, research or educational areas).

No new discharges or expansions of existing discharges shall be permitted.

Swamp Waters (Sw): Waters that generally have naturally occurring very low velocities, low pH and low dissolved oxygen. No specific restrictions on development are involved.

Trout Waters (Tr): Freshwaters for natural trout propagation and survival of stocked trout. This designation affects wastewater quality but not the type of discharges and there are no watershed development restrictions except stream buffer zone requirements of the North Carolina Division of Land Resources. The Department's classification is not the same as the state Wildlife Resources Commission's *Designated Public Mountain Trout Waters* classification.

Unique Wetland (UWL): Wetlands of exceptional state or national ecological significance. These wetlands may include wetlands that have been documented to the satisfaction of the Environmental Management Commission as habitat essential for the conservation of state or federally listed threatened or endangered species. There are currently no water bodies in the state that have this classification.

Additional Stream Classifications Determined by Other Agencies

North Carolina Natural and Scenic Rivers: The North Carolina Natural and Scenic Rivers Act of 1971 (Chapter 113A, Art. 3, G.S.N.C) adopted a policy of retaining the natural and scenic conditions in some of the State's valuable rivers by maintaining them in a free-flowing state and to protect their water quality and adjacent land by retaining these natural and scenic conditions." There are three river classifications: Natural, Scenic, and Recreational river areas. The designation places no land use or development regulations on developments on private lands except on the construction of dams and other water resources projects.

Federal Wild and Scenic Rivers: A federal government river designation intended to protect certain free flowing rivers or segments with outstanding scenic, recreational, geologic, fish and wildlife, historic, archaeologic, or other values. There are three river classifications: Wild, Scenic, and Recreational. The designation restricts or prohibits certain "water resources projects." It places no federal land use or development regulations on private lands.

Designated Public Mountain Trout Waters: A state fishery management classification administered by the N.C. Wildlife Resources Commission which provides for public access to streams for fishing on private and public lands. It regulates fishing activities only (seasons, size limits, creel limits, and bait and lure restrictions) and is not the same classification as the DWQ Tr classification which protects water quality.

Areas of Environmental Concern: The Division of Coastal Management is responsible for maintaining estuarine Areas of Environmental Concern (AECs) and establishing Specific Use Standards that specify the types of projects and construction methods that may be located/used in these areas.

Designated Shellfish Harvesting Areas: The Shellfish Sanitation and Recreational Water Quality Branch of the Division of Environmental Health classifies saltwaters for their quality and public safety relative to the harvesting of shellfish. They are responsible for monitoring shellfish harvesting areas and closing them if there is danger to the public from consumption of shellfish from a particular area. The agency reviews and makes recommendations regarding permit applications for projects located in coastal North Carolina (15A NCAC 02B).

Reclassification

A waterbody's classification may be changed at the request of a local government or citizen. The Division reviews each request for reclassification and conducts an assessment of the waterbody to determine whether or not reclassification is appropriate. It also conducts periodic waterbody assessments which may result in a recommendation to reclassify the waterbody. In order for a waterbody to be reclassified it must proceed through a formal rule-making process.

Water Quality Criteria

Dissolved Oxygen and Site Specific Alternative Criteria

The Swamp Waters (Sw) classification is designated to waters that generally have naturally occurring very low velocities, low pH and low dissolved oxygen. No specific restrictions on development are involved.

Fecal Coliform

Fecal coliform, *Escherichia coli* and enterococci bacteria are being monitored in selected streams of North Carolina that have been placed on DWQ's 303(d) list of impaired streams. The purpose of this sampling is to define the level of stream impairment for bacteria according to North Carolina water quality standards and EPA water quality criteria for fecal coliform, *E. coli* and enterococci.

Water Quality Monitoring

Ambient Monitoring Program

For over thirty years, The Ecosystems Unit within the Environmental Sciences Section of North Carolina DWQ has collected monthly physical, chemical, and bacterial samples from a network of 365 stations statewide. The program's objectives include monitoring water bodies of interest for comparison with a subset of water quality standards and action levels and identification of long-term temporal or spatial patterns. These data are used to support the Basinwide Water Quality Management Plan, 305(b) and 303(d) reporting to EPA, and development of TMDLs and NPDES permit limits.

A core suite of indicators is measured at all stations. These include water temperature, specific conductance, turbidity, total suspended residue, DO, metals (As, Cd, Cr, Cu, Fe, Pb, Ni, Zn, Al, Hg), fecal coliform, and weather conditions. Additional indicators may be included depending on site-specific concerns such as stream classification, discharge types, and historical or suspected issues. Examples of these site-specific indicators include salinity, Secchi depth, flow, nutrients (NH₃, NO₂+NO₃, TKN, TP), fluoride, sulfate, Mn, color, oil and grease, chlorophyll *a*. Metals and residue are sampled quarterly at all stations (NCDENR(a)).

Basin-wide Planning Program

Basin-wide water quality planning is a non-regulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by North Carolina DWQ for each of the 17 major river basins in the state. Preparation of a basinwide water quality plan is a five-year process. Part of the process includes the development of a Basinwide Assessment.

The Basinwide Assessment draws on data from several units within the Division's Environmental Sciences section including the Biological Assessment Unit, Aquatic Toxicology Unit, and Intensive Survey Unit.

The Biological Assessment Unit employs a standard method for assessing streams' biological integrity by examining the structure and health of fish communities. This assessment incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. By analyzing fish tissue, determinations of what bioaccumulative chemicals are in the water can be made. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species have been documented for heavy metals, pesticides, and other complex organic compounds.

Bioclassification criteria using macroinvertebrate populations have been developed that are based on the number of taxa present and the relative pollution tolerance of each taxa. Stream and river reaches are then given a final bioclassification of; Excellent, Good, Good/Fair, Fair or Poor. In addition to assessing the effects of water pollution, biological information is also used to define High Quality or Outstanding Resource Waters, support enforcement of stream standards, and measure improvements associated with management actions.

The Intensive Survey Unit collects and interprets a variety of biological, chemical, and physical data that are incorporated in the basinwide assessment. Numerous special studies are conducted including water quality characterization studies for model support, sediment evaluations for oxygen demand, nutrient flux, and chemical contamination, and a variety of more intensive water quality investigations.

Ohio

The Ohio Environmental Protection Agency (Ohio EPA, Agency) assigns one or more beneficial use designations to surface waters of the state. Attainment of uses is based on specific numeric and narrative criteria. In streams where more than one use is assigned, the more stringent numeric criteria apply. The Ohio EPA utilizes a rotating five year basin approach to water quality monitoring. Stressor, exposure, and response variables are measured to assess the chemical, physical, and biotic integrity of the streams. Ohio relies heavily on assessments of biotic communities as measures stream health.

Regulatory Agency

The Division of Surface Water within Ohio EPA is responsible for the restoring and maintaining the quality of Ohio's rivers (OEPA(a)).

Surface Water Classifications

Ohio EPA assigns one or more beneficial use designations to surface waters of the state. Use designations are defined in paragraph (B) of rule 3745-1-07 of the Ohio Administrative Code (OAC) and are assigned in rules 3745-1-08 to 3745-1-32 of the OAC. Attainment of uses is based on specific numeric and narrative criteria. Work is underway to develop use designations for primary headwater habitat streams (OEPA(a)).

Beneficial Use Designations for the Protection of Aquatic Life

Coldwater Habitat: Waters that sustain native cold water or cool water species or put-and-take trout stocking. Additional wastewater treatments may be required.

Exceptional Warmwater Habitat: Waters that support a unique and diverse assemblage of fish and invertebrates. This designation is accompanied by more stringent temperature, dissolved oxygen, and ammonia criteria. Additional wastewater treatments may be required.

Seasonal Salmonid Habitat: Waters that support lake run steelhead trout fisheries. This designation is accompanied by more stringent ammonia, cyanide, dissolved oxygen, phenol, pH, silver, and temperature criteria. Slightly more restrictive chlorine disinfection practices may be required.

Warmwater Habitat: Waters that support assemblages of fish and invertebrates similar to least impacted reference conditions. These baseline regulatory requirements are in line with the CWA's 'fishable' goal.

Limited Warmwater Habitat: This was a designation that is being phased out and is not subject to designated use analysis. These waters are exempt from total dissolved solids criteria as well as pH, iron, and zinc criteria.

Modified Warmwater Habitat: Waters that support tolerant assemblages of fish and macroinvertebrates. Often, the water's condition precludes complete recovery. These waters are subject to less restrictive requirements for dissolved oxygen, ammonia, and wastewater treatment.

Limited Resource Waters: These waters support fish and macroinvertebrate populations that are severely limited by physical habitat or another irretrievable condition. This designation is accompanied by less restrictive aquatic life criteria for a majority of pollutants as well as less restrictive wastewater treatment requirements.

Designations for the Protection of Recreational Activities

These use designations are in effect only from May 1 to October 15, for all water bodies except those designated seasonal salmonid habitat. The recreation season for streams designated seasonal salmonid habitat is June 1 to September 30.

Bathing Waters are waters that, during the recreation season, are suitable for swimming where a lifeguard is present and any such additional areas where the water quality is approved by the director. The use represents waters where users are at the greatest risk for exposure to bacteria. This designation is accompanied by standards that require a low risk of swimmer's illness after exposure and a greater disinfection of wastewater.

Primary Contact Recreation

These waters are not used as regularly as Bathing Waters yet still are at a depth that allows full body immersion. These waters are typically in close proximity to residential areas. This designation is accompanied by standards that require only an intermediate risk to users and a baseline level of disinfection.

Secondary Contact Recreation: These waters are at depths that preclude full body immersion. The waters are not located in close proximity to residential areas and there is a low risk of exposure to bacteria.

Designations for the Protection of Water Supplies

Public Water Supply: These are waters within 500 yards of all public water supply surface water intakes, all publicly owned lakes and reservoirs, all privately owned lakes and reservoirs used as a drinking water source, and all emergency water supplies. This designation is accompanied by standards that maintain or improve potable water supplies and reduce water treatment costs.

Agricultural Water Supply: These waters are used, or potentially used, for livestock watering and irrigation. This designation is not accompanied by criteria that protect against long term adverse effects on crops and livestock as a result of crop irrigation and livestock watering.

Industrial Water Supply: These waters are used for industrial purposes. There are no criteria contained in the rule for this designation (OEPA(b)).

Reclassification

Ohio EPA reviews and, as appropriate, revises water quality standards at least once every three years. The revision process involves public notification and opportunity for comment. The Surface Water Division has convened special External Advisory Groups (EAGs) as a means to educate and build consensus on revisions to water quality standards rules. Each EAG consists of representatives of the regulated community, environmental and citizen groups, academia and Ohio EPA. The Division considers the recommendations of the EAGs when revising the rules (OEPA(a)).

Water Quality Criteria

Narrative "Free Froms" Criteria

Narrative "free froms", located in rule 3745-1-04 OAC, are general water quality criteria that apply to all surface waters. These criteria state that all waters shall be free from sludge, floating debris, oil and scum, color and odor producing materials, substances that are harmful to human, animal or aquatic life, and nutrients in concentrations that may cause algal blooms. Much of Ohio EPA's present strategy regarding water quality based permitting is based upon the narrative free from, "no toxics in toxic amounts" (OEPA(a)).

Numeric Criteria

Numeric criteria are estimations of concentrations of chemicals and degree of aquatic life toxicity allowable in a waterbody without adversely impacting its beneficial uses. Each surface water use designated by Ohio EPA is assigned a unique set of numeric criteria. Numeric criteria consist of chemical criteria, whole effluent toxicity levels and biological criteria. Chemical Criteria are derived from laboratory studies of biological organisms' sensitivity to specific chemicals or combinations of chemicals. Whole Effluent Toxicity levels indicate the harmful effects of an effluent on living organisms. Biological criteria are based on aquatic community structural and functional characteristics of an aquatic community.

The principal biological evaluation tools used by Ohio EPA are the Index of Biotic Integrity (IBI), the Modified Index of Well-Being (MIWB), and the Invertebrate Community Index (ICI). These three indices are based on species richness, taxonomic composition, diversity, presence of pollution-tolerant individuals or species, abundance of biomass, and the presence of diseased or abnormal organisms. The IBI and the MIWB apply to fish; the ICI applies to macroinvertebrates. Ohio EPA uses the results of sampling reference sites to set minimum criteria index scores for use designations in water quality standards (OEPA(a)).

Water Quality Monitoring

Each year the Ohio EPA conducts surveys in 10-15 different study areas with an aggregate total of 300-400 sampling sites. Biological, chemical, and physical monitoring and assessment techniques are employed in order to: determine the extent to which use designations assigned are attained; determine if use designations assigned to a given waterbody are appropriate and attainable; and determine if any changes in key ambient biological, chemical, or physical indicators have taken place over time (Ibid).

Five-year Basin Approach

Beginning in 1990, Ohio EPA initiated a rotating five-year basin approach to water quality monitoring. The state's waters were divided into 25 hydrologic units. Within a given year, the Agency monitors five of the hydrologic units. Once the field monitoring is complete the data is analyzed and used to produce a technical support document which contains the summary and integration of the biological, chemical, and physical assessments.

Data collected as part of the five-year basin approach are often environmental indicators that can be categorized as stressor, exposure, and response indicators. Stressor indicators generally include activities that impact the environment. These include point and nonpoint source loadings, land use changes, and other broad-scale influences that generally result from anthropogenic activities. Exposure indicators include chemical-specific, whole effluent toxicity, tissue residues, and biomarkers. Response indicators include the direct measures of the status of use designations. For aquatic life uses the Ohio EPA's biological criteria are the principal response indicators. For recreation uses, fecal bacteria (e.g., *E. Coli*, fecal coliforms) are the principal response indicators (OHEPA(c)).

Oregon

Oregon's surface waters are classified by a combination of designated uses. Each entire basin is assigned as many uses as is appropriate for the surface waterbody. Oregon establishes both numeric and narrative water quality criteria. The Oregon Department of Environmental Quality (DEQ, Department) implements a multi-tier monitoring process that includes rotating basin, targeted site, reference site, and large river network protocols. Oregon DEQ administers a highly developed volunteer monitoring program throughout the state. Oregon is the only state surveyed that has a formal monitoring program for emerging pollutants such as endocrine disruptors.

Regulatory Agency

The Department of Environmental Quality is the State agency responsible for protecting Oregon's surface waters and groundwater. The Department's Water Quality Program accomplishes this by developing water quality standards for Oregon's waters, monitoring

water quality in designated river basins, and controlling nonpoint sources of pollution through statewide management plans (ODEQ(a)).

Surface Water Classification

According to Oregon State water quality law, “the waters of the state” include “lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or ground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or affect a junction with natural surface or ground waters), which are wholly or partially within or bordering the State or within its jurisdiction.” State water quality standards extend to all waters meeting this definition, including isolated wetlands, and intermittent streams (ODEQ(a)).

Designated Uses

Oregon’s designated uses are established by basin. Each entire basin is assigned as many uses as is appropriate for the surface waterbody. The uses are as follows:

- Public domestic water supply;
- Industrial water supply;
- Irrigation;
- Livestock watering;
- Anadromous fish passage;
- Salmonid fish rearing;
- Salmonid fish spawning;
- Resident fish and aquatic life;
- Wildlife and hunting;
- Fishing;
- Boating;
- Water contact recreation;
- Aesthetic quality;

- Hydro power;
- Commercial navigation; and
- Transportation. (ODEQ(b))

Outstanding Resource Water Policy

The Environmental Quality Commission may specially designate high quality water bodies to be classified as Outstanding Resource Waters to protect the water quality parameters that affect the ecological integrity of critical habitat or special water quality values that are vital to the unique character of those water bodies (340-041 O.A.R.).

