Revised Pasquotank Local Watershed Characterization Report

Prepared by

Decision Support Professionals, Inc.

And

The North Carolina Wetlands Restoration Program

December 2003

DSPRO

N.C. Wetlands Restoration Program
NCDENR

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TABLE OF CONTENTS

FIGURES - The figures listed in blue are seperate from report; click to view

TABLES

APPENDICES

1.0 Introduction

1.1 Introduction to Local Watershed Planning

The North Carolina Wetlands Restoration Program (NCWRP) is a non-regulatory, statewide program established to promote the restoration, enhancement, creation and preservation of wetlands, streams, and riparian areas throughout North Carolina. These activities are important for the improvement and protection of watershed functions including water quality, hydrology and habitat. The NCWRP works to identify project opportunities to address anticipated impacts through a process called Local Watershed Planning. Local Watershed Plans (LWPs) are designed to comprehensively identify watershed functional deficits as well as assets, along with solutions which have the highest potential to improve and protect watershed functions. The LWP is also designed to guide NCWRP restoration expenditures to ensure that restoration goals are achieved and measurable results are obtained.

Each river basin in the state is made up of smaller 14-digit hydrologic units, or component watersheds that together contribute to the overall watershed function of the basin. The NCWRP has targeted specific 14-digit hydrologic units, or Local Watersheds, within each of the 17 major river basins through Basinwide Watershed Restoration Planning. The Targeted Local Watersheds in these plans are selected based on their need for restoration (water quality, habitat, sensitive resources, and impact information) and the opportunity for restoration (based on land-use information). For more information about Targeted Local Watersheds and the NCWRP Watershed Restoration Plan for the Pasquotank River Basin, please visit the NCWRP website at http://h2o.enr.state.nc.us/wrp/index.htm.

The NCWRP has targeted Pasquotank River Local Watersheds for a Local Watershed Restoration Planning (LWRP) initiative. The Targeted Local Watersheds for this LWRP are 14-digit hydrologic units 03010205010020, 03010205050010, 03010205040010, herein referred to as the Pasquotank River Local Watershed Planning Area. This planning area is located in Pasquotank (including Elizabeth City), Camden, and Gates Counties within the Pasquotank River Basin. Figure 1 illustrates the watershed planning area. These smaller watersheds also make up Subbasin 50 of the Pasquotank River Basin (Pas 50), as defined by the North Carolina Division of Water Quality Basinwide Assessment Report for the Chowan and Pasquotank River Basins (NC DENR 2002).

The NCWRP is currently in the process of refocusing Local Watershed Restoration Plan (LWRP) development to reflect ecological enhancement based on functional need and opportunity. The LWRP identifies all factors contributing to watershed functions within subcatchments and provides multiple strategies to address the threats to those functions. The development of the LWRP from this perspective is important for watershed rehabilitation because wetland and riparian restoration projects alone cannot provide the level of functional improvement needed within a watershed. The strategies identified in the LWRP include not only wetlands, stream, and riparian buffer restoration projects, but also strategies that may be initiated through collaboration with other Local, State, and Federal programs as well as the private sector initiatives to enhance the success of any single strategy. This approach is also being embraced by certain regulatory programs, such as the US Army Corps of Engineers as articulated in Regulatory Guidance Letter 02-2 (Appendix A).

1.2 Functional Watershed Assessment and the Pasquotank River Local Watershed Planning Area

In an effort to provide higher quality, more cost-efficient, and sustainable strategies for local watershed restoration, the NCWRP is undertaking a functional assessment approach to achieve measurable results for the Pasquotank River Local Watershed Planning Area. This is possible because restoration and rehabilitation strategies can measurably affect a variety of functional aspects of the watershed.

The focus on watershed functional assessment defines watershed needs more specifically, leading to more specific watershed rehabilitation recommendations. This form of analysis considers the multi-facets of overall ecosystem health individually as well as for the watershed as a whole. This approach is being applied to the Pasquotank River Local Watershed Planning Area.

Literature, studies, and stakeholder input provide justification for watershed rehabilitation within the Pasquotank River Local Watershed Planning Area. Key findings demonstrating the need for watershed functional assessment and ultimately rehabilitation of degraded functions include:

- 42% of the streams within the watershed are unbuffered, with 7 of the 16 subcatchments having 50% or more of their streams unbuffered (Section 6.2).
- Because of extensive farming activities in the hydric soils of the watershed, prominent restoration areas exist which could reduce sediment and nutrient inputs and enhance water quality (Section 5.1).
- Algal blooms have been noted within some subcatchments, indicating nutrient inputs.
- All waters within Subbasin 50 are considered Impaired for the Fish Consumption Use Support Category (Section 7.2)
- The Pasquotank River Local Watershed Planning Area contains prohibited shellfish harvesting areas, however these areas are not rated as “Not Supporting” shellfish harvesting because the area does not support a commercially harvested shellfish species (Section 7.2 and 7.6).
- Development has reduced the stormwater storage capacity of several subcatchments in the watershed, but most notably in the subcatchments incorporating Elizabeth City (Section 8.1)
- Projected projects related to residential and commercial development and the NC Department of Transportation which could impact existing watershed functions within the Local Watershed Planning Area.
- Contains wetlands classified as Exceptional in NC-CREWS which merit protection, as well as some wetland areas rated Substantial and Beneficial ecological value which could merit enhancement and/or restoration (Section 5.1)
- Several Significant Natural Heritage Areas have been identified by the North Carolina Division of Parks and Recreation, NC Natural Heritage Program which should be protected (Section 5.6).
- Although Elizabeth City Stormwater Sampling did not use methodologies approved by the NC Division of Water Quality the data does reveal elevated levels of fecal coliform, nitrogen and phosphorous above the State Surface Water Standards (Section 7.5).
- A Greenway Study has been accomplished for Elizabeth City and has identified potential wildlife corridors, but the plan is currently unfunded (Section 8.1).
- The North Carolina Coastal Land Trust has completed *The Pasquotank River Riparian Corridor Conservation Design* and has identified the Pasquotank River as a prime opportunity for protection of riparian buffers (Section 8.2)

1.3 Pasquotank River Local Watershed Restoration Plan Organization

The Pasquotank River Local Watershed Restoration Plan (LWRP) embodies a functional assessment approach to achieve measurable strategies to improve and protect watershed functions including water quality, flood control, and wildlife and fisheries habitat. This is achieved by a series of interconnected reports accomplished by successive tasks, which allows for decisions to proceed with a finer degree of resolution (Figure 2).

Those steps and plan components are:

- **Watershed Characterization Report**
- **Functional Rehabilitation Model Report**
- **Functional Assessment Report**, and the
- **Restoration and Rehabilitation Opportunities Report**.

Collectively, these reports, along with an overall plan summary, will be the **Pasquotank River Local Watershed Restoration Plan**. Each report is described in further detail below.

