

INTRODUCTION

Water is an invaluable natural resource. It is used for drinking, irrigating, producing electricity, transporting merchandise and producing food. It also sustains many diverse and ecologically important species. North Carolina is blessed with many miles and acres of rivers, streams and estuaries. Federal, state and local governments, public and private landowners and local volunteer, civic and conservation groups are working every day to protect water across the state.

This document serves as the second edition to *A Citizen's Guide to Water Quality Management in North Carolina*. It is intended to provide general information about water quality issues in the State of North Carolina. It also provides program descriptions and identifies several best management practices (BMPs) that protect water quality. Information included in this document has historically been incorporated into the *Basinwide Water Quality Plans*, which are developed for each of the seventeen river basins on a five-year cycle.

The document is divided into twelve chapters, each with a different focus. Each chapter identifies a particular water quality issue and provides suggestions on how those issues can be addressed to avoid or minimize future degradation.

CHAPTER 1 – THE IMPORTANCE OF WATER QUALITY

The science of hydrology has evolved to help us understand the complex water systems of the Earth and help solve water quality and quantity problems. Hydrology evaluates the location, distribution, movement and properties of water and its relationship with its environment. We must understand all of the physical, chemical and biological processes involving water as it travels through the water cycle if we are to learn how to protect it. This chapter provides a brief overview of the hydrologic cycle, explores the importance of groundwater and surface water interactions, streamflow and human impacts on water quality and quantity.

CHAPTER 2 – HOW NORTH CAROLINA EVALUATES WATER QUALITY

Basinwide water quality planning is a non-regulatory, watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. This chapter provides an overview of the basinwide planning process and how North Carolina evaluates water quality. It defines water quality classifications, identifies water quality monitoring programs and explains how waters are listed on the State Impaired Waters List as required by Section 303(d) of the Clean Water Act.

CHAPTER 3 – WATER QUALITY STRESSORS

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. The many types of pollution generated by human activities may seem insignificant when viewed separately, but when taken as a whole, can be very stressful to aquatic ecosystems. Water quality stressors are identified when impacts have been noted to biological (benthic and fish) communities and/or water quality standards have been violated. This chapter provides an overview of how stressors are identified in a watershed, defines commonly identified stressors and reviews the water quality standards that can be listed as water quality stressors.

CHAPTER 4 – SOURCES OF WATER QUALITY STRESSORS

When evaluating water quality stressors, DWQ evaluates and identifies the source of the stressor as specifically as possible depending on the amount of information available for that particular watershed. Sources are most often associated with the predominant land use where the altered hydrology is able to easily deliver the water quality stressor to the waterbody. Construction, stormwater outfalls, agriculture and impervious surface are just a few of the sources that can be identified in any given watershed. This chapter provides an overview of point and nonpoint sources of pollution, identifies sources of nonpoint source (NPS) pollution and describes several state and federal programs that focus on reducing the impacts of pollution.

CHAPTER 5 – STORMWATER AND WATER QUALITY IMPACTS

Stormwater is the flow of water that results from precipitation and usually occurs immediately following a rainfall event or is produced during snowmelt. Common stormwater pollutants include sediment, nutrients, organic matter, bacteria, oil and grease, and toxic substances (i.e., metals, pesticides, herbicides, hydrocarbons). Stormwater can also impact the temperature of a surface waterbody, which can affect the water's ability to support healthy aquatic communities. This chapter provides an overview of stormwater runoff and its impacts to water quality. It also provides information related to state and federal regulations and management practices that can be employed to control stormwater from individual properties and large urbanized areas.

CHAPTER 6 – AGRICULTURE AND WATER QUALITY IMPACTS

Confined animal operations, grazing, plowing, stream access, pesticide spraying, fertilizing, planting and harvesting are all agricultural activities that may impact water quality. The major agricultural nonpoint source pollutants that result from these activities are sediment, nutrients, pathogens (i.e., bacteria), pesticide and salts. Agricultural activities can also damage habitat and stream channels. This chapter includes an overview of how agricultural activities can impact water quality, a summary of key legislative rules that effect animal operations throughout the State of North Carolina, how several federal and state agencies play an active role in protecting water quality, and how conservation and BMPs can protect water quality.