Water Quality Criteria

Oregon establishes both numeric and narrative water quality criteria. Numeric criteria assign numbers that represent limits or ranges of chemical concentrations or physical conditions. Narrative criteria describe what Oregon's waters will be "free from," such as oil and scum, color and odor, and other substances. Numeric and narrative criteria are given for all waters of the state in addition to basin-specific criteria necessary to meet the designated uses assigned within each basin.

Oregon waters must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. Oregon rules do not currently provide further guidance with regard to biocriteria, the composition of resident biological communities. Oregon also does not have specific streamflow criterion to accompany designated use categories (340-041 O.A.R.).

Water Quality Monitoring

In addition to the requirements of the Clean Water Act, Oregon DEQ is authorized or mandated to conduct water quality monitoring under several Oregon Revised Statutes (ORS).

- ORS 468.05(1)(b) and ORS 468.05(1) authorizes DEQ to conduct monitoring.
- ORS 468.110(4) requires DEQ to establish guidelines to determine whether water quality standards are being met.
- ORS 468B.035 authorizes DEQ to implement the Clean Water Act.

The objectives for the Department's monitoring program include status and trend monitoring, compliance monitoring for standards and permits, and effectiveness monitoring of water quality pollution management programs (ODEQ 2005).

Survey Methods

Each of DEQ's monitoring programs uses one or both of the following sampling designs depending on the objective of the program (ODEQ 2005).

Random Sampling (Probabilistic Survey) Method

In a probabilistic design, data are representative of the entire population being surveyed. This approach provides an unbiased evaluation of water quality conditions across small to large geographic areas. This protocol allows for the extent of stressors affecting water quality across basins to be accurately characterized (Ibid).

Targeted Site Method

This approach is used to characterize a site or specific waterbody. It is used to identify waters not meeting standards, aid in TMDL development, or measure temporal trends at a specific site or spatial trends along a stream (ODEQ 2005).

Other Monitoring Programs

Oregon DEQ uses the Oregon Water Quality Index (OWQI) to track changes in water quality. The Index was designed to allow comparison of water quality among different stretches of the same river or between different watersheds. The Index benchmark measurement is tied to key indicator sites routinely monitored by DEQ, representing the range of water quality found throughout the State. The Index can be used to communicate trends in water quality and measure the progress (or lack of progress) made by water quality management practices. Eight parameters are used in the index: temperature, dissolved oxygen for percent saturation and concentration, biochemical oxygen demand, pH, total solids, ammonia and nitrates, total phosphorus, and fecal coliforms (Ibid).

Rotating Basin Monitoring Program

The Oregon Watershed Enhancement Board has divided Oregon's watersheds into 15 major basins based on USGS Hydrologic Unit Classification (HUC) level. The Department implements a rotating basin design by assessing waters in three HUCs per year. Each year, 50 random sites are assessed within three HUCs (150 sites per year). A new set of random sites is sampled within each basin once every five years, resulting in complete state coverage every five years (Ibid).

Large River Network Monitoring Program

The large monitoring network is a fixed network of 151 sites on more than 50 rivers across the states. These sites cover fourth order and larger rivers; coverage is approximately one site for every 56 miles of large river in Oregon. Sites are selected to be integrator sites, meaning they reflect the integrated water quality effects from point and nonpoint source activities as well as natural geological and hydrological factors for

the watershed. Most sites are sampled six times per year. Twenty chemical constituents are sampled for and analyzed at each site (Ibid).

Reference Site Monitoring

A network of sites that represent streams or stream segments with minimal human disturbance are sampled to provide data for evaluating regional conditions relative to water quality standards. Reference sites within each of the 15 HUCs will be sampled on the same timeline as the rotating basin probabilistic surveys (Ibid).

Volunteer Monitoring

Volunteer monitoring through watershed groups and other organizations is a new and expanding contribution to the collection of water quality data. The Department provides a volunteer monitoring coordinator, monitoring equipment, training, technical assistance, and data management for volunteer monitoring groups. A data quality matrix has been developed to assign data quality levels and appropriate uses for volunteer monitoring data (Ibid).

Toxic Monitoring/ Emerging Pollutants

As part of a broader toxic monitoring program, Oregon DEQ will provide instream evaluation of pharmaceuticals, personal care products, pesticides, and other chemicals known to cause harm to humans and animals by disrupting hormone function. Very little water quality data on these toxins have been collected in Oregon and thus risks to human health or the environment are unknown. This program evaluates 34 point sources per biennium, covering major municipal dischargers, major industrial dischargers and nonpoint sources, including livestock operations. Water quality data collected between 2005 and 2007 will be used to evaluate whether these compounds are detectable at levels of concern in Oregon (Ibid).

South Carolina

South Carolina's surface water monitoring program has three main components: the ambient surface water monitoring network, the watershed water quality management strategy, and the watershed management planning program. To implement the ambient surface water monitoring program, the South Carolina Department of Health and Environmental Control (DHEC) collects data from a statewide network of fixed stations and rotating watershed monitoring stations to determine long-term water quality trends and assessing attainment of water quality standards. The watershed water quality management strategy is a rotating basin sampling protocol for the eight major basins in South Carolina. The watershed management planning program enables the creation of a community-based management plan that balances the interests of economic development and conservation of natural and cultural resources.

Regulatory Agencies

South Carolina DHEC's Office of Environmental Quality Control (EQC) has authority over the enforcement of federal and state environmental laws and regulations, and for the issuing of permit for activities that may impact the environment. The Bureau of Water within EQC is responsible for activities related to water quality, drinking water, pollution control, and recreational waters (ODEQ(a)).

Statutory Authority

The South Carolina Pollution Control Act, Section 48-1-10 et seq. 1976 Code of Laws declares it to be the policy of the State of South Carolina to, "maintain reasonable standards of purity of the air and water resources of the State, consistent with.... the propagation and protection of terrestrial and marine flora and fauna...." There are 14 general standards that apply to all water bodies of the state. These standards include minimum qualitative standards, process for administering permits and variances for discharges into state waters.

Regulations regarding water quality, including classified uses for all waters of the State, are promulgated under the authority of the South Carolina Pollution Control Act, Section 48-1-10 et seq. 1976 Code of Laws

Classification of Surface Waters

All water use classifications protect for a balanced indigenous aquatic community of flora and fauna. Where surface waters are not classified by name, the use classification and numeric standards of the class of the stream to which they are tributary apply, disregarding any site-specific numeric standards for the named waterbody. In tidal areas, where an unlisted tributary flows between two differently classified water bodies, the more stringent numeric standards of the classified waters apply to the unlisted tributary, disregarding any site-specific numeric standards for those water bodies.

Surface Water Categories

Outstanding National Resource Waters (ONRW): Water quality conditions shall be maintained and protected to the extent of the Department's statutory authority.

Outstanding Resource Waters (ORW): Freshwaters or saltwaters which constitute an outstanding recreational or ecological resource or those freshwaters suitable as a source for drinking water supply purposes with treatment levels specified by the Department.

Trout Waters: The State recognizes three types of trout waters: Natural; Put, Grow, and Take; and Put and Take.

Freshwaters: freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the

requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.

Shellfish Harvesting Waters: Tidal saltwaters protected for shellfish harvesting and uses that fall under Class SA and SB. Suitable for primary and secondary contact recreation, crabbing, and fishing. Can also support a balanced indigenous aquatic community of marine flora and fauna (SCR 61-68).

Reclassification

Waters where classified uses are not being attained can be reclassified if any of the following conditions apply:

- Natural conditions (including low flow) prevent attainment;
- Human caused conditions that cannot be effectively remedied prevent attainment;
- Dams or other hydrologic modification preclude attainment and restoration is not feasible;
- Physical habitat features of the waterbody preclude attainment of aquatic life protection uses; or
- Controls more stringent than Sec. 301(b) and 306 of the Clean Water Act would result in widespread economic and social impacts.

If one or more of the above conditions has been demonstrated, the DHEC may grant a variance to an individual discharger for a specific pollutant or parameter. Any variance must be reviewed every three years and will not be granted without notice and opportunity for a public hearing (SCR 61-68).

Water Quality Criteria

Dissolved Oxygen/ Site Specific Criteria

Certain natural conditions may cause a depression of dissolved oxygen in surface waters while existing and classified uses are still maintained. These conditions shall be allowed to persist if:

- Under these conditions the quality of the surface waters shall not be cumulatively lowered more than 0.1 mg/l for dissolved oxygen from point sources and other activities, or
- Where natural conditions alone create dissolved oxygen concentrations less than 110 percent of the applicable water quality standard established for that waterbody, the minimum acceptable concentration is 90 percent of the natural

condition. Under these circumstances, an anthropogenic dissolved oxygen depression greater than 0.1 mg/l shall not be allowed unless it is demonstrated that resident aquatic species shall not be adversely affected. The Department may modify permit conditions to require appropriate instream biological monitoring.

- The dissolved oxygen concentrations shall not be cumulatively lowered more than the deficit described above utilizing a daily average unless it can be demonstrated that resident aquatic species shall not be adversely affected by an alternate averaging period.

In general, waters where natural conditions prevent the attainment of the intended use and associated water quality standards can be reclassified. Site-specific standards apply only to the water named and not to tributary or downstream waters. Site-specific criteria developed by the state supersede any national criteria developed by USEPA (SCR 61-68 Section E (6), (14) and Section D).

Thermal Pollution

The water temperature in all free-flowing freshwaters shall not be increased more than 5 degrees F above natural temperature conditions or 4 degrees F in shellfish harvesting waters (SCR 61-68)

Fecal Coliform

Enterococci criteria apply only to Outstanding Natural, Outstanding Resource Waters, Shellfish Harvesting waters, and Class SA and SB. Standards for fecal coliform apply to all classification categories (Ibid).

Surface Water Monitoring

The biological, water quality and shellfish monitoring program are accomplished by the Aquatic Biology Section, the Water Quality Monitoring Section, and the Shellfish Sanitation Section within DHEC's Bureau of Water, respectively.

Within the Water Quality Monitoring Section, two of the major programs are the Ambient Surface Water Monitoring and Aquatic Toxicology Programs. The Ambient Surface Water Monitoring Program coordinates a network of monitoring stations located across South Carolina. In addition to physical parameters measured at each station, surface water and sediment samples are collected and analyzed for chemical specific parameters on a periodic basis. The Aquatic Toxicology Program is responsible for monitoring to ensure that those holding discharge permits are in compliance with acute and chronic toxicity limits (SCDHEC 2005).

The Aquatic Biology Section (ABS) uses a variety of biological and chemical parameters and biological methods to assess the streams, rivers, lakes and estuaries of South Carolina. The various biological programs collect data as part of both the Ambient

Surface Water Monitoring and the Watershed Water Quality Management Strategy (SCDHEC (b)).

Ambient Surface Water Monitoring

In an effort to evaluate the State's water quality, DHEC collects data from a statewide network of fixed stations and rotating watershed monitoring stations. The ambient monitoring network is directed toward determining long-term water quality trends, assessing attainment of water quality standards, identifying locations in need of additional attention, and providing background data for planning and evaluating stream classifications and standards.

The ambient monitoring network includes integrator sites and special purpose sites. Integrator sites are a network of 313 permanent monitoring sites which are sampled once per month, year round, over an extended period of time. Sites are typically at the most downstream access of each Natural Resource Conservation Service designated watershed unit. There are 320 watershed units in South Carolina. Special purpose sites are sampled with equal regularity as integrator sites but target points of interest to DHEC such as locations of remediation activities, TMDL development sites, among others (SCDHEC(c)).

Watershed Water Quality Management Strategy (WWQMS)

In 1991, DHEC implemented the WWQMS to improve its effectiveness in protecting the water quality of state waters. Watershed water quality monitoring stations provide data on the eight major basins in South Carolina. These sites are sampled once per month, for full year, every five years. These sites target locations listed as impaired on the 303(d) list and locations where there is history of extensive monitoring in order to compare present to historic conditions. Significant trends in water quality and support of waterbody uses are identified and published in Watershed Water Quality Assessment document. Assessments are published once every five years for each basin (SCDNR).

Watershed Management Planning Program

The South Carolina Department of Natural Resources' River Conservation Program assists in the State's water quality efforts through their administration of the River Corridor and Watershed Management Planning program. Stakeholders request the development of a plan to the River Conservation Program. If DNR staff time and funding are available, the planning process begins.

The goal of the program is to enable the creation of a community-based management plan that balances the interests of economic development and conservation of natural and cultural resources. Management plans address such issues as riparian zone management, water quality, recreation, wildlife management, agricultural and forestry practices, and the economic development needs of the community. The plans are developed by a planning committee comprised of a broad spectrum of river stakeholders and facilitated

by DNR staff. After identifying the key uses of the river, a non-regulatory management plan is written. It contains a series of recommendations intended to guide future use within the watershed. The final phase is implementation of the plan. Local governments, developers, business leaders, and landowners are asked to voluntarily put the project's recommendations into action (SCDNR).

Appendix C

STORMWATER AND NONPOINT SOURCE POLLUTION PREVENTION POLICIES IN OTHER STATES

Note: Chapter 3 contains a summary of Georgia's stormwater and nonpoint pollution policies. Chapter 5 contains condensed forms of the following descriptions of programs in other states.

Florida

The Surface Water Improvement and Management (SWIM) program is the centerpiece of Florida's nonpoint source pollution management program. The program entails identification and maintenance of a priority list of water bodies of regional or statewide significance and the development plans and programs for the improvement of those water bodies. The state's five water management districts and Florida Department of Environmental Protection (DEP, Department) are directly responsible for the SWIM program.

Regulatory Agencies

Florida's Nonpoint Source Management Programs are implemented cooperatively by Florida DEP, Florida's five regional water management districts, other state agencies (i.e., Department of Agriculture and Consumer Services, Department of Health), local governments, and the public. Statutory authority for these activities is found in Chapter 403.061(32) and 403.0891, F.S. (FDEP 2006h).

Surface Water Improvement and Management program

This program was created in 1987 when the Florida legislature enacted the Surface Water Improvement and Management Act (SWIM) to address non-point sources of pollution (Chapter 373, Part IV, F.S.). The Act requires each management district to identify and maintain a priority list of water bodies of regional or statewide significance and to develop plans and programs for the improvement of those water bodies. Today, twenty-nine water bodies are now on the SWIM waterbody priority list.

SWIM is the only program in Florida that uses a watershed approach to pollution control. The state's five water management districts and Florida DEP are directly responsible for the SWIM program; they work with partners at all scales of government as well as the private sector.

Initially, money for SWIM came from state general revenues, matched by funds raised by the water management districts. However, the legislature's original commitment of \$15 million a year began to erode by 1990. In many cases, SWIM's shrinking funding has meant that water management districts have had to increase their share of dollars to

continue successful protection and restoration programs. Several water management districts have put more resources in SWIM than they receive from the state, and SWIM dollars have been used as a match to secure federal grants.

By way of example, the St. Johns River Management District initiated the Northern Coastal Basin project in 1995 in response to water quality concerns and the closure of shellfish harvesting areas. The SWIM plan for the Northern Coastal Basin is organized around five major initiatives: water quality (including flow), watershed master planning, stormwater retrofit and master plan implementation, compliance and rules enforcement for permitted stormwater treatment systems, and resource assessment, protection, and restoration (§373.451-373-4595 F.S.; FDEP(i); SJRWMD(b)).

State Stormwater Regulation

The NPDES stormwater permitting program is separate from the State's stormwater/environmental resource permitting programs and local stormwater or water quality programs.