The **Watershed Characterization Report** (WCR) is a general overview of conditions in the watershed and subcatchments. This report documents the existing condition of the watershed, need for restoration, goals for rehabilitation and/or restoration, and management strategies to achieve those goals. The report introduces the characteristics that make up the watershed and provides an overview of the general conditions including:

- Landuse/land cover
- Soils
- Hydrology
- Current water quality and biological sampling within the watershed and subcatchments
- Review of findings from studies related to water quality improvement
- Stakeholder issue identification and ranking
- Population and growth trends
- Natural resources inventories
- Watershed stressors
- Projected Impacts from Department of Transportation proposed projects

The broad goals and management strategies identified in this report are supported by local stakeholder input including ranking of functional significance and priorities for restoration and/or rehabilitation practices for each subcatchment and the watershed. The WCR is the basis for information that will be further analyzed in the **Functional Rehabilitation Model**.

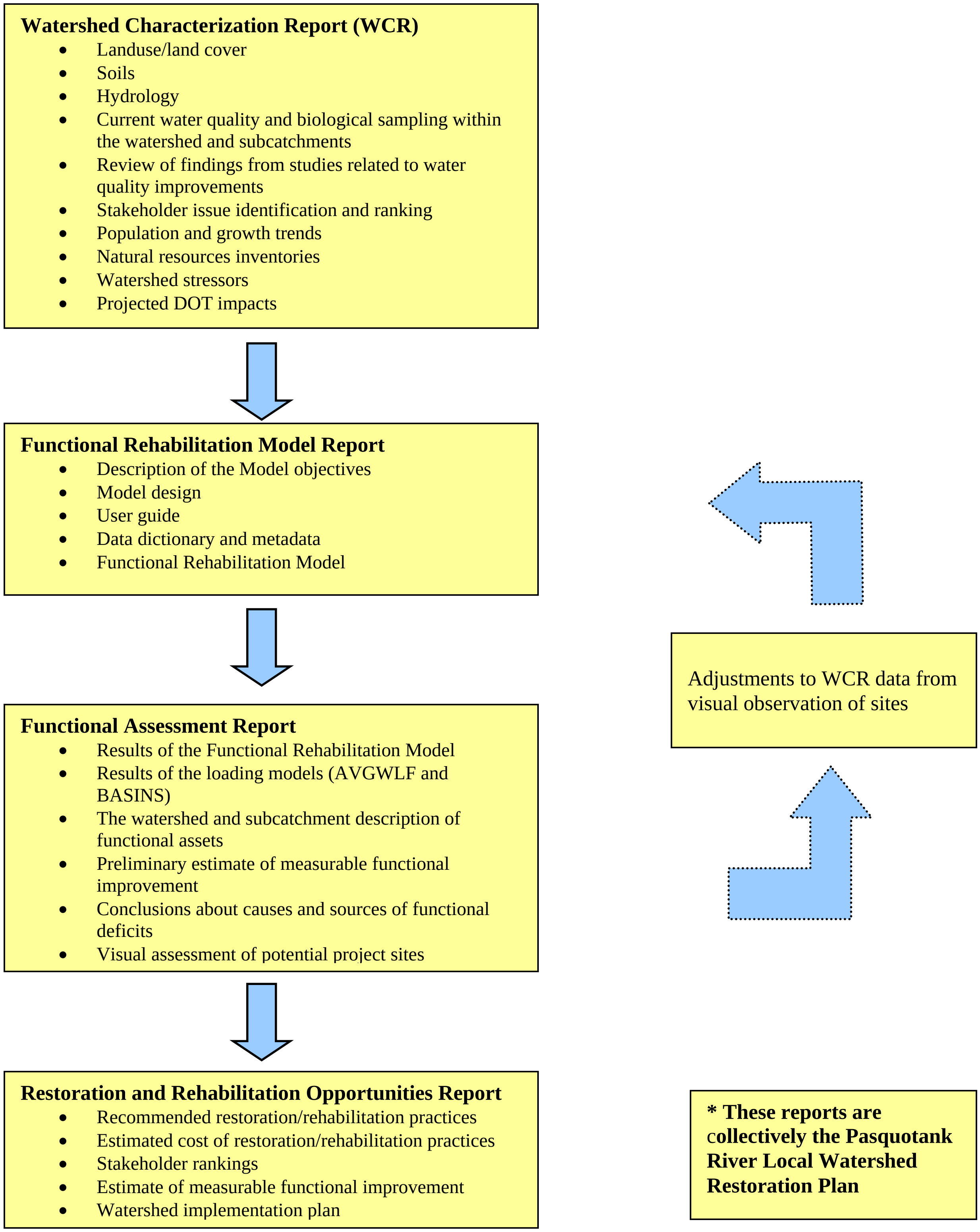


Figure 2: Pasquotank River Watershed Restoration Plan Organization

The **Functional Rehabilitation Model Report** creates a finer degree of resolution of the watershed condition and restoration/rehabilitation strategies by incorporating the data from the Watershed Characterization Report, watershed functional information from the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS), [Summary Appendix B], and other data into a decision support model (*CommunityViz*). The *CommunityViz* software uses the data handling and visualization capabilities of Geographic Information System (GIS) to model the potential impact of restoration and/or rehabilitation alternatives. This report includes:

- Description of Model objectives
- Model design
- User guide
- Data dictionary and metadata
- Functional Rehabilitation Model

The **Functional Assessment Report** analyzes functions within subcatchments of the Local Watershed Planning Area to more specifically determine the causes of functional degradation issues leading to the most appropriate solutions to address such issues. The report will also more specifically identify watershed asset areas which should be protected. The Functional Rehabilitation Model will also be a component of this report and will be used as a tool to identify degradation issues and solutions, yielding the greatest benefit for the watershed based on identified pollutant removal parameters. This report takes into consideration and documents:

- Results of the Functional Rehabilitation Model
- The results of the watershed loading modeling (AVGWLF and BASINS)
- The watershed and subcatchment description of functional assets
- Visual assessment of potential project sites
- Conclusions about causes and sources of functional deficits
- Preliminary estimate of measurable functional improvement

During the visual assessment of subcatchment areas identified by the Functional Rehabilitation Model, physical features are confirmed or adjusted to indicate the veracity of the model information. The Functional Assessment Report documents and analyzes adherence to stakeholder issue ranking and their recommended actions for restoration and/or rehabilitation.

The data from the three previous studies is further refined to create the **Restoration and Rehabilitation Opportunities Report**. This report identifies appropriate restoration/rehabilitation practices, which address Stakeholder priorities and provide measurable improvements to watershed function. This report includes:

- Recommended restoration/rehabilitation practices
- Estimated cost of restoration/rehabilitation practices
- Stakeholder rankings
- Estimate of measurable functional improvement
- Watershed implementation plan

As a part of this report, the opportunities for restoration and/or rehabilitation at each project site will be prioritized using the stakeholder ranking to create a plan for implementation in the watershed.