CHAPTER 7 – FORESTRY AND WATER QUALITY IMPACTS

Forests are an ideal land use for water quality protection because they stabilize soil and filter stormwater runoff from adjoining, non-forested areas. In order to sustain a forest's ability to protect water quality, some degree of management is often required. Timber harvesting is part of the forest renewal cycle and is usually the most intensive forest management activity that requires special attention to assure water quality is protected. Inappropriate management practices can impact water quality by destabilizing streambanks, reducing riparian vegetation and removing tree canopies. Any one of these impacts can alter the interface of the aquatic and terrestrial ecosystem, influence downstream flooding and change watershed functions. This chapter explores forestry in North Carolina. It includes information on forestland ownership, resources and management. It also includes information related to BMPs and forestry operations.

CHAPTER 8 – LAND-DISTURBING ACTIVITIES AND WATER QUALITY IMPACTS

Land-disturbing activities are often associated with road construction and maintenance, industrial, commercial and residential development and mining operations. All of these can be a

major source of pollution because of the cumulative number of acres disturbed at any given time. Even though such activities are short-lived and considered temporary sources of pollution, the impacts to water quality and overall stream function can be severe and long lasting. To avoid potential environmental and financial problems, it is essential to use the proper BMPs to control erosion and sedimentation. It is also imperative that the practices be maintained throughout the duration of the development or land-disturbing activity. This chapter provides an overview of land-disturbing activities and impacts to water quality. It includes definitions of erosion and sediment, reviews the role of state and local governments and provides a list of BMPs for controlling both sediment and erosion.

CHAPTER 9 – WASTEWATER DISPOSAL AND WATER QUALITY IMPACTS

Wastewater is used water. It includes substances such as human waste, food scraps, oils, soaps and chemicals from homes, businesses and industries. Effluent is the treated water discharged from wastewater treatment plants or other point source dischargers such as municipalities and manufacturing facilities. In order to protect water quality and aquatic life, wastewater treatment is subject to local, state and federal rules and regulations. This chapter provides an overview of the wastewater treatment process, identifies water quality impacts associated with wastewater discharge and reviews federal and state programs used to manage wastewater throughout the United States.

CHAPTER 10 – BACTERIA AND WATER QUALITY IMPACTS

Recreational waters, particularly coastal areas, are valued worldwide for their economic, ecological and cultural significance. Like many states, the livelihood of North Carolina communities that cater to water related activities can be severely impacted if bacteria levels are above the water quality standards. This chapter reviews how bacteria are used as a water quality indicator. It includes how bacteria can impact water quality, provides an overview of water quality standards for freshwater and saltwater and reviews BMPs and management strategies that can reduce bacteria numbers in waterbodies throughout the state.

CHAPTER 11 – NUTRIENTS AND WATER QUALITY IMPACTS

Nutrients refer to the elements phosphorus and nitrogen. Both are common components of fertilizers, animal and human wastes, vegetation, aquaculture and some industrial processes. Nutrients in surface waters come from both point and nonpoint sources including agricultural and urban runoff, wastewater treatment plants, forestry activities and atmospheric deposition. Nutrients in nonpoint source runoff come mostly from fertilizer and animal wastes. Nutrients in point source discharges typically come from human waste, food residues, cleaning agents and industrial processes. This chapter provides an overview of nutrients and how they can impact water quality, defines nutrient sensitive waters (NSW) and management strategies that have been adopted by the state to protect those waters, and reviews lake and estuary nutrient monitoring protocols and strategies.

CHAPTER 12 – PROTECTING WATER QUALITY

The future of our rivers, streams, wetlands and estuaries are closely linked to land use decisions made on both a public and private scale. Many of the areas are privately owned and it is the private landowner who can protect our waters through conservation and various management

options. This chapter explores various options for protecting water quality and includes information related to local initiatives, planning and funding opportunities.

Protecting water quality is not only healthy for the environment, it is can also lead to societal and economic benefits. By working with landowners, public and private entities and local volunteer, civic and conservation groups, a community can protect its waters from many of the issues identified in this document. Planning on a watershed scale provides a framework to restore impaired waters and protect water quality in healthy streams. Everyone is part of the problem. Everyone must be part of the solution.

DOCUMENT PREPARED BY:

Michelle Raquet
Melanie Williams
Darlene Kucken

CONTRIBUTORS FROM DWQ:

Chrystal Bartlett
Todd Bennett
Connie Brower
Alan Clark
Nora Deamer
Boyd Devine
John Huisman
Susan Massengale
Kim Nimmer
Debra Owen
Heather Patt
Gloria Putman
Dianne Reid
Thomas Slusser
Dave Toms
Bryn Tracy
Michael Tutwiler
Adriene Weaver
Susan Wilson
Chris Wu

ADDITIONAL CONTRIBUTORS:

Chuck Cranford
Tom Gerow
Terrell Jones
Jill Slankas