Statutory authority for the state's stormwater program lies predominantly in Chapter 403, F.S. 403.0891, "State, regional, and local stormwater management plans and programs," establishes the institutional roles of Florida DEP, the regional water management districts (WMDs), and local governments in implementing the stormwater program. This section also requires the Florida Department of Transportation to inventory and map primary stormwater management systems that it builds, operates, or maintains. Florida DEP, in coordination and cooperation with the districts and local governments, is to conduct a continuing review of the costs of stormwater management systems and the effects on water quality and quantity, and fish and wildlife values.

Section 403.0893 authorizes local governments to create stormwater utilities and stormwater management system benefit areas.

Section 403.0896 requires the development of training and assistance programs for persons responsible for designing, building, inspecting, or operating and maintaining stormwater management systems (FDEP(h)).

Florida Section 319 Grant Program

The Nonpoint Source Management Section administers grant money it receives from USEPA through Section 319(h) of the Federal Clean Water Act. These grant funds can be used to implement projects or programs that will help to reduce nonpoint sources of pollution. Projects or programs must be conducted within the state's nonpoint source pollution priority watersheds, which are the state's SWIM watersheds and National Estuary Program waters. All projects must include at least a 40% nonfederal match. Examples of funded projects include: demonstration and evaluation of BMPs, nonpoint pollution reduction in priority watersheds, ground water protection from nonpoint sources, and public education programs on nonpoint source management. All approved

projects will be contracted with Florida DEP and managed by the staff of its Nonpoint Source Management Section (FDEP(k)).

Florida Stormwater, Erosion, and Sedimentation Control Inspector Training and Certification Program

Florida DEP's Nonpoint Source Management Section implements the Florida Stormwater, Erosion, and Sedimentation Control Inspector Training Program to increase the proper design, construction, and maintenance of erosion and sediment controls during construction. The training also serves to assure proper long-term operation and maintenance of stormwater systems after construction is completed. The program provides training to private and public employees, primarily inspectors and contractors. Since 1997, over 6500 inspectors have been certified.

The program curriculum was developed to educate the inspector on proper installation, inspection and maintenance of BMPs for use during and after construction to minimize erosion and sedimentation and to properly manage runoff for both stormwater quantity and quality. The class follows the curriculum provided in the Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual. Upon the completion of the class, a minimum passing grade of 70% must be made on an examination in order to obtain DEP certification (FDEP(l)).

Agricultural Industry Programs

Within Florida DEP, agricultural nonpoint source pollution issues are primarily addressed by a non-regulatory agricultural engineer. However, the Department works with the Florida Department of Agriculture and Consumer Services, researchers at the University of Florida and Florida Agricultural and Mechanical University, county extension offices, the Natural Resources Conservation Service, and various agricultural groups throughout the state towards reducing adverse environmental impacts on the environment while sustaining a vigorous and profitable agricultural industry. This is accomplished through development and dissemination of BMPs, cost-share funding of demonstration projects using Federal 319 grant funds, and consultation and discussion with the agricultural community. Special emphasis is given to the management of golf courses industry which are considered intensively managed turf grass farms (FDEP(m)).

Maine

Maine's Department of Environmental Protection (DEP, Department) relies on partnerships with state agencies, municipalities, and individual citizens to successfully implement an effective nonpoint source pollution management program. Municipalities are authorized under several state statutes to implement controls on development and growth that minimize nonpoint source pollution. The Department administers a Nonpoint Source Pollution Training and Resource Center that provides information and technical training on usage of BMPs to landowners. Maine also works to facilitate community involvement through such programs as the Maine Stream Team Program that provides educational opportunities for concerned citizens.

Regulatory Agency

The Bureau of Land and Water Quality within Maine DEP is the lead agency for both enforceable and voluntary nonpoint source pollution control activities.

Maine DEP administers the nonpoint source pollution program in coordination with other state, federal, and local governmental agencies as well as non-governmental stakeholder organizations. The Maine Departments of Agriculture Food and Rural Resources; Conservation, Maine Forest Service; Transportation; Economic and Community Development; Human Services, Division of Health Engineering; Marine Resources, and the State Planning Office all share responsibility for implementing the nonpoint source pollution program (MEDEP(a)).

Nonpoint Source Control Program

In 1991, the Maine Legislature enacted a Nonpoint Source Water Pollution Management Program statute (38 M.R.S.A. §410-I) to restore and protect water resources from Nonpoint source pollution. The basic program objective is to prompt use of agency-approved BMPs to prevent water pollution.

The overall aims of the state's Nonpoint Source Water Pollution Control Program are to:

- Prevent, control, or abate water pollution caused by nonpoint sources so that beneficial uses of water resources are maintained or restored;
- Widely implement BMPs in all Maine's watersheds to minimize transport of pollutants or excessive runoff;
- Support and enable local community awareness and citizen action that results in commitment to maintaining or improving the condition of local water resources; and
- Ensure compliance with existing state and federal laws and rules regulating nonpoint source pollution.

Maine prioritizes educational and technical assistance in promoting Nonpoint source pollution control, with an emphasis on BMPs. However, statewide regulatory programs also implement several laws that control nonpoint source pollution including: the Stormwater Management Law; the Site Location of Development Law; Subdivision Laws; the Erosion and Sedimentation Control law; the State Subsurface Wastewater Disposal Rules; the Natural Resources Protection Act; Land Use Regulation in Unorganized Territories; Pesticide Control laws; the Mandatory Shoreland Zoning Law; the Nutrient Management Act, Forest Practices Act and others.

Municipalities play a significant role in setting, promoting compliance with, and enforcing Nonpoint source pollution laws. The Mandatory Shoreland Zoning Act requires municipalities to adopt a local ordinance no less stringent than state standards. The Growth Management Law allows municipalities to adopt a growth management program and relevant ordinances to implement the program. Communities have utilized these provisions to draft phosphorus control ordinances. Municipalities are also authorized to join together to form watershed districts that can serve as planning bodies and can implement municipal ordinances to protect water quality.

Program resources are assigned to support efforts both statewide and in specific watersheds as well as to improve waters that are threatened or impaired due to Nonpoint source pollution. Maine DEP administers a Nonpoint Source Pollution Training and Resource Center that provides information and technical training on usage of BMPs (Maine 1999, ELI 2000).

Stream Team Program

The Maine Stream Team Program (MSTP) has been established to facilitate working partnerships among those who care about Maine's waters and provide assistance to teams. A stream team is a group of people, such as school groups or watershed councils, who are working together on protecting their local stream. MSTP links groups with similar goals, provides information and training, and offers technical assistance to stream teams preparing to perform stream habitat surveys, orchestrate stream "clean-ups", riparian tree planting, monitoring water quality.

The Stream Team Program also holds an annual information and education event known as the Maine Stream Summit. The purpose of the summit is to provide an opportunity for teams to present their work, learn about current river and stream issues, and attend workshops on a variety of stream related issues (MEDEP(b)).

Stormwater Program

Maine DEP's Bureau of Land and Water Quality also implements the Maine Stormwater Program. In addition to its federal responsibilities under the Clean Water Act, the program regulates stormwater under the authority of three core state laws: The Site Location of Development law (Site Law), Stormwater Management Law, and Waste Discharge Law (MEPDES, MEDEP(c)).

The Site Law requires review of developments that may have a substantial effect upon the environment. These types of development have been identified by the Maine Legislature, and include developments such as projects occupying more than 20 acres, mineral exploration projects, large structures and subdivisions, and oil terminal facilities. A permit is issued if the project meets applicable standards addressing areas such as stormwater management, groundwater protection, infrastructure, wildlife and fisheries, noise, and unusual natural areas.

The applicant for a new Site Law development (except for a residential subdivision with 20 or fewer developable lots) is required to attend a pre-application meeting. This meeting is an opportunity for the applicant to determine the requirements that apply to the project. The meeting with licensing staff is intended to help identify issues, processing times, fees, and the types of information and documentation necessary for Maine DEP to properly assess the project (MEDEPd 2006).

Maine's Stormwater Management Law provides stormwater standards for projects located in organized areas that include one acre or more of disturbed area. The wastewater discharge law requires that a license be obtained for the discharge of pollutants to a stream, river, or lake of the state, or to the ocean. Typical discharges include sanitary waste water and process water from industrial or commercial activities. A license is also required for the discharge of pollutants to groundwater, except for subsurface disposal systems installed under the State Plumbing Code. The requirements of these laws mirror those required as part of the federal NPDES program (MEDEPe 2006).

Section 319 Grant Program

Maine DEP administers the Section 319 Nonpoint Source Grant program to provide funding for efforts to curb nonpoint source pollution. USEPA and a 1998 State Bond appropriation fund the nearly \$5 million dollar program. Funds may be used to demonstrate best management practices, establish TMDLs, or restore impaired streams. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 monies.

North Carolina

North Carolina has dedicated many resources to the control of nonpoint source pollution within several of its most prominent watersheds. Enforceable regulations dictate land use standards throughout the basins with the goal of increasing water quality through the control of nonpoint source pollution. Thus far, specific regulations have been passed for the Neuse, Tar-Pamlico, and Catawba basins. The state-wide Use Restoration Waters Program to restore the beneficial uses of the over 700 nonpoint source-impaired water segments statewide through increasing the effectiveness of restoration efforts.

Regulatory Agencies

The North Carolina Division of Water Quality's (DWQ, Division) Nonpoint Source Planning Unit within the North Carolina Department of Environment and Natural Resources (DENR) is the lead state agency responsible for the control of nonpoint source pollution in North Carolina. This Unit sits within the Planning Branch of the Water Quality Section in DWQ. They lead activities to better coordinate the efforts of the various nonpoint source agencies, and to prioritize the state's waters so as to best target management efforts. Approximately one quarter of the Section 319 grant awards allocated to the state are used to fund programs within the Nonpoint Source Planning

Unit. The remainders of the 319 funds are granted in a competitive contracting process (NCDENR(d)).

The Governor of North Carolina has designated responsibility for activities relating to particular sources of nonpoint source pollution to individual state agencies. The Division is responsible for coordinating and facilitating the nonpoint source pollution control activities of those agencies:

- The Environmental Management Commission for general water quality, urban runoff, wetlands and groundwater;
- The Soil and Water Conservation Commission for agriculture;
- The Sedimentation Commission for construction;
- The Mining Commission for mining;
- The Division of Environmental Health for on-site wastewater treatment and solid waste disposal;
- The Division of Forest Resources for forestry;
- The Department of Transportation for transportation; and
- The North Carolina Cooperative Extension Service for Education. (NCDENR(d))

The Nonpoint Source Unit has four priority goals for managing nonpoint source pollution in North Carolina:

- To better coordinate the efforts of various nonpoint source agencies, local governments, and other stakeholders within the state;
- To prioritize the state's waters and to target management efforts, advocating the most cost-effective measures available;
- To integrate with related management programs and to develop new initiatives as needed; and
- To account for the progress of management strategies. (Ibid)

Use Restoration Waters Program

North Carolina DWQ has established the Use Restoration Waters Program to restore the beneficial uses of the over 700 nonpoint source-impaired water segments statewide. The program pursues three main goals: 1) prioritizing waters for restoration, 2) promoting and supporting restoration initiatives, and 3) improving documentation of restoration efforts. Priority waters will be those with the best data coverage and more local

involvement. The program functions as enabler and facilitator to the many groups around the state that can carry out restoration efforts. The Division also coordinates with various agency programs, both internal and external, to locate and improve documentation of the restoration efforts that have been completed or are underway in impaired watersheds (NCDENR(e)).

State Stormwater Management Program

North Carolina's stormwater management program was established in 1988 by the North Carolina Environmental Management Commission and Section 143-214.7 N.C.G.C. The program applies to development activities that require an Erosion of Sediment Control Plan (defined as disturbance of one or more acre) or a Coastal and Aquatic Managed Area (CAMA permits are required by the North Carolina Coastal Area Management Act of 1974) permit within one of North Carolina's 20 coastal counties or development draining to a waterbody classified as either Outstanding Resource Waters or High Quality Waters.

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintain vegetative buffers, and transporting runoff through vegetative conveyances. Low-density development thresholds vary from 12 to 30 percent impervious surface depending on the classification of the receiving stream. If low-density design criteria cannot be met, then high-density development requires the installation of structural BMPs to collect and treat stormwater runoff from the project. High-density BMPs must control the runoff from the 1 or 1.5 inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids (NCDENR(f)).

Section 319 Grant Program

The Department of Water Quality in the Department of Environmental Health administers the Section 319 Non-point Source Grant program to provide funding for efforts to curb nonpoint source pollution. USEPA funds the nearly \$5 million program. Funds may be used to demonstrate best management practices, establish TMDLs, or restore impaired streams. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 monies (NCDENR 2006c).

Basin-specific Nonpoint Source Pollution Control Strategy

North Carolina has dedicated many resources to the control of nonpoint source pollution within several of its most prominent watersheds. The North Carolina Environmental Management Commission (Commission) has passed regulations (15A NCAC 2B .0202-0240), that dictate land use standards throughout the basins with the goal of increasing water quality through the control of nonpoint source pollution. Thus far, specific regulations have been passed for the Neuse, Tar-Pamlico, and Catawba basins.

Neuse Nutrient Strategy

The Neuse River basin was listed as impaired by nitrogen on North Carolina's 303(d) list in 1993. In 1997, the Commission adopted a mandatory plan to control both point and nonpoint sources of pollution in the basin and a set of permanent rules to support implementation of the plan. The General Assembly adopted the rules the following year (NCDENR(g)).

Rule 15A NCAC 2B.0232 establishes an overall goal of reducing the annual nutrient load delivered to the Neuse River Estuary by 30 percent relative to the average annual load for the period 1991 through 1995. The rule set the year 2001 as the target for the reduction. Rules applying to the protection riparian areas, wastewater discharges, urban stormwater management, agricultural nitrogen reduction, nutrient management, and nitrogen offset fees were adopted to implement activities that would aid in reaching the reduction goal (Ibid).

The riparian area rule (15A NCAC 2B.0233) applies to all perennial and intermittent streams, lakes, ponds, and estuaries in the Neuse River basin. The rule protects forest vegetation in the first 30 feet of land directly adjacent to a waterbody, known as Zone 1. A limited amount of harvesting is allowed in the outer 20 feet of Zone 1 but the 10 feet closest to the waterbody must remain essentially undisturbed. An additional 20 feet to the outside of Zone 1, known as Zone 2, must have dense plant cover. New development is not allowed in either zone (NCDENR(h)).

The agricultural rule (15A NCAC 2B.0236 and .0238) provides farmers in the Neuse River basin two options. The first is to participate in a local nitrogen reduction strategy that includes specific plans for each farm that would collectively meet the nitrogen reduction goal. Alternatively, a farmer may implement standard best management practices such as buffers, water control structures, or nutrient management plans within four years (NCDENR(i)).

The stormwater rule (15A NCAC 2B.0235) applies to the largest and fastest-growing local governments in the Neuse River basin. The rule establishes a broad set of objectives for reducing nitrogen runoff from urban areas. The rule also sets up a process for the DWQ to work with the affected local governments to develop a model stormwater plan for meeting the objectives. The model plan will include four elements for reducing nitrogen including stormwater management plans for new development, public education, identification and removal of illegal discharges, and identification of sites where water quality management projects can be inserted into existing development (NCDENR(j)).

The nutrient management rule (15A NCAC 2B.0239) applies to persons who apply fertilizer to 50 or more acres of cropland, golf course, recreational lands, and lawns or gardens. Each person affected by this rule has two options for meeting its requirements. The first option is to complete training and continuing education in nutrient management. Alternatively, the affected person may develop a written nutrient management plan for all property where nutrients are applied (NCDENR(k)).