1.4 Pasquotank River Watershed Characterization Report Purpose

The Pasquotank River Watershed Characterization Report (WCR) is the first step in the watershed assessment process toward developing the Pasquotank River Local Watershed Restoration Plan.

The Watershed Characterization Report provides a description of existing watershed conditions and lays the groundwork for identifying potential opportunities to address degraded functions. The WCR includes information regarding trends in landuse, water quality degradation, and potential future impacts. The report also summarizes information concerning the results of other efforts applicable to the watershed area including: ongoing NC Division of Water Quality sampling programs, river basin modeling programs that are used to evaluate water quality management, and ecosystem restoration programs that will become part of the Pasquotank River Local Watershed Restoration Plan.

This final version of the WCR has been updated by Decision Support Professionals, Inc. (DSPro) and the NC Wetlands Restoration Program in December 2003. These updates were integrated into an existing draft Watershed Characterization Report completed by Landmark Design Group (Landmark) and CH2M HILL in July 2002. The updates reflect the approach that the NCWRP is undertaking to provide higher quality, more cost-efficient and sustainable strategies by utilizing a functional assessment approach to achieve measurable strategies for the watershed restoration plan.

1.5 Pasquotank River Watershed Characterization Report Organization

The Watershed Characterization begins with a discussion of the overall watershed conditions and then presents information regarding each delineated subcatchment. Based on the information developed and compiled for the document, the Watershed Characterization Report also provides subcatchment recommendations for watershed improvement projects. Key information the Watershed Characterization contains includes:

- General physical description which defines the limits of the study (the watershed boundaries)
- Landuse/land cover which assists in understanding potential causes of degradation and opportunities for rehabilitation
- Watershed soils defining the range of soils and their uses
- Watershed hydrology
- State designated uses, water quality and biological sampling data (including current water quality monitoring data collected specifically within the watershed and subcatchments)
- A summary of other initiatives and studies conducted within the watershed
- Specific comments from stakeholders of the Pasquotank Local Watershed Planning Team
- Demographics and infrastructure
- Natural resources inventories
- A summary of conditions for each of the subcatchments
- Analysis of need for restoration/rehabilitation
- Goals and Management Strategies for watershed and subcatchment rehabilitation
- Watershed stressors

The watershed characteristics are also provided as a series of data resources in a geospatial format developed using a geographic information system (GIS). Future data sets collected during the development of the Pasquotank River Local Watershed Restoration Plan will continue to enhance the overall knowledge of the conditions within the watershed.

2.0 General Physical Description / Location

2.1 Pasquotank River Local Watershed Planning Area Background

The Pasquotank Local Watershed Planning Area is located in the Coastal Plain of northeastern North Carolina and flows south-southeast from the Great Dismal Swamp in Virginia to the Albemarle Sound.

The Pasquotank River is a part of the larger Albemarle-Pamlico Estuarine System, the second largest estuarine system in the United States. The Pasquotank River drains portions of Suffolk and Chesapeake, Virginia, and is connected to Lake Drummond in southeast Virginia by means of the Great Dismal Swamp Canal. The Great Dismal Swamp comprises a large portion of the Pasquotank River headwaters. Forested swamp wetlands are also prominent along the main stem of the Pasquotank River. The watershed drops from an elevation of 5 feet above sea level near the Virginia State line to sea level at the mouth of the Pasquotank River.

The Local Watershed Planning Area is focused on watershed drainage within North Carolina and is 455 square miles in size. This includes 375 square miles of land and 80 square miles of open water within the Pasquotank River and the Albemarle Sound. An additional 180 square miles of land area drains to this watershed from Virginia making the total watershed area 635 square miles. The emphasis of this assessment and planning process is on the North Carolina portion of the Pasquotank River drainage.

2.2 Subcatchment Delineation

The Pasquotank River Local Watershed Planning Area was divided into 16 subcatchments, or subdrainages, for the purpose of assessment (Figure 3). The subcatchments were delineated utilizing LIDAR data and topographic data. All but two of these subcatchments capture local tributaries to the Pasquotank River. The Great Dismal Swamp Subcatchment includes the main stem of the Pasquotank River north of US-158. The Pasquotank River Subcatchment includes land area that drains directly to the main stem of the Pasquotank River or to unnamed minor tributaries. This study presents data for the watershed and for subcatchments. These subcatchments are listed and described in Table 1 and shown in Figure 3.

Table 1
Subcatchments and Descriptions

Subcatchment	Description
Great Dismal Swamp	This subcatchment is the northwest corner of the Local Watershed Planning Area and includes all of the Great Dismal Swamp State Park and the Great Dismal Park National Wildlife Preserve. All three Counties within the study are represented in this subcatchment.
Newland Drainage Canal	This subcatchment includes land south of NC 158 in the northwest corner of the Local Watershed Planning Area including portions of Pasquotank and Gates Counties. The Lynch's Corner community is located in this subcatchment.
Knobbs Creek	This subcatchment is centrally located in the Local Watershed Planning Area, and includes the northern half of Elizabeth City. The entire subcatchment is located within Pasquotank County. The suburbs of Elizabeth City are found in this subcatchment.
Charles Creek	This subcatchment includes the southern half of Elizabeth City just south of the Knobbs Creek subcatchment and is nearly completely developed. This is one of the smaller subcatchments by land area.
Newbegun Creek	This subcatchment is located in southern Pasquotank County. Farmland is prominent throughout this watershed. The community of Weeksville is included within this subcatchment.
Little Flatty Creek	Little Flatty Creek is the southern most subcatchment in Pasquotank County. This subcatchment includes the Little Flatty Natural Area.
Joyce Creek	This subcatchment is the northern most subcatchment in Camden County and includes the community of South Mills. The subcatchment includes the Green Sea Natural Heritage Area, which is an extensive wetland area.
Hales Lake	This subcatchment is located just south of Joyce Creek, and includes a large expanse of agricultural areas. The entire subcatchment is located within Camden County.
Cooper Creek	Cooper Creek is the smallest subcatchment defined in the Local Watershed Planning Area and is located entirely within Camden County. The Lambs Corner Community is located within this subcatchment.
Sawyers Creek	This subcatchment includes the communities of Camden, Belcross and Hastings Corner. This area contains the only active registered swine operation in the Local Watershed Planning Area.
Milldam Creek	Milldam Creek is a small watershed in Camden County, which contains a great deal of agricultural landuses.
Areneuse Creek	Areneuse Creek is located in southern Camden County.
Portohonto Creek	Portohonto Creek is a small subcatchment in southern Camden County.
Raymond Creek	Raymond Creek is a small watershed in southern Camden County.
Beaverdam Creek	Beaverdam Creek is one of the southernmost and smallest subcatchments in Camden County
Pasquotank	The Pasquotank subcatchment includes all lands within the Local Watershed Planning Area that do not drain to a named (on the USGS quadrangle mapping) tributary, but drain directly to the Pasquotank River. These lands contain all of the coastline development along the Pasquotank River, much of Elizabeth City and the southern most points in Camden County.