The wastewater discharge applies to point sources of nutrient discharge that hold permits from the DWQ (Ibid).

Tar-Pamlico Nutrient Strategy

After the classification of the Tar-Pamlico basin as a Nutrient Sensitive Water in 1989, the Commission approved, in 1992, an implementation strategy that established the framework for a nutrient reduction trading program between point and nonpoint sources of pollution.

Phase I of the strategy covered the period from 1990 to 1994. It established discharge conditions to be met by an association of dischargers known as the Tar-Pamlico Basin Association (Association). They agreed to meet specific conditions in order to reduce effluent limits for nutrients in their permits and have the opportunity to reduce nutrient loading by funding agricultural best management practices throughout the basin. Other conditions included development of modeling and evaluation of discharge patterns and annual monitoring reports on nutrient loading. Collectively, the Association met their discharge loading limits for nitrogen and phosphorus through low cost operational changes and improvements of nutrient removal from wastewater discharges.

Phase II built upon models created during Phase I to establish an overall performance goal of a 30 percent reduction in nitrogen loading relative to 1991 and no increase in loading of phosphorus from the same 1991 baseline. Phase II spanned ten years from January 1995 to December 2004. By 2003, nitrogen loads to the river had been reduced 45 percent and phosphorous loads by 60 percent relative to 1990 levels.

Phase II also established instream nutrient goals for nonpoint sources through implementation of rules similar to those in place in the Neuse basin (see detailed description of Neuse River basin rules above).

Phase III continues the structure established in Phase II through December 2014. In addition it sets 10-year estuary performance objectives and alternative management options (NCEMC 2005).

Catawba River Basin Riparian Buffer Protection Rules

The Commission proposed rules to afford special protections with regard to riparian buffers along its lakes and river mainstems. The Catawba Riparian Protection Rules call for a two-zone buffer. Zone One is 30-foot undisturbed buffer adjacent to the shoreline. Zone two, upslope from zone one, is a 20 foot managed zone consisting of grass or other vegetation. The footprints of all existing uses are exempt for continuance of that use (NCDENR(1)).

Oregon

The Oregon Plan for Salmon and Watersheds is the centerpiece of the Oregon Department of Environmental Quality's (DEQ, Department) nonpoint source pollution management program. The Oregon Plan was adopted in 1997 for the purpose of restoring the healthy functions of Oregon's natural aquatic systems and the native fish populations they support. Additionally, Oregon's Agricultural Water Quality Act and Forest Practices Act emphasize a watershed planning approach coupled with the broad implementation of BMPs to reduce nonpoint source pollution into Oregon's rivers and streams.

Regulatory Agency

The Watershed Management Section within Oregon DEQ's Water Quality Division has the responsibility of overseeing and implementing the State's nonpoint source pollution management program by coordinating with many local, state and federal agencies and organizations. The program began in 1978 as a 'stand alone' effort within the Department. However, each component of the water quality program now includes nonpoint source concerns.

Oregon DEQ's overall strategy is to further develop its own and other agencies' or individual's capabilities in each of the ten program areas listed below, emphasizing watershed protection and enhancement, voluntary stewardship, and partnerships between all watershed stakeholders (ODEQ 2000).

Nonpoint Source Control Program

Oregon DEQ's program is built around the following ten program elements:

- **Standards:** Defining the desirable conditions necessary to support sensitive beneficial uses (see description of Oregon's water quality standards);
- **Assessment:** Condition assessment of the watershed as a whole, focusing on established standards;
- **Coordinated Watershed Planning:** Evaluation by all stakeholders of needs and opportunities for sound watershed management resulting in the production of an action plan;
- **Education:** Delivery of information about watershed management to land managers and the general public;
- **Demonstration Projects:** Small-scale projects designed to develop sound watershed management techniques;
- **Technical Assistance:** Field-based experts and literature resources provided to help land managers implement best management practices;

- **Cost-Share Assistance:** Financial assistance and incentives for implementation of watershed enhancement practices on private lands;
- **Stewardship:** The adoption of responsibility for the condition of their watershed resources by local groups;
- **Watershed Enhancement Projects:** Coordinated enhancement and protection projects covering whole watersheds and sustained over a number of years; and
- **Enforcement:** The field-based capability to investigate and remedy the violation of applicable standards or regulations.

Oregon DEQ is currently completing an inventory of nonpoint source pollution control programs and capabilities in all state and federal agencies using the list of ten program elements as a framework for evaluation. The Department's nonpoint source pollution management program objectives for the next several years will be designed in part to fill gaps that are identified by that inventory (ODEQ 2000).

Oregon Plan for Salmon and Watersheds (Oregon Plan)

The Oregon Plan is the centerpiece of Oregon's nonpoint source program. The Oregon Plan was adopted in 1997 for the purpose of restoring the healthy functions of Oregon's natural aquatic systems and the native fish populations they support. The Oregon Plan also facilitates the creation of local watershed councils in each basin. It requires all government agency actions that could potentially impact aquatic systems to coordinate their activities and ensure that they are consistent with watershed restoration efforts. The Oregon Plan attempts to utilize both science and local decision-making as well as regulatory and voluntary actions (ODEQ 2000).

Agricultural Water Quality Act

This 1993 law authorized the Oregon Department of Agriculture to designate areas to be governed by a water quality management plan and to adopt rules that require landowners in the affected area to implement the plan. In practice, watersheds listed as impaired on USEPA's Section 303(d) list are those where Agricultural Water Quality Management Plans have been developed. Once a plan is implemented, all agricultural activities, including pesticide use, grazing, and irrigation, are subject to the rules of the plan. The plans are developed through a public process within each watershed. The Department of Agriculture now has adopted plans and rules for all 39 regions of Oregon where plans were needed (ELI 2000, ORDA 2006).

Oregon Forest Practices Act

The Oregon Forest Practices Act requires the Oregon Board of Forestry to establish BMPs for forest operations. Forest operators are required to comply with these BMPs

unless they demonstrate alternative methods will yield better results. If forest operators comply with BMPs they are given safe harbor from enforcement and are assumed to be in compliance with water quality standards. In addition, forest operators must notify the State Forester of all proposed operations, particularly chemical applications and operation in close proximity to known habitat of endangered species (ELI 2000).

Statewide Comprehensive Land Use Planning

Oregon's land use planning laws allow for the protection of environmentally sensitive areas in local development plans. In addition, the Department of Land Conservation and Development has the authority to designate, "areas of critical concern" that must also be taken into account during the planning process (Ibid).

South Carolina

South Carolina's Department of Health and Environmental Control (DHEC, Department) is the lead agency for the nonpoint source program in the state but program success relies heavily on partnerships with all levels of government, private sector stakeholders, and citizens. With these partners, DHEC is in the process of developing watershed master plans for designated watersheds that have regulatory requirements for land disturbing activities within the watershed clearly specified including nonpoint source pollution control, stormwater management, and flood control components.

Regulatory Agency

The South Carolina nonpoint source management program includes 17 long-term goals for reducing or preventing nonpoint source pollution. The long-term goals will be met by five-year action strategies with annual milestones leading to the attainment of the action strategies. The goals are two-pronged; focusing on reducing nonpoint source impacts in priority watersheds, and implementing activities statewide in order to prevent nonpoint source pollution. Components include both regulatory and voluntary approaches. South Carolina DHEC is responsible for program implementation.

Nine categories of nonpoint source pollution are identified for management under the program: agriculture, forestry, urban areas, marinas and recreational boating, mining, hydrologic modification, wetlands disturbance, land disposal/groundwater impacts, and atmospheric deposition. Management measures addressing each category have been identified.

South Carolina DHEC is the lead agency for program implementation, but partnerships with all levels of government, private sector stakeholders, and citizens are vital to the program's success. The Department may delegate responsibilities for stormwater management and sediment control to local governments or conservation districts. The program applies CWA Section 319 grant money as well as state resources on impaired 303(d) listed water bodies in priority watersheds.

The Department also develops and implements educational programs in stormwater management and sediment control for state and local government officials, persons engaged in land disturbing activities, interested citizen groups, and others. It is in the process of developing watershed master plans for designated watersheds that have regulatory requirements for land disturbing activities within the watershed clearly specified including nonpoint source pollution control, stormwater management, and flood control components (SCDHEC 1999).

Nonpoint Source Monitoring Program

The Aquatic Biology Section within the Division of Environmental Quality Control of DEHC, monitors nonpoint source activity through a variety of efforts, including water quality and biological assessments. The team monitors the effectiveness of BMPs in an effort to determine which practices yield the most effective reduction in nonpoint source pollution. Most BMPs are implemented on agricultural and silvicultural lands, and two to four years of monitoring begins prior to implementation to determine before and after differences in water quality.

The team works also closely with the Bureau of Water Enforcement Section in complaint investigations and enforcement referrals. Professional judgment and biological assessments are utilized to determine cause and degree of impact to watersheds effected by nonpoint source pollution and recommend any needed enforcement action. The Aquatic Biology Section also focuses on water bodies deemed impaired by nonpoint sources (SCDHEC(b)).

319 Nonpoint Source Pollution Grants

South Carolina receives an annual grant allocation from USEPA to implement nonpoint source abatement strategies as described in the state's Nonpoint Source Management Program. A portion of these funds are passed on through a competitive grant process to stakeholder groups, government entities, or other agencies interested in conducting projects that reduce or prevent nonpoint source water pollution through the implementation of an approved TMDL. These funds are known as Section 319 grants and they pay up to 60 percent of eligible project costs, with the applicant providing a 40 percent non-federal match (SCDHEC(e)).

Source Water Protection Program

The 1996 Amendments to the Safe Drinking Water Act provide for a greater focus on pollution prevention as an approach to protecting surface water and groundwater supplies from pollution. The amendments require DEHC to provide Source Water Assessments to federally defined public water supply systems.

USEPA approved South Carolina's Source Water Assessment and Protection Program Plan in 1999. In May 2003, DEHC provided an assessment report to all federally defined public water supply systems (those systems which have at least 15 service connections or provide water to at least 25 people for 60 or more days out of the year). This assessment

contains important information about the drinking water source and how susceptible it may be to contamination (SCDHEC(f)).

Stormwater

In South Carolina, the federal NPDES permitting process has largely replaced stormwater control activities previously implemented under statutes such as the Stormwater Management and Sediment Reduction Act of 1991.

Regulation 72-300 sets standards for sediment and erosion control for land disturbing activities regulated under the 1991 Act. Regulation 61-9 describes rules for implementing the federal NPDES program. At this time, despite the duplication in the regulations, permits are required under each for any land disturbing activity greater than two acres (Clark, DHEC(g)).

Wisconsin

Wisconsin has a relatively long history with nonpoint source pollution management. The Wisconsin Department of Natural Resources has been implementing a nonpoint source pollution program since 1978. The program revolves principally around providing technical and financial assistance to landowners who implement BMPs on their land. Resources were targeted at state-determined “priority watersheds” for the first 20 years of the program. As that program is phased out, resources are now concentrated on urban basins and other watershed that have not been served in the first 30 years of the program’s history.

Regulatory Agencies

The Wisconsin Department of Natural Resources’ (DNR, Department) Bureau of Watershed Management has primary authority for administering the WI’s nonpoint source pollution program. The Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) shares responsibility with Wisconsin DNR, particularly with respect to nonpoint pollution from agricultural sources. The Land and Conservation Board provides oversight of both agencies and their nonpoint source programs (ELI 2000).

Nonpoint Source Pollution Management Program

Wisconsin’s nonpoint source pollution management program began in 1978 primarily to administer grants to landowners for voluntarily implementing BMPs. An enforcement element was added to the program in 1987, when DNR received authority to issue Nonpoint Source Abatement Orders. If DNR deems pollution to be ‘significant’, an order can be issued to all types of nonpoint source pollution except for animal waste. Significant pollution is defined as causing violation of water quality standards, impairing aquatic habitat or organisms, restricting navigation, or endangering human health (ELI 2000).

In cases where water quality monitoring point to animal waste is the source of pollution, the Department has the authority to issue a Notice of Discharge which requires correction of the problem. A specific regulatory program for the handling, storage, and utilization of manure was developed by DNR in 1984 in Chapter NR 243 of the Wisconsin Administrative Code. The rule creates criteria and standards to be used in issuing permits to agricultural feeding operations as well as establishing procedures for investigating water quality problems. If the landowner does not comply, Wisconsin DNR may require a state NPDES permit (WDNR(a), NR 243 W.A.C.).

Wisconsin counties, and to a lesser extent municipalities, play a substantial role in nonpoint source pollution control. Land Conservation Commissions provide funding and cost share assistance to counties for the development of water resource management plans and ordinances that address sources of nonpoint source pollution. Wisconsin's efforts emphasize allowing local governments control over implementing projects to meet state standards (ELI 2000).

Priority Watershed Program

Under authorization of Chapter NR 120, Wis. Adm. Code, from 1978 to 1997, Wisconsin DNR and the DATCP ranked all watersheds of the state to assist in targeting resources for nonpoint source pollution abatement. Once the priority watersheds were determined, DNR, DATCP, and the relevant local government developed a watershed plan to guide cost-share assistance and other nonpoint source abatement activities. A planning committee composed of farmers, riparian landowners, and others served in an advisory capacity. During the planning process, "critical sites" were identified and defined as a site that due to the amount of pollution it generates and/or its location in the watershed must be addressed in order for the plan to achieve its water quality objectives.

Upon county approval of the plan, the DNR was required to provide cost-sharing grants to local governments and individual landowners for the installment of best management practices.

Amendments to the program authorized by the legislature in 1997, known collectively as "Act 27," implemented a multi-year phase out of the priority watershed program, to be complete in 2009.

With the phase out of the priority watershed program, a significant portion of Wisconsin's nonpoint efforts will be shifted to the entire state, not just priority watersheds. Each county must prepare a land and water resources management plan to develop and implement performance standards for nonpoint source pollution. A \$7.2 million cost share program is available to aid counties (WDNR(b)).

Standards for BMPs

Act 27 required the Wisconsin DNR to undergo formal rulemaking to develop performance standards for BMPs designed to meet water quality standards. Technical

specifications to achieve these standards are defined in ch. NR 154, Wisconsin Administrative Code.

Targeted Runoff Management (TRM) Program

Targeted Runoff Management (TRM) grants are provided to control nonpoint polluted runoff from high-priority urban and rural sites. The grants are authorized and specifications for the funding are set forth in ch. NR 153, Wisconsin Administrative Code. Projects funded by TRM grants are site-specific and serve areas generally smaller in size than a subwatershed. The grant period is two years, and grants can provide up to 70 percent of total costs up to \$150,000. Municipalities, regional planning commissions, counties, tribal governments, and lake, sewerage or sanitary districts may apply for the grants

TRM grants can fund the construction of rural and urban BMPs. Examples of eligible BMPs include some cropland protection, detention ponds, livestock waste management practices, stream bank protection projects and wetland construction (WDNR(b)).

Urban Nonpoint Source & Stormwater Management Program

Urban Nonpoint Source and Stormwater Management Program grant funds are used to control polluted runoff in urban project areas and are authorized in Chapter NR 155, Wis. Adm. Code. Funds are awarded for either planning or construction projects. Projects funded by these grants are site-specific and must meet one of the following requirements:

- Has a population density of at least 1,000 people per square mile;
- Has a commercial land use;
- Is the non-permitted portion of a privately owned industrial site; or
- Is a municipally-owned industrial site.

Planning grants can be used for activities such as stormwater management planning, related information and education activities, ordinance and utility development and enforcement. There is a 70 percent cost share and a maximum grant total of \$85,000 for planning grants.

Construction grant costs may include such projects as stormwater detention ponds, filtration and infiltration practices, streambank stabilization, and shoreline stabilization. There is a 50 percent cost share and a maximum grant total of \$150,000 for construction grants. Construction projects involving land acquisition and permanent easements can be awarded up to an additional \$50,000 in cost-share funds (50 percent cost-share rate). Municipalities, regional planning commissions, counties, tribal governments, and sewerage or sanitary districts may apply for the grants (WDNR(c)).

Watershed Based Pollutant Trading

Wisconsin DNR has implemented pollutant trading pilot projects for four years. There has been no actual trading to date but detailed annual reports for each year of the project have resulted in a greater understanding of the best design framework for a trading program and what requirements are needed to make the program successful (WDNR(d)).

Stormwater

To meet the requirements of the federal Clean Water Act, Wisconsin DNR developed the Wisconsin Pollutant Discharge Elimination System (WPDES) Stormwater Discharge Permit Program, which is regulated under the authority of ch. NR 216, Wisconsin Administrative Code. As part of NPDES, the program regulates discharge of stormwater in Wisconsin from construction sites, industrial facilities, and selected municipalities. Beyond regulatory stormwater management, the Department also supports a wide variety of voluntary stormwater management activities. These include projects funded through the Urban Nonpoint Source and Stormwater and Targeted Runoff Management Grant Programs. The University of Wisconsin Extension Service provides additional information about stormwater management from the scale of a residential rain garden through construction site erosion control plans for multi-acre construction sites (WDNR(e)).

Appendix D

ON-SITE WASTEWATER MANAGEMENT IN OTHER STATES

Note: Chapter 3 contains a summary of Georgia's onsite wastewater policies. Chapter 6 contains condensed forms of the following descriptions of onsite wastewater programs in other states.

Florida

In Florida, the Bureau of Onsite Sewage (Bureau) Programs in the Florida Department of Health (FDOH, Department) and the environmental health section of the County Health Departments regulate the use of Onsite Sewage Treatment and Disposal Systems. The state does not encourage the use of onsite sewage treatment and disposal systems and special regulations apply to the Florida Keys because of the limestone soil in that region.

Regulatory Agencies

In Florida, the Bureau of Onsite Sewage Programs in the Florida Department of Health and the environmental health section of the County Health Departments regulate the use of Onsite Sewage Treatment and Disposal Systems (OSTDS) through Chapter 381, Florida Statutes and Chapter 64E-6, F.A.C. The Bureau programs' mission is to protect the public health and environment by developing and promoting a comprehensive onsite sewage program. Florida DOH shares jurisdiction with DEP in some cases where estimated sewage flow is above Florida DOH jurisdictional flow or where there is a possible discharge of toxic, hazardous or industrial wastewater. An interagency agreement details coordination between the agencies.

The Bureau develops statewide rules and provides training and standardization for County Health Department employees responsible for permitting the installation and repair of onsite sewage treatment and disposal systems within the state. The bureau licenses septic tank contractors, approves continuing education courses and course providers for septic tank contractors, funds a hands-on training center, and mediates on-site wastewater contracting complaints. The bureau manages a state funded research program, prepares research grants, and reviews and approves innovative products and septic tank designs.

The state does not encourage the use of onsite sewage treatment and disposal systems (which generally takes the form of septic tanks and drain fields). Both the statutes and Florida DOH rules require the use of public or investor-owned sewage systems in areas where they are available (FLDOH 2006, FCES 2002).

Alternative Technologies

The rules give the individual county health departments, as part of DOH, the authority to approve alternative onsite systems such as composting toilets, mounds, gravity sewers,

low pressure pipe, and other systems so long as the county feels there will be no adverse effects. However, any approvals of alternate systems must comply with applicable rule and law. The county health department may, require submission of plans prepared by an engineer registered in the State of Florida, prior to considering the use of any alternative system.

If a technology is not listed in the current State Code, statute allows Florida DOH to approve a limited number of innovative systems where there is compelling evidence that the system will function properly and reliably to meet the requirements of law and rule (64E-6 F.A.C.).

Permitting and Inspection of On-site Sewage Management Systems

No portion of an onsite sewage treatment and disposal system shall be installed, repaired, altered, modified, abandoned, or replaced until an “Onsite Sewage Treatment and Disposal Construction Permit” has been issued from the appropriate county health department. Before covering the earth or placing a system into service, a person installing the onsite treatment and disposal system must notify the county health department and pass an inspection by the department confirming that the system is in compliance with the requirements listed in Chapter 64E-6, F.A.C.

An application for a Construction Permit must be completed in full and signed by the owner or licensed contractor. The suitability of a lot, property, subdivision or building for the use of onsite sewage treatment shall be determined from an evaluation of lot size, sewage flow, soil and water table conditions, soil drainage, and topography. Site investigations and tests shall be performed by either an engineer or septic tank contractor registered in the State of Florida. The application shall also include the following data:

- A plot of the lot, drawn to scale, that includes:
 - Dimensions and locations of existing or proposed buildings;
 - Swimming pools;
 - Easements,
 - Onsite sewage treatment components and location on property,
 - Slope of property,
 - Existing or proposed wells;
 - Water lines, and
 - Surface water bodies.

- For residences, a floor plan showing total building area including number of bedrooms.
- For non-residences, a floor plan showing square footage and all plumbing drains and fixtures.
- At least two soil profile descriptions to a minimum depth of six feet at the beginning and end of the proposed drainfield site.
- Water table elevations. (Ch. 64E-6.004 F.A.C.)

Monitoring

Florida's rules require maintenance and management contracts for aerobic treatment units (ATUs), performance-based treatment systems, commercial wastewater systems, and systems in industrial/manufacturing zoning or use. Traditional systems do not have a regulated monitoring program (64E-6 F.A.C.).

Maintenance

The owner of the property is responsible for maintenance and upkeep of the system. It is important to note that an onsite sewage treatment and disposal system must be operated under the terms of the rule and permit under which it was approved. The owner may not make any changes to the structure or to the system or increase sewage flow without approval from the local health department. Under DOH rules, the owner should have the level of the tank checked a minimum of once every three years by a licensed septic tank contractor. A licensed contractor should also perform any necessary maintenance to the system. If garbage grinders or commercial sewage are being discharged into a tank, the owner needs to have the system inspected by a licensed septic tank contractor or pumper once a year. Both the statute and the rules prohibit the use of organic chemical solvents, toxic or hazardous chemicals, or petroleum products to degrease or de-clog the system. A licensed contractor must be issued an annual service permit prior to the removal of septage from any onsite sewage treatment and disposal system (FCES 2002).

Location

Septic tanks must be installed with minimum setbacks as follows (Ch. 64E-6.005 F.A.C.). No septic tank may be installed:

- Less than five feet from a property line;
- Less than 75 feet from surface waters;
- Less than 15 feet from wetlands;
- Less than 75 feet from a private well; or

- Less than five feet from a dwelling or structure. (64E-6.005 F.A.C.)

Failure

In Florida, a system failure is defined as a condition existing within an onsite sewage treatment and disposal system that prohibits the system from functioning in a sanitary manner and which results in the discharge of untreated or partially treated wastewater onto ground surface, into surface water, into groundwater, or which results in the failure of building plumbing to discharge properly. The most common reasons for system failure in the state include the age of the system followed by lack of proper maintenance, abuse of the system, and/or installation/construction. If a system is failing or has already failed, permitting and inspection are required (64E-6 F.A.C.).

Disposal of Septage

Florida regulations require permitting for both the handling and disposal of septage by the Department of Health and Rehabilitative Services of each county. Regulations specify that only septage which has been properly treated by lime stabilization may be land applied and that it may not be spread on land where frequent public access is likely to occur. Several stipulations exist for use of septage in agricultural settings to protect food crops. In addition, the following restrictions on septage application are designed to protect water quality:

- Septage may not be land applied within 3000 feet of any Class I waterbody or Outstanding Florida Water. For surface waters of lesser quality, a buffer zone of 200 feet must be maintained. No buffer is required around irrigation waters that are located entirely on the land application site and do not flow off the site.
- Septage may not be land applied within 500 feet of any shallow public water supply wells, nor closer than 300 feet to any private drinking water supply well.
- At the time of septage application, a minimum of 24 inches of unsaturated soil above the ground water table must be present.
- Septage may not be applied during rain events when runoff might occur.
- The septage application area must have buffer zones and stormwater management structures with a capacity to hold runoff during flash floods.
- The slope of the land application area may not be more than eight percent.
- Land used for septage application may not contain any hole or channel which would allow septage to contaminate ground water.

- Septage may not be applied within 300 feet of any dwelling, or within 75 feet of the property boundary or any drainage ditches. (USEPA 1993, biosolids)

Massachusetts

Massachusetts has a well-developed process for integrating innovative and alternative septic technologies into their on-site wastewater management program. The Massachusetts Alternative Septic System Test Center, part of the Buzzards Bay National Estuary Program is a national leader in test alternative septic technology. State regulation governs the maintenance of approved alternative systems but not systems that rely on traditional septic technology. The Massachusetts Department of Environmental Protection (DEP, Department) has developed the Community Septic Management Program to provide funds and assistance to homeowners for compliance with state on-site wastewater while also encouraging communities to create and implement a comprehensive community septic management plan.

Regulatory Agencies

In Massachusetts, on-site wastewater disposal systems include systems that treat less than 10,000 gallons per day. Title 5 of the State Environmental Code, 310 CMR 15.000 contains regulations for siting, construction, upgrade, and maintenance of on-site systems.

Local Boards of Health are the primary regulatory authorities. However, the Department approves the use of innovative and alternative technologies and is responsible for overseeing local implementation of Title 5.

Massachusetts DEP has designated parts of the state as “Nitrogen Sensitive Areas.” These areas are particularly sensitive to pollution from nitrogen in sewage because of their proximity to drinking water supplies. Title 5 contains special requirements for repairing failed and constructing new systems in Nitrogen Sensitive Areas.

Innovative/ Alternative Technologies

Massachusetts DEP has a three-tiered approval process for innovative or alternative (I/A) technologies: piloting, provisional use, and general use.

The Department encourages the development of I/A technologies that have superior performance to conventional systems. Currently, there are 50 I/A technologies that have been approved at one of the three tiers. Once I/A technologies have been approved for use in Massachusetts, they still must be reviewed and approved for actual installation at a specific site.

Alternative systems proposed may include:

- Humus or composting toilets;

- Alternative mounded systems (such as the Wisconsin mound) designed to overcome limiting site conditions;
- Any system designed to chemically or mechanically aerate, separate, or pump the liquid, semi-solid or solid constituents in the systems; or
- Any system designed specifically to reduce, convert, or remove nitrogenous compounds, phosphorus, or pathogenic organisms by biological, chemical, or physical means.

Piloting involves the installation, field testing, and technical evaluation to demonstrate that the technology can function effectively under the physical and climatological conditions at the pilot sites and provide environmental protection equivalent to a conventional Title 5 system.

Provisional use approvals are intended to evaluate whether an I/A technology can provide environmental protection at least equivalent to a conventional system under actual field conditions and with a broader range of uses than in the controlled environment of piloting.

When an I/A technology has successfully completed the Provisional Use stage, it receives Certification for General Use. I/A systems certified for General Use can be installed at any site where a conventional Title 5 system can be installed. Additional monitoring and reporting is generally not required, although DEP has the option of requiring monitoring as part of its Certification (310 C.M.R.15.280-289).

Massachusetts Alternative Septic System Test Center

The Massachusetts Alternative Septic System Test Center (Center) was constructed by the Buzzards Bay National Estuary Program (BBP), a unit of the Massachusetts Office of Coastal Zone Management, in collaboration with Massachusetts Department of Environmental Protection (DEP), Barnstable County Department of Health and the Environment (BCDHE), and UMass Dartmouth's School for Marine Science and Technology (SMAST). The Center was initially funded with a grant from USEPA (Environmental Technology Initiative), with subsequent funding received from the Massachusetts Environmental Trust, the Massachusetts Office of Coastal Zone Management, the Massachusetts Department of Environmental Protection, and USEPA Region I.

The mission of the Center is to evaluate the performance and operation costs of new and innovative wastewater disposal technologies in a carefully controlled and unbiased manner and provide this information to regulators and consumers and assist vendors in getting their technologies approved for use in Massachusetts more quickly and at a lesser cost.

Testing Programs

- Environmental Technology Initiative (ETI): This was the first initiative of the Test Center and incorporated testing technologies in triplicate over two years. The program operated from 1999 to 2002, tested 6 technologies (including a conventional Title 5 system), and has now terminated. Participants agreed to install three of their systems at no cost. In return they received comprehensive testing at a nominal cost. If successful, participants received Piloting Approval in Massachusetts.
- Environmental Technology Verification (ETV): Under the ETV program, the Test Center is establishing national protocols for evaluation of nitrogen removal and septic system stress testing. Additional Systems are being tested under this program. The program tests one unit of the technology for 14 months. Five technologies have been evaluated, one is pending.
- Independent testing: Approximately ten technologies have been tested using modified ETV testing protocols. These evaluations are at various stages of completeness.
- Phosphorus Removal Technologies: This work was undertaken through a special 319 grant. Three technologies are currently being evaluated.

Research and Development "Open enrollment": Various companies have utilized Test Center space for Research and Development. This is allowed on a first-come basis as space is available (BBNEP 2006).

Permitting and Inspection of On-site Sewage Management Systems

Every location proposed for the construction, upgrade, or expansion of an on-site subsurface sewage disposal system shall be evaluated based upon an analysis of all site characteristics which may affect system function and performance. The field evaluation will be conducted by a Soil Evaluator approved by Massachusetts DEP prior to commencement of final system design and application for a Disposal System Construction Permit. The evaluation must include a soil evaluation that meets the requirements set forth in 15.101 through 15.103 (310 C.M.R.15.100).

A percolation test must be conducted to provide data necessary to assess the suitability of the soil to transmit water from the soil absorption system to a depth of four feet below this elevation. The test shall be performed by a Massachusetts Registered Professional Engineer, Registered Sanitarian, or a Soil Evaluator and must meet the requirements outlined in 15.104-15.105.

Landscape position and hydrogeologic properties of the site must also be noted. Landscape position includes details such as bedrock outcrops, steep slopes, disturbed soil, evidence of tidal inundation, evidence of surface water runoff, ponding, or freshwater vegetation, and low-lying areas adjacent to surface water bodies and streams.

Hydrogeologic properties include such items as direction of ground water flow, ground water table elevation, depth to bedrock, and location of public and private water supplies (310 C.M.R.15.106-15.107).

Design and Construction

Every system shall be designed by a Massachusetts Registered Professional Engineer or a Registered Sanitarian and their signature must accompany any plan submitted for approval. Each design plan shall be at a scale no smaller than one inch= 40 feet and shall include depiction of:

- Legal boundaries of the facility to be served;
- Location of any easements that may impact the system;
- Location of all dwellings or buildings;
- Location of existing or proposed impervious surfaces;
- Location and dimensions of the septic system;
- System design calculations, including daily sewage flow, tank capacity, and soil absorption capacity;
- Existing and proposed contours;
- Results of soil and percolation analyses;
- Location of water supplies, surface waters, subsurface utilities; and
- Construction materials and specifications for the system.

All construction elements must meet the requirements outlined in 15.201-15.293 (310 C.M.R.15.201-15.293).