2.3 Local Governments

2.3.1 Counties - Camden, Pasquotank, and Gates

The Local Watershed Planning Area contains portions of Pasquotank, Camden, and Gates Counties. County boundaries are shown in Figure 1. The Local Watershed includes 165.5 square miles (54%) of Pasquotank County, 232.3 square miles (76%) of Camden County, and 56.7 square miles (16%) of Gates County. The county seats of Pasquotank and Camden Counties are located within the Local Watershed Planning Area (Elizabeth City and South Mills Township respectively), while the seat of Gates County is located outside of the Local Watershed in Gatesville. Census data are presented below in Table 2.

Table 2
Census data and Percent Increase from 1990 to 2000

Municipality	1990	2000	Increase
Elizabeth City	14,300	18,300	28%
Camden County	5,904	6,885	17%
Pasquotank County	31,298	34,897	11%
Gates County	9,305	10,516	13%

2.3.2 Cities - Elizabeth City

Elizabeth City is the only city within the Local Watershed Planning Area (Figure 4). The population of Elizabeth City is 18,300 according to the 2000 Census. Elizabeth City contains an area of 9.2 square miles and also maintains an area called the “extra territorial jurisdiction”, which is an additional 7.7 square miles. While the City does not provide services in their “extra territorial jurisdiction”, nor do those residents vote in City elections, this area is included as part of the Elizabeth City for zoning and administration.

2.4 Other Considerations

2.4.1 Coastal Area Management Act (CAMA)

Pasquotank, Camden, and Gates Counties are three of the 20 coastal counties in North Carolina that are regulated by the Coastal Area Management Act (CAMA). These “CAMA Counties” are required to develop local landuse plans in accordance with guidelines established by the Coastal Resources Commission (CRC). Once the landuse plans are certified by the CRC, the NC Division of Coastal Management (NCDCM) uses the plans in making CAMA permit decisions and federal consistency determinations. NCDCM carries out the state’s Coastal Area Management Act, Dredge and Fill law, and the federal Coastal Zone Management Act in the 20 Coastal Counties. Among the many functions of CAMA and the NCDCM, the most pertinent to this project are, the designation of Areas of Environmental Concern (AEC), and the oversight of landuse plan development. These regulations and requirements must be considered when working to address the Pasquotank River Local Watershed Planning Area.

2.4.2 Coastal Habitat Protection Plans

The Coastal Habitat Protection Plans (CHPPs) are being developed for the long- term enhancement of coastal fisheries through protection and heightened consideration of fish habitat in resource management decisions. Plan development is part of a cooperative effort among scientists from state agencies with jurisdiction over marine fisheries, water quality and coastal area management.

An overall plan, applying to the entire coastal area, is being developed first. It is based on the six basic habitats that support all of North Carolina's coastal fisheries resources: the Water Column, Shell Bottom, Submerged Aquatic Vegetation, Wetlands, Soft Bottoms, and Ocean Hard Bottom. For each habitat type, the initial CHPP will include a description of the habitat; its distribution, ecological role and function; status and trends; and threats. The plan will also recommend research needs and management actions to be taken by state regulatory agencies to protect and restore habitat. The regulatory agencies, which include the Marine Fisheries, Environmental Management and Coastal Resources commissions, are required to incorporate CHPP recommendations into their rulemaking processes. The CHPP will be finalized by December 2004, and then reviewed and updated every five years. A specific CHPP for the Albemarle Sound will be developed in the future, which will include the Pasquotank River Local Watershed Planning Area and the Pasquotank River Basin as a whole. For more information about this process and the CHPPs please visit: http://www.ncfisheries.net/habitat/chpp1.htm (information provided from NC Division of Marine Fisheries website).

2.5 Infrastructure

Major roads in the watershed include US 17, US 158, NC 343, and NC 34 as shown in Figure 4. The CSX railroad traverses the watershed as it runs from Hertford to Elizabeth City, to Moyock and then across the Virginia state line into Chesapeake. There is one municipal airport within the Local Watershed Planning Area southeast of Elizabeth City along the Pasquotank River at the U. S. Coast Guard Base. A helicopter pad is also located at the Albemarle Hospital north of the municipal airport. There are five marinas in the Local Watershed Planning Area, all near Elizabeth City, which include a yacht club and a shipyard.

There are two sewage treatment facilities in the watershed, the Elizabeth City Waste Water Treatment Plant in Elizabeth City, and the Waste Water Treatment Plant at the Pasquotank County Commerce Park (which includes the North Carolina Department of Commerce certified Mega Site within its service area). The service areas for these waste water treatment plants are shown (existing and proposed) in Figure 5. Several National Pollutant Discharge Elimination System (NPDES) permitted discharges (including the two waste water treatment plants) are located within the Local Watershed (Figure 5). Other than the two treatment plants, none of the other permitted point sources are significant in volume. NPDES sampling data is presented in Appendix C.

There are three potable water plants in the watershed area; Elizabeth City, Pasquotank County, and Camden County plants.

The Elizabeth City plant is currently producing 2.2 million gallons per day and is permitted to produce 5 million gallons per day. It currently is discharging 30,000 to 90,000 gallons per day of backwash indirectly into Knobbs Creek. The monthly discharge data is provided as Appendix D.

Pasquotank County produces potable water at their plant authorized for 2.7 million gallons per day. Current production is 1.2 million gallons per day resulting in a backwash discharge of 40,000 to 50,000 gallons per day. The backwash discharges to a lined lagoon, then to a series of canals and ditches which discharge into Newbegun Creek. The monthly discharge data is provided as Appendix E.

A reverse osmosis plant has been approved and constructed in Camden County to provide potable water service to the area. This plant is authorized to produce 720,000 gallons per day and is currently operating at 240,000 gallons per day. Current effluent monitoring results are included in Appendix F.

3.0 Landuse

3.1 Overview

Landuse data was collected for the entire Local Watershed Planning Area. Existing landuse plans were collected from the counties and Elizabeth City. Existing landuse data for Gates and Camden Counties was updated using aerial photography from 1998 and field verification. Additional aerial photography was accomplished for the area in 2003, but will not be available during the period of this study. Camden County is currently in the process of updating their landuse plan, however results from the revised plan will not be available during the duration of this project. Pasquotank County and Elizabeth City last updated their landuse plans in 1998 and 2002 respectively. The landuse data was considered recent and was not field verified.

The collected landuse data was standardized and separated into ten landuse designations. These categories are listed in Table 3 and depicted in Figure 6. Expanded descriptions of high and low intensity development landuse are included as Sections 3.2 and 3.3. More detailed discussions of row crops are described in Section 3.5, while wetlands and forested non-wetlands are further described in Section 5.1 and 5.2.