Monitoring

A monitoring program was put in place effective in 1995 that requires regular monitoring for treatment systems in single family homes that use I/A technologies treating less than 2000 gallons per day. Over 2000 of these systems have been installed since the enactment of Title 5. The Department had required quarterly inspection and effluent sampling for pH, BOD, and TSS for the first year of operation in remedial situations. Sampling was reduced to an annual event after the first year. All I/A systems certified for General Use were inspected quarterly (without effluent sampling). Data indicate that these systems are producing a higher quality effluent than required by regulation. Beginning in Jan, 2006, new monitoring rules require a field test that includes: visual examination, pH of effluent,

dissolved oxygen, and turbidity. If the effluent does not pass all of the field tests, the operator will be required to collect a sample for laboratory analysis. Monitoring will occur twice a year for remedial systems and once a year for general use systems.

There is no monitoring program required for traditional systems (MADEP 2005).

Maintenance

Pumping of traditional septic systems is required whenever the top of the sludge or solids layer is within 12 inches or less of the outlet tee or the top of the scum layer is within two inches of the outlet tee. Pumping is typically necessary at least once every three years. Whenever a septic tank is pumped its condition shall be noted on a DEP approved system pumping form and submitted to the local approving authority. Homeowners are encouraged to maintain their system according to these rules, but no enforcement mechanism is currently implemented (310 C.M.R.15.351).

Location

Septic tanks must be located with minimum setbacks as follows (310 C.M.R.15.211). No septic tank may be installed:

- Less than ten feet from a property line;
- Less than 25 feet from surface waters, bordering vegetated wetland, salt marsh, or inland and coastal banks;
- Less than 400 feet from reservoirs and impoundments;
- Less than 200 feet from tributaries to surface water supply;
- Less than 100 feet from wetlands bordering surface water supply; or
- Less than 50 feet from a private water supply well.

Failure

A system is considered failing if:

- There is backup of sewage into the facility served by the system;
- There is discharge of effluent to the surface through ponding or surface breakout or to a surface water of the state;
- Liquid level in the distribution box is above the level of the outlet invert; or
- Septic tank requires pumping more than four times a year. (310 C.M.R.15.303)

Disposal of Septage

Sludge and septage is classified in Massachusetts as either:

- Type I, which may be sold or distributed on any site without approval by the Department and which may be used for growing vegetation;
- Type II, which may be offered or distributed only with approval of the Department and may be used for growing vegetation; or
- Type III, which may be sold or distributed only with approval of the Department, and which may be used for growing any vegetation not including direct food chain crops, and whose land application to a site must be recorded in the registry of deeds in the chain of title for such site.

Specific and detailed specifications exist for land application of each type of sludge or septage, including requirements for soil texture and drainage, depth to ground water, soil pH, slope, proximity to public water supplies and other surface and ground waters, public access, and agricultural activities (310 C.M.R. 32).

Community Septic Management Program

The Department's Bureau of Resource Protection and Division of Municipal Services developed, in collaboration with the Executive Office of Administration and Finance, the Office of State Treasurer, and the Department of Revenues, the Community Septic Management Program (CSMP) to provide funds and assistance to homeowners for compliance with Title 5.

With the revision of Title 5 in 1995, inspection requirements were increased and any system deemed to be "failed" is required to be repaired, replaced, or upgraded. CSMP was funded by a 1996 Open Space Bond Bill that authorized DEP to spend \$30 million to assist homeowners to comply with Title 5. That authorization is used to fund loans to communities through the MA Water Pollution Abatement Trust (the Trust). The Trust is composed primarily of State Revolving Fund (SFR) monies. Communities have two avenues by which to pursue Trust funds.

Option 1. The community proposes a Comprehensive Community Septic Management Program on either a community-wide basis, or for a portion of the town, targeted sensitive areas (such as shellfish beds, recreational lake, or water supply) and high failure rates. Under this option, a \$20,000 pre-loan assistance payment is awarded to assist communities in identifying priority areas and establishing a comprehensive approach. Upon approval of the plan, loans of \$20,000 are available. Communities proposing a comprehensive inspection program that meets DEP requirements and communities that join other communities, will be eligible for larger loans.

Option 2. If the community opts to target known or suspected failures, loans not to exceed \$100,000 are available.

Massachusetts offers the SRF loan at an effective zero percent interest rate to the Community. The Community reloans these funds usually at the rate of either two percent or five percent interest to the homeowners (MADEP 2005, MADEP(a)).

Homeowner Septic Loan Program

The Homeowner Septic Loan Program was designed to meet the demand for funds by homeowners whose systems will not pass Title 5 inspection. The program provides below market rate loans to homeowners upgrading systems. Loans are administered by banks and are then purchased by the Massachusetts Housing Finance Agency (MADEP(a)).

Tax Credit

The Department of Revenue allows homeowners to claim up to \$6,000 in tax credits for septic upgrades. The credit cannot exceed \$1,500 in any year and may be spread over four years. The tax credit is limited to work done on a primary residence (MADEP(a), MADEP(b)).

Minnesota

Minnesota's state agencies responsible for the management of on-site wastewater systems delegate many of the tasks associated with enforcement and implementation of relevant statutes to counties and local communities. All counties are required to have an Individual Sewage Treatment System ordinance, but it can be either more or less restrictive to state code. While statewide enforcement is lacking, the Metropolitan Council (Minneapolis-St. Paul area) requires all local governments within its seven-county jurisdiction to have maintenance programs. In addition, many lake associations, homeowner associations, sanitary sewer districts, etc., have created and implemented effective management programs.

Regulatory Agencies

On-site wastewater regulations are split between several agencies in Minnesota. The Minnesota Pollution Control Agency (MPCA) writes and interprets rules, administers state licensing program, reviews and approves septic designs with average design flows greater than 10,000 gallons per day. The Minnesota Department of Health (MDH, Department) reviews and approves plumbing systems, including the septic system, for facilities serving the public and those that are designed for less than 10,000 gallons per day. The Minnesota Department of Natural Resources (DNR) is responsible for the shoreland management act that requires septic systems to be inspected when any permit or variance is requested for the property. Implementation of the act is done locally.

All counties are required to have an Individual Sewage Treatment System (ISTS) ordinance, but it can be either more or less restrictive to state code. Local authorities are not required to seek approval from the state to create more stringent codes.

Two processes are in place for allowing new technologies to be used in the state. First, (7080.0179) performance standards now allow any technology to be used if the local government specifically adopts that portion of the rule, issues renewable operating permits on the system, and reviews and approves monitoring and mitigation plans. Second, (7080.0400) MPCA can now designate a new technology as an “alternative” (has research data) or “standard” (proves itself over time and location) system (MPCA 2004, MPCA 2001).

Permitting and Inspections

Permitting of septic tanks is divided into two parts in Minnesota. Phase I consists of a site field evaluation while Phase II requires a detailed report on the design of the system.

Phase I

Site evaluations consisting of preliminary and field evaluations shall be conducted for all proposed sites for individual sewage treatment systems.

A preliminary evaluation shall include:

1. Flow determination for the dwelling or other establishment;
2. Location of proposed or existing water supply wells within 100 feet of the proposed system or transient public water supply wells within 200 feet of the proposed system if alternative local standards are in effect;
3. Buildings or improvements on the lot;
4. Buried water pipes within 50 feet of the proposed system;
5. Easements on the lot;
6. Ordinary high water level of public waters and floodplain designation;
7. Property lines;
8. All required setbacks from the system;
9. Soil classifications and applicable characteristics at the proposed soil treatment areas;
10. Legal description and lot dimensions;
11. names of property owners; and

12. Inner wellhead management zone or wellhead protection area of a public water supply.

A field evaluation shall consist of:

1. Description of the percent and direction of the slope at the proposed system location; vegetation type; any evidence of compacted soil or flooding potential; and landscape position;
2. Soil observations shall be conducted prior to any required percolation tests to determine whether the soils are suitable to warrant percolation tests and, if suitable, at what depths percolation tests shall be conducted. Observations should include details of soil depth, color, texture, and distance for seasonally saturated soil; and
3. Percolation tests, where required, shall be made as described in Minn. R ch. 7080.0020/

A written report on the site evaluation shall be prepared and include the following:

1. Dates of and results from all components of the preliminary and field evaluations.
2. A map drawn to scale including:
 - Reference points of the proposed soil treatment area or areas;
 - The location of any unsuitable, disturbed or compacted areas;
 - The access route for tank maintenance;
 - Estimated depth of seasonally saturated layer, bedrock, or flood elevation, if appropriate;
 - Proposed elevation of the bottom of the soil;
 - Treatment system;
 - Anticipated construction-related issues; and
 - Name, address, telephone number, and certified statement of the individual conducting the site evaluation.

Phase II

A completed design report shall be considered the second phase for an individual sewage treatment system design. Phase II design reports shall include drawings, design flows, system component sizings and calculations, hydraulic and organic loading rates, setbacks, construction considerations, and, as applicable, maintenance contracts, operational requirements, monitoring, and mitigation plans.

Designs shall comply with all applicable ordinances, codes, rules, laws, and include other items necessary to comply with Minnesota Rules.

Permits are issued for new construction of onsite systems and most of the time for the repair of existing and the upgrade or modification of onsite systems. Homeowner inspections are performed by local permitting authority staff and in some areas a homeowner hires a licensed inspector. All onsite inspectors must be licensed and complete training, pass exams, and have the first 15 inspections supervised. Site evaluations before an onsite system is installed or approved must be conducted by licensed designer. Either a percolation test or soil characterization must be conducted as part of the site evaluation. (M.R. Ch. 7080.0020; M.R. Ch. 7080.0060-7080.0176).

Maintenance

Septic tanks are required by Minnesota Rules Chapter 7080 to be checked for sludge and scum levels by the owner every three years. Local ordinances may have additional requirements. Minimum maintenance standards require that homeowners do a visual assessment of the tank and its components for leakage and measurement of scum and sludge depths. Septage must be removed from tanks when the top sludge layer is less than 12 inches below the outlet baffle or the bottom of the scum layer is less than three inches about the baffle. When these requirements are exceeded, a state-licensed pumper must remove accumulated septage.

Minnesota State Code recommends that local management districts monitor and maintain aerobic tanks and holding tanks. Aerobic treatment units must have a service contract for the life of the system; performance systems require monitoring and mitigation plans approved by local government; and holding tanks must have a service contract approved and managed by the local government.

The Metropolitan Council (Minneapolis-St. Paul area) requires all local governments within its seven-county jurisdiction to have maintenance programs. In addition, many lake associations, homeowner associations, sanitary sewer districts, etc., have created and implemented effective management programs (MPCA 2001).

Location

Septic tanks must be located with minimum setbacks, as follows. No septic tank may be installed:

- Less than 10 feet from a dwelling or structure;
- Less than 50 feet from a private well;
- Less than 50 feet from surface water; or
- Less than 10 feet from property lines. (NESC 2001)

Septic System Failure

A failed system is one in which a tank that obviously leaks below the designed operating depth or any system with less than the required vertical separation. Any situation with the potential to immediately and adversely affect or threaten public health or safety, including ground surface or surface water discharges and sewage backups.

Minnesota's revolving loan program provides loans to municipalities for planning, design, and construction of wastewater treatment projects that are eligible under Minnesota Rule Chapter 7077. The MPCA is responsible for reviewing and monitoring projects and the Department of Trade and Economic Development is responsible for the terms and conditions of the loans (MPCA 2001).

Septage Disposal

Minnesota's land application of septage does not require permitting, but the Minnesota Pollution Control Agency issued a document entitled *Land Application of Septage*, which explains the state's guidelines. This document contains the following controls for land application:

- Setbacks vary with the method of applying the septage, the time of the year, the slope of the application site, and whether the septage was stabilized with alkali treatment. Setbacks are included for surface waters, drainage tile inlets, and sinkholes.
- Slope restrictions vary based on the method used to apply the septage and whether the soil is frozen.
- Several characteristics for soil characteristics are specified.
- Several harvesting and food crop limitations prevent contamination of food crops or food chain crops.
- Application rates are based on nitrogen inputs relative to other sources of nitrogen. Septage may not be applied when it is raining. (USEPA 1993)

North Carolina

The strength of North Carolina's on-site management program lies in the variety of programs at the state level that work to assist local health departments in providing a comprehensive program for control of sub-surface on-site wastewater treatment in their communities. The Program Improvement Team within the On-Site Wastewater Section of the North Carolina Department of Environment and Natural Resources (NC DENR) assists local level on-site wastewater programs in improving the quality and efficiency of their work. The team conducts local program evaluations and works closely with each local on-site specialist to assess their field performance and provide rule interpretation and documentation detail. The Wastewater Discharge Elimination Program (WaDE) Program assists counties in initiating door to door surveys to identify straight pipes, which discharge sewage directly to surface waters, and failing septic systems. The program also assists counties in enabling homeowners to access financial assistance programs for loans or grants to repair onsite systems identified as failing during the surveys.

Regulatory Agencies

The On-Site Wastewater Section (OSWS, Section) within the North Carolina Department of Environment and Natural Resources' (DENR) Division of Environmental Health, in a joint effort among the local health departments, is responsible for providing a comprehensive program for control of sub-surface on-site wastewater treatment and disposal.

North Carolina Rules are adopted by the Commission for Health Service (CHS, Commission) and are mandatory throughout North Carolina. Local boards of health may adopt more stringent rules along with adoption of the CHS rules and this agency's approval. Currently only two of 100 counties have state approved local rules (NCDENR(m)).

Program Improvement Team

The Program Improvement Team within the OSWS assists local level on-site wastewater programs in improving the quality and efficiency of their work. The team conducts local program evaluations and works closely with each local on-site specialist to assess their field performance and provide rule interpretation and documentation detail. The team also undertakes special projects such as system performance surveys to improve the Section's regulations (NCDENR(n)).

Permitting and Inspection of On-site Sewage Management Systems

A permit issued by the local health department is needed before any septic system is installed or repaired. Applications for an Improvement Permit, Construction Authorization, or Operation Permit shall be submitted to the local health department for each site prior to any construction.

An Improvement Permit shall contain:

- Owner's name, contact information, and signature;
- Location of property;
- Site plan depicting existing and proposed facilities including number of bedrooms or persons served; and
- Type of water supply, including existing or proposed wells.

In addition to the requirements above, the application for a Construction Authorization must contain the locations of the proposed facility and the system showing setbacks to property lines and fixed reference points as well as details of the proposed system.

No residence, place of business shall be occupied nor shall any wastewater system be covered or placed into use until an authorized agent issues and Operation Permit (15A NCAC 18A. 1937).

A county Environmental Health Specialist must visit the site to evaluate the soil and site conditions prior to issuance of a permit. The Environmental Health Specialist must also approve the installation before the system is put into use. The investigation of each proposed site shall include the evaluation of the following factors:

- Topography and landscape position;
- Soil morphology;
- Soil wetness;
- Soil depth;
- Restrictive horizons; and
- Available space. (15A NCAC 18A. 1939)

Maintenance and Monitoring

Maintenance is required by the State for a subset of systems. North Carolina code does require contracts for pressure dosed systems, all systems with 2 or more pumps, all systems with a design flow greater than 3000 gallons/day, all treatment systems beyond primary treatment. The state requires perpetual maintenance on mechanical systems that have surface discharge to surface water, but not for discharge to ground surface. Traditional septic tanks do not fall under this category and no regularly reported maintenance is required by the state.

Ground absorption sewage treatment and disposal systems shall be checked, and the contents of the septic tank removed periodically from all compartments to ensure proper operation of the system. The contents shall be pumped whenever the solids level is found to be more than one-third of the liquid depth in any compartment. There is currently no enforcement mechanism in place to ensure compliance with this rule (15A NCAC 18A. 1961).