The acreage of each of the 10 landuse categories for all 16 subcatchments is provided in Table 4. The percentage of each subcatchment comprised of the landuse categories is included in Table 5. Landuse was then summarized using five general categories and is presented in Table 6.

Agricultural lands make up the greatest land area (41 %) of the Local Watershed. Other prominent landuses include forested wetlands (29 %) and forested non-wetlands (26 %) [Table 6]. Less than 1 % of the Local Watershed is non-forested wetlands and 3.4 % is developed (high-and-low-intensity combined).

Table 3
Landuse/Cover Classification and Descriptions

Landuse Designation	Description of Landuse and Derivation
Coniferous Woodland	These areas include forest lands, which were nearly completely coniferous forests as determined using infrared aerial photography.
Deciduous Woodland	These areas include forest lands, which were nearly completely deciduous forests as determined using infrared aerial photography.
Mixed Woodland	Any forested areas with a mix of coniferous and deciduous trees were included in this category. These areas made up a majority of the forested areas in the Local Watershed.
Woody Wetland	Wooded wetlands were determined using both NC Division of Coastal Management (NCDCM) wetlands mapping and infrared aerial photography. Any area that was included in the forestry cover and was also designated as a wetland on the NCDCM wetlands map was labeled as a wooded wetland.
Emergent Wetland	Emergent wetlands were determined using the NCDCM wetlands mapping and the infrared aerial photography. Any area that was indicated as a wetland on the NCDCM wetlands map and was not dominated by woody vegetation was determined to be emergent wetlands. These areas were then verified to be emergent wetlands by the DCM wetlands mapping.
Row Crops	Row crop is the designation used for agricultural land within the Local Watershed. Row crops were designated as any land that was set aside for agricultural practices.
Hay/Pasture	These areas were determined as areas, which had little vegetation and were not used for agricultural practices. This designation includes predominately parks and pastures.
Low-Intensity Developed	This designation includes all areas that are single residential housing. This data was provided by the Counties or Elizabeth City and field verified where appropriate.
High-Intensity Developed	These areas included high-density residential landuses including mobile home parks and apartment buildings, as well as industrial areas; churches; schools; and places of business.
Open Water	Open water areas included the main stem of the Pasquotank River, the Albemarle Sound, and open water areas, which were large enough to identify using the infrared photography.

3.2 High Intensity Development

Within the watershed area there are a total of 3,865 acres of high intensity development with the greatest density found in Elizabeth City. Ninety five percent (3,557 acres) of this acreage is located within Elizabeth City in the Knobbs Creek, Charles Creek and Pasquotank Subcatchments. The remainder of the Local Watershed Planning Area is rural with small areas of industrial and commercial landuses, schools, and churches.

Areas of future commercial development include the Tanglewood Mega Site, Pasquotank County Commerce Park, the South Mills-Camden corridor, and Elizabeth City.

Table 4

Landuse by Acreage for Each Subcatchment

	Subcatchment	Total	Coniferous Woodland	Deciduous Woodland	Mixed Woodland	Woody Wetlands	Emergent Wetlands	Row Crops	Hay/Pasture	Low-Intensity Developed	High-Intensity Developed	Water
1	Little Flatty Creek	3,520.5	0.0	0.0	968.3	1,011.0	22.7	1,306.8	0.0	80.6	0.0	131.0
2	Newbegun Creek	14,703.1	0.0	0.0	1,707.3	2,334.9	6.4	8,190.1	**1,288.0**	506.1	68.6	601.2
3	Charles Creek	2,104.1	0.0	0.0	152.3	155.2	0.3	742.5	0.0	107.6	594.2	0.0
4	Knobbs Creek	19,803.9	0.0	0.0	2,579.4	2,344.5	0.2	11,863.5	466.2	**1,432.4**	**1,092.6**	24.7
5	Newland Drainage Canal	29,884.6	830.2	0.0	11,571.2	2,240.8	9.9	**15,197.7**	0.0	33.6	0.0	0.9
6	Great Dismal Swamp	71,194.5	**4,865.3**	0.0	**18,317.6**	**34,960.3**	0.5	12,302.3	0.0	629.8	80.6	37.8
7	Joyce Creek	24,706.8	11.4	**154.1**	4,907.4	7,597.0	0.0	11,274.0	0.0	654.9	93.6	14.1
8	Hales Lake	17,492.4	26.8	8.9	6,160.3	2,754.0	1.9	8,259.3	0.0	226.4	50.2	4.0
9	Cooper Creek	1,005.0	0.0	0.0	90.6	198.3	0.0	687.7	0.0	28.1	0.0	0.0
10	Sawyers Creek	8,374.3	21.7	0.0	1,049.2	1,408.3	0.4	5,631.9	0.0	225.7	15.0	21.6
11	Milldam Creek	3,890.1	0.0	0.0	749.0	730.6	0.0	2,295.2	0.0	99.6	0.0	15.4
12	Areneuse Creek	4,210.6	0.0	0.0	665.6	468.8	0.5	2,910.9	0.0	164.5	0.0	0.0
13	Portohonto Creek	2,602.6	6.9	0.0	458.3	157.4	13.2	1,892.8	0.0	73.8	0.0	0.0
14	Raymond Creek	2,586.6	0.0	0.0	583.1	479.9	**68.1**	1,385.5	0.0	61.7	0.0	8.0
15	Beaverdam Creek	912.2	0.0	0.0	80.2	118.4	0.0	665.1	0.0	48.0	0.0	0.3
16	Pasquotank	84,127.6	46.9	3.2	6,130.4	13,032.7	65.3	10,491.8	382.3	1,857.2	1,870.3	**50,247.2**
Total	Local Watershed Area	291,119.7	5,809.4	166.2	56,171.3	69,992.8	189.9	95,098.1	2,488.3	6,230.8	3,865.5	51,106.9

Note: The largest number of each landuse is presented in boldface and underline.

Table 5

Landuse Distribution by Percentage of each Subcatchment

	Subcatchment	Coniferous Woodland	Deciduous Woodland	Mixed Woodland	Woody Wetlands	Emergent Wetlands	Row Crops	Hay/ Pasture	Low-Intensity Developed	High-Intensity Developed	Total Percent Impervious
1	Little Flatty Creek	0.0%	0.0%	27.5%	**28.7%**	0.6%	**37.1%**	0.0%	2.3%	0.0%	2%
2	Newbegun Creek	0.0%	0.0%	11.6%	**15.9%**	0.0%	**55.7%**	8.8%	3.4%	0.5%	2%
3	Charles Creek	0.0%	0.0%	7.2%	7.4%	0.0%	**35.3%**	0.0%	5.1%	**28.2%**	14%
4	Knobbs Creek	0.0%	0.0%	**13.0%**	11.8%	0.0%	**59.9%**	2.4%	7.2%	5.5%	5%
5	Newland Drainage Canal	2.8%	0.0%	**38.7%**	7.5%	0.0%	**50.9%**	0.0%	0.1%	0.0%	2%
6	Great Dismal Swamp	6.8%	0.0%	**25.7%**	**49.1%**	0.0%	17.3%	0.0%	0.9%	0.1%	2%
7	Joyce Creek	0.0%	0.6%	19.9%	**30.7%**	0.0%	**45.6%**	0.0%	2.7%	0.4%	2%
8	Hales Lake	0.2%	0.1%	**35.2%**	15.7%	0.0%	**47.2%**	0.0%	1.3%	0.3%	2%
9	Cooper Creek	0.0%	0.0%	9.0%	**19.7%**	0.0%	**68.4%**	0.0%	2.8%	0.0%	2%
10	Sawyers Creek	0.3%	0.0%	12.5%	**16.8%**	0.0%	**67.3%**	0.0%	2.7%	0.2%	2%
11	Milldam Creek	0.0%	0.0%	**19.3%**	18.8%	0.0%	**59.0%**	0.0%	2.6%	0.0%	2%
12	Areneuse Creek	0.0%	0.0%	**15.8%**	11.1%	0.0%	**69.1%**	0.0%	3.9%	0.0%	2%
13	Portohonto Creek	0.3%	0.0%	**17.6%**	6.0%	0.5%	**72.7%**	0.0%	2.8%	0.0%	2%
14	Raymond Creek	0.0%	0.0%	**22.5%**	18.6%	2.6%	**53.6%**	0.0%	2.4%	0.0%	2%
15	Beaverdam Creek	0.0%	0.0%	8.8%	**13.0%**	0.0%	**72.9%**	0.0%	5.3%	0.0%	2%
16	Pasquotank	0.1%	0.0%	7.3%	**15.5%**	0.1%	**12.5%**	0.5%	2.2%	2.2%	4%
Total	Local Watershed Area	2.0%	0.1%	19.3%	24.0%	0.1%	32.6%	0.9%	2.1%	1.3%	3%

Note: 1) The top two percentages for each subcatchment are presented in boldface.

Table 6

Generalized Landuse by Total Acres and Percentages, Excluding Open Water

	Subcatchment	Total	Forested Non-Wetlands (Acres)	Forested Wetlands (Acres)	Wetlands (Acres)	Agriculture (Acres)	Developed (Acres)	Forested Non-Wetlands (%)	Forested Wetlands (%)	Wetlands (%)	Agriculture (%)	Developed (%)
1	Little Flatty Creek	3,390	968	1,011	23	1,307	81	29%	30%	1%	39%	2%
2	Newbegun Creek	14,102	1,707	2,335	6	9,478	575	12%	17%	0%	67%	4%
3	Charles Creek	2,104	152	155	0	743	702	7%	7%	0%	35%	33%
4	Knobbs Creek	19,779	2,579	2,345	0	12,330	2,525	13%	12%	0%	62%	13%
5	Newland Drainage Canal	29,884	12,401	2,241	10	15,198	34	41%	7%	0%	51%	0%
6	Great Dismal Swamp	71,157	23,183	34,960	1	12,302	710	33%	49%	0%	17%	1%
7	Joyce Creek	24,693	5,073	7,597	0	11,274	749	21%	31%	0%	46%	3%
8	Hales Lake	17,488	6,196	2,754	2	8,259	277	35%	16%	0%	47%	2%
9	Cooper Creek	1,005	91	198	0	688	28	9%	20%	0%	68%	3%
10	Sawyers Creek	8,353	1,071	1,408	0	5,632	241	13%	17%	0%	67%	3%
11	Milldam Creek	3,875	749	731	0	2,295	100	19%	19%	0%	59%	3%
12	Areneuse Creek	4,211	666	469	1	2,911	165	16%	11%	0%	69%	4%
13	Portohonto Creek	2,603	465	157	13	1,893	74	18%	6%	1%	73%	3%
14	Raymond Creek	2,579	583	480	68	1,386	62	23%	19%	3%	54%	2%
15	Beaverdam Creek	912	80	118	0	665	48	9%	13%	0%	73%	5%
16	Pasquotank	33,880	6,181	13,033	65	10,874	3,728	18%	38%	0%	32%	11%
Total	Local Watershed Area	240,013	62,147	69,993	190	97,586	10,096	26%	29%	0%	41%	4%

3.3 Low Intensity Development

Low intensity development exists around Elizabeth City as well as along the roadway system in the rural portions of the watershed. There is a greater land area of low intensity development than high intensity development (6,230 acres and 3,865 acres respectively). The Knobbs Creek (1,432 acres) and Pasquotank (1,857 acres) Subcatchments have the greatest acreages of low intensity development. Low intensity development is also prominent in the Great Dismal Swamp (630 acres), and Joyce Creek (655 acres) Subcatchments. The Charles Creek Subcatchment contains 107 acres of low-intensity development.

3.4 Impervious Surfaces and Development

The location and extent of impervious areas are important when studying the effects of landuse on watershed functions. Landuse and percent impervious surface directly correlate with the amount of nonpoint source pollution received by surface waters. As landuse becomes more intensive, the proportion of land that is impervious (no longer allows water to percolate into the ground) increases, and pollutants suspended or dissolved in the water increases.

The percentage of impervious surface within a particular landuse type dictates the effect that storm water runoff will have on local water quality. Lands that have a low percent of impervious surface area will normally allow a greater amount of rainfall to infiltrate into the ground. Lands with a high proportion of impervious surface produce reduced groundwater infiltration and cause runoff to flow rapidly across the impervious surface while picking up pollutants. The rainwater then discharges to receiving waters with greater velocities and higher pollutant concentrations. These increased velocities and pollutant loads can further degrade stream channels and water quality conditions downstream.

The percent impervious area was estimated for high and low intensity development using values from the *Derivations of Impervious Cover for Suburban Land Uses in the Chesapeake Bay Watershed (CWP, 2000.)* All other percent impervious values were derived from *Urban Stormwater Pollutant Assessment Report prepared for the North Carolina Department of Environmental and Natural Resources (CH2M HILL, 2000).* High intensity development was considered to be 44% imperviousness and low intensity development was considered to be at 15% respectively (CWP, 2000). Percent impervious values for each subcatchment are included in Table 5.

The Charles Creek Subcatchment reported the highest percent imperviousness with 14 %. This is a consequence of this subcatchment containing much of Elizabeth City's high intensity development. The Newbegun Subcatchment is 6% impervious. Little Flatty and Knobbs Creek are both 5% impervious, while the remaining subcatchments are each approximately 2% impervious. Overall the basin is fairly undeveloped with 3.4% of the land area in either low or high intensity development, with an overall watershed imperviousness of 3%.