Location

Septic tanks must be located with minimum setbacks as follows. No septic tank may be installed:

- Less than ten feet from a property line;
- Less than between 25 and 100 feet from surface waters depending on the surface water classification of the waterbody;
- Less than between 0 and 100+ feet from wetlands depending on soil conditions;
- Less than 100 feet from a private well; or
- Less than 50 feet from a public well. (15A NCAC 18A. 1950)

Failure

North Carolina State Code defines a failed system as one that fails to meet one or more of these requirements, either continuously or intermittently, or if it is necessary to remove the contents of the tank at a frequency greater than once per month in order to satisfy the conditions of Parts (a), (b), or (c):

Ground absorption sewage treatment and disposal systems shall be operated and maintained to prevent the following conditions:

- A discharge of sewage or effluent to the surface of the ground, the surface waters, or directly into groundwater at any time;
- A backup of sewage or effluent into the facility, building drains, collection system, or freeboard volume of the tanks; or
- A free liquid surface within three (3) inches of finished grade over the nitrification trench for two (2) or more observations made not less than 24 hours apart. Observations shall be made greater than 24 hours after a rainfall event. (15A NCAC 18A. 1961)

Septage Disposal

North Carolina treats septage as solid waste and allows any of three septage disposal methods: treatment at a wastewater treatment plant, treatment at an independent septage treatment plant, or land application. For land application, the state places restrictions on application to food or food chain crops, requires lime stabilization to reduce pathogens and vectors, requires nutrient management plans for agricultural application, and mandates that land application rates are based on the nitrogen rate required to produce a realistic yield for the crop grown. Borders and setbacks are required to protect human health and the environment, including setbacks from residences, wells, springs, streams, public road right of way, food crops, and wetlands (N.C. State Univ.).

Non Point Source Pollution Management

The OSWS takes an active role in the prevention of non point source pollution from on-site septic systems by:

- Evaluating appropriate innovative and alternative systems from both public health and water quality perspectives;
- Documenting potential effects of on-site wastewater systems and community wastewater systems on coastal water quality;
- Evaluating the extent of water quality impacts from high-density on-site wastewater systems and designing measures to mitigate water quality impacts; coordinating education and technology transfer to government agencies and the public (NCDENR(o)).

Wastewater Discharge Elimination Program

The Wastewater Discharge Elimination Program (WaDE) Program was established pursuant to S.L. 1996-18es2, Section 27.26, to identify and eliminate discharges from straight pipes, which discharge sewage directly to surface waters, and failing septic systems.

Funds appropriated by the N.C. General Assembly support the program. Additional financial support has been secured through grants from the N.C. Clean Water Management Trust Fund (CWMTF) and the EPA's 319 Nonpoint Source Program.

The WaDE program assists counties in initiating door to door surveys to identify straight pipes and failing septic systems. DENR has established a self-reporting policy for the WaDE program that allows home and business owners who self report on-site violations to be exempt from related legal action as long as there is reasonable progress towards correcting the violation. The WaDE program also assists counties in enabling homeowners to access financial assistance programs for loans or grants to repair onsite systems (NCDENR(p)).

South Carolina

The Onsite Wastewater Management Division (OMWD, Division) of the Bureau of Environmental Health within South Carolina DHEC provides program management through DHEC's eight regions and forty-six county health offices. The Division develops regulations that establish minimum site and soil conditions as well as system design and construction. It administers a licensing program for septic system contractors and septage haulers as described in S.C.R. 61-56.1. Program quality is evaluated by residents and permit holders through region and county program surveys. The Division also implements public education initiatives that emphasize the importance of routine maintenance (S.C.R. 61-56.1, SC DHEC 2006).

Permitting and Inspections

It is the responsibility of the property owner to ensure that a permit to construct an on-site sewage disposal system is obtained from DHEC prior to construction of the system. The property owner must furnish all information required by the DHEC permit application form as well as a boundary plat or deed specifying the lot size and its boundaries. The Department must perform a site evaluation prior to the issuance of a permit.

Once a permit is issued, the on-site sewage disposal system must be constructed in accordance with the specifications stated in the permit. Soil texture, depth of soil to rock, and maximum seasonal high water table shall meet minimum standards as required by DHEC (S.C.R. 61-65).

Maintenance

No water quality testing procedure is currently in place but regulations require that systems are installed in a manner that will not violate laws governing pollution (Ibid).

Location

Septic tanks must be located with minimum setbacks as follows. No septic tank may be installed:

Minimum setback/separation distances include:

- Less than five feet from a property line;
- Less than 50 feet from ordinary high water level of impounded or natural surface waters; and
- Less than 50 feet from a private well. (S.C. R. 61-65)

Septic System Failure

In South Carolina, a failed system is one that is discharging onto the surface or is backing up into the dwelling. Lack of proper maintenance is cited as the most common reason for system failure in the state. If a system is considered to be failed, an official notice from DHEC will be issued to the homeowner. This notice states that the homeowner is in violation of Regulation 61-56, and must repair the system within ten days. If the homeowner does not cooperate, legal action will be taken through the local magistrate's office. No funding or financing options are available to individual homeowners for the repair or replacement of failing or malfunctioning systems or for new construction (NESC 2001).

Septage Disposal

South Carolina DHEC issues individual land application permits, which may contain:

- Effluent limitations on pollutants of concern;
- Pollutant monitoring frequencies;
- Ground water monitoring;
- Reporting requirements;
- Schedules of compliance;
- Operating conditions;
- Best management practices; and
- Administrative requirements.

Vermont

Over 55% of Vermont's households use some form of on-site wastewater systems. Vermont's Department of Environmental Conservation issues permits from five regional offices throughout the state. Vermont code requires that, at least once a year, the depth of sludge and scum in the septic tank should be measured. However, Vermont code does not include an enforcement mechanism to address situations where maintenance requirements are not met, unless system failure results.

Regulatory Agencies

The Wastewater Management Division (WMD, Division) of Vermont's Department of Environmental Conservation (DEC) has primary oversight over the regulation of septic tanks. The five regional offices of WMD issue permits for wastewater and potable water

supply systems less than 6500 gallons per day and water or sewer connections. All rules apply state wide and can be made more stringent on the local level without state approval.

Vermont's small-scale wastewater rules apply to the subdivision of land, the construction, modification, or change in use of a building or structure or campground and their associated soil-based wastewater disposal systems with design flows of less than 6500 gallons per day. Those technologies approved for onsite wastewater treatment and disposal include trenches, beds, Wisconsin mounds, at-grade systems, sand filters, and the Advantex system. The rules include a protocol for review of experimental, pilot, and general use systems (VANR(a), VANR(b)).

Permitting and Inspections

Permits are issued, and kept track of, by the state for construction, repair of existing system, and for upgrade or modification of all onsite systems. Within ten days of submittal, an applicant will receive notice of receipt from Vermont WMD with information as to whether the application is complete or incomplete. A written decision is issued within 60 days of the notice of receipt. If WMD approves the project, a permit to proceed with the project is issued.

All plans for wastewater systems submitted for approval shall be prepared by a designer. Designers have to be licensed engineers or certified site technicians. Each application for a permit must include the following:

1. Name, address, and signatures of the owner, the applicant, and the designer;
2. Design flow of the project's wastewater system(s);
3. Purpose of the project, including the intended use;
4. Type of wastewater system proposed for the project;
5. Identification using latitude and longitude of any existing or proposed potable water sources serving the project;
6. Description of the existing use of adjacent properties and all existing potable water supplies or wastewater systems;
7. A plot plan drawn to a scale of 1"=100' or larger showing:
 - Locations and dimensions of land involved;
 - Scale of the plan and the preparer's signature;
 - Permanent benchmark on the land;

- Existing and proposed topographic contours; and
 - Locations of standing and flowing waters and wetlands, drainage courses, and any applicable flood prone area.
8. A detail sheet that includes plans for the wastewater system drawn to a scale of 1"=30' or larger showing:
- Existing or proposed buildings;
 - Existing and proposed wastewater systems; and
 - Existing and proposed potable water supply sources.
9. Results of all soil tests or investigations
10. Basis of design calculations for the wastewater system
11. Construction details such as materials used and their accompanying specifications, invert elevations, final grades, specifications on methods of installation.

Site evaluations are conducted by licensed designer who prepares the design and submits it to the state for review. Percolation test and soil characteristic tests are required as part of the site evaluation. The State operates a licensing/certification program for onsite wastewater professionals (VT Ch. 1§ 1-303- 1-316).

Design and Construction

All new and replacement septic systems must be constructed according to the technical standards found in VT Ch. 1 § 1-501.

Location

Septic tanks must be located with minimum setbacks as follows. No septic tank may be installed:

- Within ten feet of an existing dwelling or structure;
- Less than 25 feet from any surface waterbody;
- Less than 10 feet from a property line; or
- Less than 50 feet from a well less than 100 feet in depth.

There is no minimum lot size required for the placement and use of onsite wastewater systems by the state (NESC 2001).

Maintenance

At least once a year, the depth of sludge and scum in the septic tank should be measured. The tank should be pumped if the sludge is 12 inches or less to the outlet or the scum is closer than three inches to the outlet. Following pumping, tanks over 5,000 gallons should be inspected for leaks and cracks. The burden to complete this maintenance falls on the homeowner. Vermont code does not include an enforcement mechanism to address situations where maintenance requirements are not met, unless system failure results.

At least once a year, dosing tanks and distribution boxes should be opened and settled solids removed as necessary.

Vermont Code does not require management districts to monitor and maintain onsite systems or individual liquid waste systems. Periodic inspections are required by the state only for innovative systems or systems over 6,500 gallons per day (VT Ch. 1§ 1-514).

Septic System Failure

A failed system is one that is functioning in a manner that allows wastewater to be exposed to the open air, pool on the surface of the ground, discharge directly to surface water, or back up into a building or structure, unless these instances are approved in the design of the system. A system is also considered failed if it renders a potable water supply contaminated or presents a threat to human health (VT Ch. §1-201 (26)). Most failed systems are thought to be those that were not designed based on the current rules.

No funding program exists to assist homeowners either replacing failing systems or installing new ones, but legislation has been proposed. A State Revolving Fund may be available. Currently, there are no programs in Vermont that offer the homeowner insurance policies on the onsite systems (NESC 2001).

Septage Disposal

Of the nearly 22 million gallons of septage pumped annually in Vermont, more than half (59 percent) is transported to wastewater treatment facilities. The remaining 42 percent is land applied after being stabilized with lime. Septage is regulated under the state's Solid Waste Management Rules, which include provisions for land application, or "diffuse disposal." Land application is prohibited for food and food chain crops, and for non-food crops, application must include consideration of crop nutrient requirements and must meet soil pH requirements. Prior to application, all wastes must be sampled and analyzed for toxicity. In addition, the following restrictions apply:

- Provisions for controlling public access shall be established and maintained for the duration of disposal and for 12 months beyond the last disposal episode;

- Application is prohibited within the 100 year flood plain unless incorporated within 48 hours;
- Application is prohibited in a watershed for a Class A stream or stream segment;
- Application is prohibited when ground water is within three feet of the zone of incorporation;
- Application is prohibited in Class I and Class II ground water areas.

Appendix E

INFRASTRUCTURE FINANCING IN OTHER STATES

Note: Chapter 3 contains a summary of Georgia's infrastructure financing. Chapter 7 contains condensed forms of the following descriptions of programs in other states.

California

California's infrastructure financing programs are unique in the fact that they primarily rely on voter-approved state bond monies. The State Water Resources Control Boards' Division of Financial Assistance administers all of the programs. Several of the programs fund infrastructure as part of a broader nonpoint source pollution control program.

State Water Resources Control Board, Division of Financial Assistance

The Division of Financial Assistance (DFA) within the State Water Resources Control Boards administers financial assistance programs, which include loan and grant funding for construction of municipal sewage and water recycling facilities, remediation for underground storage tank releases, watershed protection projects, nonpoint source pollution control projects, etc. (SWRCB(a)).

Integrated Regional Water Management Grant Program

The Integrated Regional Water Management (IRWM) grant program, funded by Proposition 50, Chapter 8, will provide approximately \$380 million between 2005 and 2007 for competitive grants for projects to protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water. Funding for the program is administered jointly between the State Water Resources Control Board and the Department of Water Resources. Both planning and implementation grants are awarded (SWRCB(b)).

Small Community Wastewater Grant Program

The Small Community Wastewater Grant (SCWG) program, funded by Proposition 40 and Proposition 50, provides grant assistance for the construction of publicly owned wastewater treatment and collection facilities. Grants are available for small communities with financial hardships. Communities must have a population less than 20,000 and annual median household income of less than \$37,994 to qualify for funding under the program. Funding is provided only to local public agencies (SWRCB(c)).

State Revolving Fund Loan Program

The DFA administers the State Revolving Fund loan program, a low-interest loan program that funds construction of publicly-owned wastewater treatment facilities, local sewers, sewer interceptors, water reclamation facilities, as well as expanded use projects

such as implementation of nonpoint source projects or programs, development and implementation of estuary Comprehensive Conservation and Management Plans, and stormwater treatment. Currently, \$200-\$300 million is available annually, and funds come from federal appropriations, state funds, and revenue bond sale (SWRCB(d)).

Urban Stormwater Grant Program

The Urban Stormwater Grant Program, administered by the DFA, is under development. Funded by Proposition 40, it is estimated that the urban stormwater grant program will award up to \$14.25 annually to local public agencies for projects designed to implement stormwater pollution reduction and prevention programs. Eligible projects include those to divert dry weather flows to publicly owned treatment facilities, acquisition and development of constructed wetlands, and the implementation of approved stormwater BMPs (SWRCB(e)).

Florida

The bulk of Florida's infrastructure financing programs target rural and disadvantaged communities. Two semi-private entities, Enterprise Florida, Inc. and the Florida Rural Water Association, both administer loan and grant programs to communities on behalf of the state. The five regional water management districts are responsible for maintaining wastewater infrastructure in municipalities under their jurisdictions.

Enterprise Florida

Enterprise Florida, Inc. (EFI) is a public-private partnership responsible for leading Florida's statewide economic development efforts. The organization's mission is to diversify Florida's economy and create better paying jobs for its citizens by supporting, attracting and helping to create businesses in innovative, high-growth industries.

EFI administers the Rural Infrastructure Fund to facilitate the creation of rural economies. The program provides financial assistance that will enable rural communities to better access other infrastructure programs such as the USDA Rural Development and U.S. Department of Commerce-Economic Development Administration programs.

The Rural Community Development Revolving Loan Program, also administered by EFI, provides financial assistance to local governments in the form of either a loan or loan guarantee. The program's purpose is to provide financial assistance for a specific project that will lead to the creation of new jobs and increased economic vitality in rural Florida (FRWA 2006).

Florida Rural Water Association

The Florida Rural Water Association Loan Program was created to assist communities in obtaining financing for construction projects. The program provides a loan program for communities that have received a permanent loan commitment from the USDA Rural

Development or the Department of Environmental Protection's State Revolving Fund programs, yet still need construction funds (Ibid).

Disadvantaged Small Community Wastewater Grant Program

The Bureau of Water Facilities Funding implements this grant-in-aid program that assists small communities in planning, designing, and constructing wastewater management facilities. In order to participate, a community must have a maximum population of 7,500 and a per capita income below the Florida average. The program provides funding for new wastewater management facilities such as sewers, treatment plants, effluent disposal systems, and reclaimed water reuse facilities. The program also provides funding for the renovation of existing wastewater management facilities. A partial match of local funds is required.

The first grants were made available under this program during 2000. The top priority projects will involve the elimination of a public health hazard. Funding began at \$2.5 million in 2000 and is anticipated to grow to an annual availability of about \$10 million (Chapter 62-505, F.A.C., (FDEP(f)).