3.5 Agriculture

3.5.1 Crop Distribution

Figure 7 presents the location of agricultural lands within the Local Watershed Planning Area by subcatchment. Table 7 lists the major agricultural crops in the three counties of the watershed by acres of land dedicated to each crop and crop production (NCDA, 2001). The statistics listed include all lands within Camden, Gates, and Pasquotank Counties. The majority of the agriculture in the watershed is a three-stage cycle of corn, soybeans and wheat. With the three crop rotations, an acre of land may be represented up to three times. For example, an estimated 90,000 acres of land are used for agriculture in

Pasquotank County where 184,000 acres are represented in the table. Table 8 presents the percentage of acreage within each subcatchment used for the major crops. The distribution of crop type by subcatchment was developed through coordination with Mr. Freddie O'Neil and Mr. Al Wood of the North Carolina Cooperative Extension Service (personal communication, December, 2001).

The northern agricultural lands of Pasquotank County are mainly planted in corn, wheat, soybeans, and some cotton. The southern portion of Pasquotank County in the Newbegun Creek and Little Flatty Creek Subcatchments contains an estimated two-thirds corn, wheat, and soybean rotation; and one-third potatoes and cabbage. Cotton is represented sporadically throughout the County, with the exception of the Charles Creek, Newbegun Creek, and Little Flatty Creek Subcatchments where cotton represents less than 2% of the agricultural land.

Corn, soybeans, and wheat dominate the portion of Camden County in the Local Watershed Planning Area. The Hales Lake Subcatchment has an estimated 10% potatoes by acreage with the remainder being corn, soybeans, and wheat. The Raymond Creek and Beaverdam Creek Subcatchments contain an estimated 2% potatoes and 2% cotton with the remaining 96% being corn, soybeans, and wheat. Agricultural land located within Gates County (that is included in the Local Watershed Planning Area) is used to produce mainly corn, wheat, soybeans, and cotton. This information is incorporated in Table 8.

3.5.2 Agricultural Practices and Management Districts

Agricultural Best Management Practices (BMP's) in place within the watershed include water control structures, no till or reduced till practices, and soil testing prior to fertilizing to limit the total pounds of fertilizer applied. Reduced till practices are widespread in fields planted with corn, soybeans and wheat, while land used for potatoes and cabbage crops require full tillage. In addition, the Natural Resources Conservation Service has implemented limited nutrient management programs in the counties to integrate soil testing with fertilizer use to minimize overall fertilizer application.

3.5.3 Drainage Districts

The Newland Special Use Water Management District is located in Pasquotank County and is implementing a variety of drainage improvements intended to satisfy multiple objectives: improve drainage from fields for agricultural production, retain runoff in ditches and canals to reduce irrigation needs, and improve downstream water quality.

The Joyce Creek Water Management District is located in Camden County. Projects have included removal of snags and obstructions within drainage ways (personal communication, J.C. Roundtree, dated December 2001). The District also maintains a sediment trap located on Joyce Creek.

Table 7
Agricultural Statistics for Camden, Pasquotank, and Gates Counties (including areas outside of the target watershed)

Commodity		Camden	Pasquotank	Gates
Corn	Bushels	2,082,000	2,673,000	593,000
	Acres	15,900ac	18,500	5,350
Cotton	Bales	2,300	8,600	30,200
	Acres	1,500	5,600	21,600
Soybeans	Bushels	1,065,000	1,784,000	303,000
	Acres	25,500	45,100	9,500
Hay	Tons	N/A	N/A	1,400
	Acres	N/A	N/A	800
Oats	Bushels	N/A	27,000	N/A
	Acres	N/A	380	N/A
Peanuts	Pounds	N/A	294,000	20,291,000
	Acres	N/A	105	6,270
Potatoes	Hundred wt	619,000	801,500	N/A
	Acres	2,900	4,150	N/A
Sorghum	Production	N/A	164,400	N/A
	Acres	N/A	3,600	N/A
Sweet Potatoes	Hundred wt	N/A	N/A	N/A
	Acres	N/A	N/A	N/A
Wheat	Production	598,000	1,127,000	86,000
	Acres	11,900	25,500	1,800
Total Harvested	Acres	49,000	84,000	45,000
Cows	# On Farms	N/A	700	1,400
Hogs	# On Farms	4,600	N/A	30,000
Broilers produced	#	N/A	N/A	4,900,00

Table 8
Estimated Percentage of Acreage Used for Major Crops within Each Subcatchment

Subcatchment		Corn Soybeans and Wheat	Cotton	Cabbage	Potatoes
1	Little Flatty Creek	67		16	17
2	Newbegun Creek	67		16	17
3	Charles Creek	100			
4	Knobbs Creek	95	5		
5	Newland Drainage Canal	95	5		
6	Great Dismal Swamp	95	5		
7	Joyce Creek	100			
8	Hales Lake	90			10
9	Cooper Creek	100			
10	Sawyers Creek	98			2
11	Milldam Creek	98	2		
12	Areneuse Creek	98	2		
13	Portohonto Creek	98	2		
14	Raymond Creek	96	2		2
15	Beaverdam Creek	96	2		2

In Pasquotank and Camden Counties farmers are encouraged to use guidance from the 2002 North Carolina Agricultural Chemicals Manual. The suggested fertilizer application rates in this guidance are based on Realistic Yield Expected (RYE). Through interviews with local Extension Service agents it has been noted that local farmers use as little fertilizer as necessary to reduce costs (Personal communication, Freddie O'Neil and Al Wood, dated December 2001). Table 9 represents estimated total fertilizer use for each crop, as estimated by Extension Service agents. These estimates should be considered maximums as less fertilizer may be used when appropriate.

Table 9
Estimated Fertilization Practices

Crop	Description of fertilizing Practice	Total Application Weight per Crop
Corn	Normally two applications. Potash before planting and Nitrogen after planting	160 lbs of Nitrogen /acre Potash as needed after soil testing
Wheat	Two applications. Pre-plant and then top dress	120 lbs of Nitrogen /Acre
Soybeans	No fertilizing necessary as these crops are rotated with corn and wheat	None
Cotton	One application after planting	60 lbs of Nitrogen /Acre Potash as needed after soil testing
Cabbage	Preplant and Side Dress	Pre-Plant with an average of 1000 lbs. of 10-10-10 per acre. Side Dress with an Average of 200 lbs. Calcium Nitrate 17-0-0 per acre
Potatoes	One application after planting	150 lbs Nitrogen per acre 75 lbs Phosphorus per acre 150 lbs Potassium per acre

Table 10 presents estimates of fertilizer and pesticide application on a countywide basis. Estimates are presented for all of Pasquotank and Camden Counties, including county land outside the Local Watershed Planning Area. Estimates were taken from the *Pasquotank River Riparian Corridor Restoration Design* (2001), with application rates taken from the website of the North Carolina Department of Agriculture and Consumer Affairs. This data is provided to illustrate the magnitude of land applications associated with agricultural practices.