Federal Funds Available in Florida

Clean Water State Revolving Fund (CWSRF)

In Florida, CWSRF funds, which provide low-interest loans to local governments to plan, design, or build wastewater, stormwater, and nonpoint source pollution prevention projects, are made available by the Bureau of Water Facilities Funding within the Florida Department of Environmental Protection. It is by far Florida's largest financial assistance program for water infrastructure. The drinking water State Revolving Fund program is also implemented by the Bureau of Water Facilities Funding.

Community Development Block Grants

The Florida Department of Community Affairs administers the Small Cities Community Development Block Grant Program. About \$11 million is available annually for water and sewer projects, primarily benefiting low and moderate income persons. Approximately \$9 million in additional funds are also available annually for Economic Development water and wastewater projects required to serve a job-creating entity. The majority of jobs created must be for low and moderate income persons (FRWA 2006).

North Carolina

North Carolina has a relatively robust collection of financial programs. Many loan and grant programs are focused on North Carolina's rural communities, particularly those in the mountainous western part of the state. The Clean Water Management Trust Fund was created in 1996 by the General Assembly of North Carolina to make grants to local governments, state agencies, and conservation non-profits to help finance projects that

specifically address water pollution problems. Infrastructure projects are eligible for these funds. The North Carolina Rural Economic Development Center is a private, non-profit organization that administers three programs designed specifically to help rural communities develop the water and sewer systems they need to support local economic growth and ensure a reliable supply of clean water.

North Carolina Clean Water Management Trust Fund

Created in 1996 by the General Assembly of North Carolina (Article 18; Chapter 113A N.C.G.S.), the Clean Water Management Trust Fund makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems.

Over \$595.8 million have been appropriated by the General Assembly and those funds have leveraged an additional \$906 million in private and other public funds. Forty-four percent of these grants were made to municipalities, counties, or other local government agencies. Examples of projects funded include improvements to wastewater treatment and collection systems, stormwater management, repair of septic tanks and removal of straight-pipes, wetlands, riparian buffer, and stream restoration, acquisition of buffers and greenways, and agricultural BMPs. Wastewater and stormwater projects represent 29 percent of the total grants made (CWMTF).

North Carolina Revolving Loan and Grant Program

In 1987, the North Carolina General Assembly created the North Carolina Revolving Loan and Grant Program to provide state financing for the construction of wastewater facilities. Funding for this program is dependent upon legislative appropriations and may not be available at all times. The program is administered by the Construction Grants & Loans Section, a non-regulatory section that operates as both a financial and technical resource for publicly owned wastewater treatment facilities, with DENR.

As with the CWSRF program, eligible applicants are limited to units of local government who may apply for funding from any of three available funds:

4. Low Interest Revolving Loans at one-half (1/2) of the market rate for wastewater collection and treatment facilities for up to a maximum of twenty (20) years. (Maximum Loan Amount: \$8,000,000)
5. Low Interest Emergency Revolving Loans for certified water quality or public health emergencies associated with existing facilities.
6. High-Unit Cost Grants for up to \$3,000,000 per applicant over three fiscal years. These funds allow local governments to make projects more affordable by keeping user fees at a reasonable level (NCCGL).

The North Carolina Rural Economic Development Center

The North Carolina Rural Economic Development Center (REDC) is a private, non-profit organization, funded by both public and private sources and led by a 50-member board of directors. The mission of the REDC is to develop, promote, and implement sound economic strategies to improve the quality of life of rural North Carolinians. The center serves the state's 85 rural counties, with a special focus on communities with limited resources.

The REDC administers three programs, described below, that are specifically to help rural communities develop the water and sewer systems they need to support local economic growth and ensure a reliable supply of clean water. Local governments and non-profit organizations located in rural counties are eligible to apply.

- The Supplemental Grants Program: Local governments and qualified non-profit corporations may apply for funds to address public health, environmental, and/or economic development needs. The maximum grant amount for this program is now \$400,000.
- Capacity Building Grants Program: Local governments may apply for funds to undertake planning efforts that support strategic investments in water and sewer facilities. Funds typically are used to prepare preliminary engineering reports, master water/sewer plans, capital improvement plans, water/sewer feasibility studies, rate studies, and grant applications. The maximum grant amount for this program is generally \$40,000. This program is open to all counties.
- The Unsewered Communities Grants Program provides funding for the planning and construction of new central, publicly owned sewer systems. Qualified communities must be unserved by wastewater collection or treatment systems. Grants are designed to cover 90 percent of the total cost of a project, but will not exceed \$3 million.

Since the programs began in 1994, the Rural Center has awarded nearly 500 communities and counties more than \$64 million to plan, install, expand, and improve their water and sewer systems. The programs are made possible through appropriations from the North Carolina General Assembly and through proceeds from the Clean Water Bonds, approved by the voters of North Carolina in November 1998. (NCREDC).

Federal Funds Available in North Carolina

Clean Water State Revolving Fund (CWSRF)

The 1987 amendments to the Federal Clean Water Act replaced the Construction Grants program with the Clean Water State Revolving Fund Program (CWSRF). Under the CWSRF, Congress provides the states with grant funds to establish revolving loan

programs to assist in the funding of wastewater treatment facilities and projects associated with estuary and nonpoint source programs. The states are required to provide 20 percent matching funds. In North Carolina, these funds are made available to units of local government at one-half (1/2) of the market interest rate for a period of up to twenty (20) years. The actual term of the loan is determined by the State Treasurer's Office. The program is administered by the Construction Grants & Loans Section, a non-regulatory section that operates as both a financial and technical resource for publicly owned wastewater treatment facilities, with DENR (NCCGL).

Community Development Block Grants

The Division of Community Assistance (DCA) is a division of the North Carolina Department of Commerce. The Division provides assistance through the Small Cities Community Development Block Grant (CDBG) Program. The funding for this program is federally appropriated monies to the Department of Housing and Urban Development. The primary objective of the CDBG Program is the development of viable urban communities by providing decent housing, a suitable living environment, and expanding economic opportunities, principally for persons of low and moderate income. The program has an "infrastructure bias" toward water and wastewater projects (UNC).

USDA Rural Utilities Service - Water and Wastewater Loans and Grants

Funds are for community water, sewer, storm sewer, and solid waste. Loan and grant funds may be used to construct, repair, modify, expand or otherwise improve water supply and distribution systems. These funds are distributed through USDA offices throughout North Carolina (Ibid).

Clean Water Act Section 319 Grants

These grants are administered in North Carolina by the Division of Water Quality within DENR for projects that address nonpoint source pollution. Projects to repair failing septic or other onsite sewage treatment systems are eligible (NCDENR).

Ohio

Ohio's Water Pollution Control Loan Fund has been recognized by the US EPA for its innovation and effectiveness at achieving performance and protection through the Clean Water State Revolving Fund. Of particular note is the Ohio Environmental Protection Division's (Ohio EPA) Water Resource Restoration Sponsor Program. The program offers communities an interest rate reduction on their point source loan if they agree to sponsor a non-point source project. Many of these projects address infrastructure construction and repair. Other programs target Ohio's rural and low-income communities (USEPA 2005).

Water Pollution Control Loan Fund

The Water Pollution Control Loan Fund (WPCLF) provides below-market interest rate loans and technical assistance for a wide variety of projects to protect or improve the quality of Ohio's rivers, streams, lakes, and other water resources. Planning, design, and construction assistance is available for both public and private applicants. The program is administered by the Ohio EPA's Division of Environmental and Financial Assistance. The fund was created by the Ohio legislature in 1989 and is financed by federal State Revolving Funds.

WPCLF assistance is available for wastewater treatment projects such as wastewater treatment plant improvements or expansion; new or replacement sewers; facilities for unsewered areas; and combined sewer overflow correction. Projects fulfilling NPDES stormwater requirements for Phases I and II also qualify. Water quality-based activities to reduce or avoid nonpoint source water pollution including: agricultural or sivicultural BMPs, wellhead protection, landfill closure, stream corridor restoration, or hazardous waste cleanup (brownfields) are also qualified to receive funds.

In general, WPCLF loans for wastewater collection and treatment activities and stormwater activities are available to public entities such as villages, cities, counties, and sewer districts. Loans for nonpoint source are available to both public entities and private entities (e.g, non-profit organizations, private companies, individuals, etc.).

The "linked deposit" program of WPCLF is available to private organizations and individuals for nonpoint source projects such as agriculture best management practices, urban stormwater runoff control, stream corridor restoration, or home sewage treatment system replacements. What makes linked deposits different from a loan for nonpoint source activities is instead of borrowing directly from the WPCLF, a linked deposit loan is made to the applicant by a private lending institution at a below-market interest rate. The interest rate for the loan is supported by a WPCLF-funded certificate of deposit with the lender (OEPA(a))

The Water Resource Restoration Sponsor Program (WRRSP) provides an opportunity for WPCLF funding recipients to finance planning and implementation of additional projects that address nonpoint source pollution. The WRRSP offers communities very low interest rates on loans for wastewater treatment plant improvements if the communities also sponsor projects that protect or restore surface water resources. WPCLF recipients can initiate projects themselves or sponsor approved projects planned by another group, such as a land trust, park district or other entity with the ability to protect and manage such resources.

Since October 2000, the Ohio EPA has provided more than \$35 million to projects that have protected or restored approximately 38 miles of stream corridors and 4,000 acres of wetlands (USEPA 2006, OEPA(b)).

Village Capital Improvement Fund

The Village Capital Improvement Fund (VCIF) provides loans up to \$25,000 for planning and \$50,000 for the design of water supply and wastewater treatment projects. VCIF is administered jointly by Ohio EPA's Division of Environmental and Financial Assistance and the Ohio Water Development Authority (OWDA).

Projects for sewer systems include sewage disposal works, treatment plants and pumping stations. Water supply projects include wells, well-head protection, dams, reservoirs, intakes, water mains, pumping stations and purification works. Separate applications are required for wastewater and water supply loans as well as each planning phase. VCIF monies can be used for engineering plans, feasibility studies and legal costs incurred for planning phases of a project.

Only Ohio villages with a population of 500 or less or with a population over 500 and a median household income of \$37,134 or less are eligible to apply for VCIF. Villages applying for VCIF funds are prioritized by evaluating six socioeconomic indicators of need: median household income, unemployment rate, population change (1990-2000), income below poverty, children in poverty and senior citizens in poverty.

Repayment of VCIF loans must begin when permanent construction financing is in place, and in any event no later than two years after the initial planning or design loan is awarded. The first three years on annual repayments are interest-free and beginning with the fourth year, payments will include both principle and interest which accrues at an annual rate of 2.2 percent on the outstanding balance (OEPA(c)).

Local Economic Development Fund

The Ohio Department of Development recommends to the OWDA local governments in need of loans for water and wastewater projects based upon expected economic development benefits. The limit is a maximum of \$5,000,000 to any local government for any one project. Loans are funded by the OWDA revenue bonds surplus. The rate of interest is determined by the Ohio Department of Development.

Privately-owned facilities may be eligible for tax-exempt financing. OWDA approves issuance of private activity bonds for sewage facilities, solid waste facilities, facilities that furnish potable water, and facilities for the disposal of hazardous waste (OWDA 2006).

Community Assistance

Local government agencies may qualify for low-interest financing under the OWDA two-percent Community Assistance Loan Program. The program is designed to help communities maintain affordable water and wastewater rates. To be eligible, the project can be either a water or wastewater project causing an economic hardship to the community. A maximum of \$3,000,000 per project is the maximum loan available. To be eligible, communities should have a population under 5,000 or 2,000 residential users.

The projected annual cost per user must be above 1.1 percent of the community's median household income for drinking water projects, and above 1.5 percent of the community's median household income for wastewater projects (OEPA(b)).

Federal Funds Available in Ohio

Small Cities Community Development Block Grants

Small Cities Community Development Block Grants (CDBGs) are administered in Ohio by the Office of Housing and Community Partnerships in the Community Development Division of the Ohio Department of Development (OHEPA(b)).

Clean Water Act Section 319 Grants

The Division of Surface Water within OH EPA is the designated water quality agency in Ohio for administering the Section 319 Grants program (Ibid).

South Carolina

The only infrastructure financing program currently available in South Carolina relies on USEPA-funded State Clean Water Revolving Fund.

State Revolving Fund

Financing assistance for wastewater and drinking water infrastructure is limited to EPA-funded loans through the State Revolving Fund. Municipalities and counties can apply for low-interest loans offered by the state. The DHEC and the South Carolina Budget and Control Board share implementation duties for the program (SCDHEC(d)).

Wisconsin

Wisconsin's financing of wastewater treatment facilities shifted (by an act of legislature) in 1987 from grants to loans and placed an increased emphasis on preventive maintenance. Toward that end, the Wisconsin Clean Water Fund makes low interest loans and hardship grants to municipalities and counties. Wisconsin's Private Onsite Wastewater Treatment System (POWTS) Replacement or Rehabilitation Financial Assistance Program focuses funds on assisting homeowners in the repair or replacement of failing individual septic systems.

Clean Water Fund Program

The Bureau of Community Financial Assistance within the Wisconsin Department of Natural Resources makes low interest loans and hardship grants to municipalities, counties, sewerage districts, or tribes to construct or modify municipal wastewater systems or to construct urban stormwater BMPs. Enacted in 1987, Act 399 shifted Wisconsin's financing of wastewater treatment facilities from grants to loans and placed

an increased emphasis on preventative maintenance. The Clean Water Fund includes federal state revolving fund monies as well as state revenue bonds.

Currently, \$150 million is available annually for loans. In addition, \$6.5 million per year in hardship grants is available. Grants may be awarded up to 70 percent of total costs. To be eligible for a hardship grant, municipalities must have a median household income that is 80 percent or less of the state average, and the estimated residential user charge relating to wastewater treatment must exceed two percent of the median household income (WDNR(a)).

Private Onsite Wastewater Treatment System Replacement or Rehabilitation Financial Assistance Program

Since its inception in 1978, the Private Onsite Wastewater Treatment System (POWTS) Replacement or Rehabilitation Financial Assistance Program has awarded over \$77 million in grants for nearly 34,300 residences. Wisconsin counties, Indian tribes, and selected municipalities may apply to assist eligible owners in rehabilitating or replacing a failing system. Funds are appropriated by the state legislature. The Safety and Business (S&B) Division of the Department of Commerce works in conjunction with county government officials who assist individuals in eligibility considerations and preparation of grant applications. Eligibility depends on income, residence in an area not served by a municipal sewer system, and verification that the applicant has a failing system. A portion of the funds set aside for S&B to fund experimental POWTS, with the goal of identifying additional POWTS choices for people faced with replacement of their failing POWTS (WDOC).

State Trust Fund Loan Program

The Board of Commissioners of Public Lands and the Wisconsin DNR award low interest loans to any municipality for wastewater and stormwater BMPs. The state trust fund was originally derived from the sale of public lands granted to the state. The majority of the trust fund principal is invested in loans to Wisconsin school districts and municipalities (BCPL 2006).

Community Development Block Grants (CDBGs)

The Bureau of Community Finance within the Wisconsin Department of Commerce awards approximately \$4-5 million annually in CDBGs for public facilities grants to communities. Grants with a required match are made for the installation, upgrade or expansion of municipal drinking water and wastewater systems (WDNR(b)).

The Division of Housing & Community Development within the Department of Commerce administers the Small Cities CDBG program that provides grants to communities and zero-percent loans to homeowners for water and wastewater hookups or well and septic repair or replacement. Approximately \$6.5 million is available for this program annually in WI, with a limit of \$600,000 per community (WDNR(c)).