Table 10
Total Estimated Pesticide and Fertilizer use Camden and Pasquotank Counties for Soybeans, Corn, and Wheat.

Crop	Chief Pesticides Used			Fertilizer		
		Rate (lbs/acre/ crop year)	**Est. Annual Usage (lbs. used in counties)**		**Rate (lbs/acre/ crop year)**	**Est. Annual Usage (lbs. used in counties)**
Soybeans	Glyphosate	0.79	48,190 lbs.	Nitrogen	24	1,464,000 lbs.
	Pendimethalin	0.63	38,430 lbs	Phosphorus	74	4,514,000 lbs.
				Potassium	72	4,392,000 lbs.
Corn	Atrazine	1.29	42,957 lbs.	Nitrogen	123	4,095,900 lbs.
	Metolachlor	1.41	46,953 lbs.	Phosphorus	58	1,931,400 lbs.
	Terbufos	1.14	37,962 lbs.	Potassium	84	2,797,200 lbs.
	Glyphosate	0.53	17,649 lbs.			
Winter wheat	Thifensulfuron	0.02	726 lbs.	Nitrogen	124	4,501,200 lbs.
	Tribenuron	0.01	362 lbs.	Phosphorus	46	1,669,800 lbs.
				Potassium	76	2,578,800 lbs.

3.5.4 Livestock

Production of livestock as determined by the United States Department of Agriculture (USDA) in Gates, Pasquotank, and Camden Counties is listed in Table 7. Livestock production in the watershed was estimated using statistics from the USDA and GIS data collected by North Carolina Corporate Geographic Database and NC Division of Water Quality (NCDWQ). All registered intensive livestock operations are included.

The NCDWQ requires registration of intensive livestock operations if they are of a certain size and have a liquid waste management system. One registered swine operation was identified as operational in the Local Watershed Planning Area. This swine operation is located in the Sawyer’s Creek Subcatchment. The farm is designed to handle 2,235 swine with a steady state live weight of 145,800 lbs.

4.0 Soils

Soils data was collected and analyzed for the entire Local Watershed Planning Area. These soils are listed along with hydric status in Table 11. Hydric soils are classified by the National Technical Committee on Hydric Soils, and are of importance since wetlands are dependent on this soil type.

Table 11
Soils and Hydrologic Groups for the Pasquotank River Local Watershed

Soil Name	Hydric (Y/N)	Soil Name	Hydric (Y/N)	Soil Name	Hydric (Y/N)
ALAGA	N	WICHHAM	N	ICARIA	Y
AUGUSTA	N	ALTAVISTA	N	LENOIR	Y
BIDD	N	CRAVEN	N	LEON	Y
BONNEAU	N	EXUM	N	MUCKY PEAT	Y
BORROW	N	LYNCHBURG	N	NAWNEY	Y
CONETOE	N	SEABROOK	N	NIMO	Y
DRAGSTON	N	WAHEE	N	PANTEGO	Y
PACTOLUS	N	WANDO	N	PASQUOTANK	Y
TOMAHAWK	N	WINTON	N	PETTIGREW	Y
VALHALLA	N	ARAPAHOE	Y	PORTSMOUTH	Y
BOJAC	N	BALLAHACK	Y	PUNGO	Y
GOLDSBORO	N	BELHAVEN	Y	RAINS	Y
MUNDEN	N	BLADEN	Y	ROANOKE	Y
NOBOCO	N	CAPE FEAR	Y	TOMOTLEY	Y
STATE	N	CHOWAN	Y	WEEHAVILLA	Y
UDORTHENTS	N	DOROVAN	Y		

Total land area in the Pasquotank River Local Watershed Planning Area is 375 sq. mi. This is the total planning area less the 80 square miles of open water. Of this land area, 85% contains hydric soils (Table 12) equivalent to a total of 319 square miles of hydric soils within the watershed area. The majority of these hydric soils are found in forested areas (189 sq. mi.), although nearly one third are found in agricultural lands (116 sq miles). This indicates that wetland restoration opportunities are available within the watershed.

Table 12
Distribution of Hydric Soils by Landuse

		Hydric Soils		Non-Hydric Soils	
	Total Land Area	Total Square Miles	Percent of Total	Total Square Miles	Percent of Total
Agriculture	149	116	31	33	22
Forest	206	189	50	18	9
Developed	16	9	4	7	41
Other	5	5	<1	<1	<1
Total	375	319	85	56	15

Hydric soils by subcatchment are presented in Table 13. Percentage of hydric soils, by subcatchment, range from 63% in the Newbegun Subcatchment to 91% in the Little Flatty Creek, Newland Drainage Canal, and Hales Lake Subcatchments.

Table 13
Hydric Soils by Subcatchment

	Subcatchment	Total Area (Sq Miles)	Non-Hydric Soils (Sq Miles)	Percent Non-Hydric	Hydric Soils (Sq Miles)	Percent Hydric
1	Little Flatty Creek	6	1	9%	5	91%
2	Newbegun Creek	23	8	37%	15	63%
3	Charles Creek	3	1	28%	2	72%
4	Knobbs Creek	31	5	15%	26	85%
5	Newland Drainage Canal	47	4	9%	42	91%
6	Great Dismal Swamp	111	14	13%	97	87%
7	Joyce Creek	39	3	7%	36	93%
8	Hales Lake	27	3	9%	25	91%
9	Cooper Creek	2	0	14%	1	86%
10	Sawyers Creek	13	3	25%	10	75%
11	Milldam Creek	6	1	15%	5	85%
12	Areneuse Creek	7	2	23%	5	77%
13	Portohonto Creek	4	0	10%	4	90%
14	Raymond Creek	4	1	29%	3	71%
15	Beaverdam Creek	1	0	34%	1	66%
16	Pasquotank Subcatchment	51	10	19%	42	81%
	Total Land Area	375	56	15%	319	85%

Note: Calculations do not include the Main Stem of the Pasquotank River

5.0 Natural Lands

5.1 Wetlands

The majority of the wetlands in the Local Watershed Planning Area, based on the NC Division of Coastal Management (NCDCM) wetlands data, are wooded wetlands (24% of total watershed land area). The greatest density of wetlands exists in and around the Great Dismal Swamp in the northwest corner of the Local Watershed Planning Area. Significant tracts of forested wetlands also exist along the Pasquotank River and its tributaries.

Specific wetland types found within the Local Watershed Planning Area are listed below.

Wooded Wetlands

- Hardwood Flat
- Headwater Swamp
- Pine Flat
- Swamp Forest
- Bottomland Hardwood
- Pocosin

Emergent Wetlands

- Salt/Brackish Marsh
- Freshwater Marsh

Most of the wetlands identified in the NCDCM wetlands data are Swamp Forests, Hardwood Flats, Pine Flats and Managed Pine. Bottomland Hardwoods, Headwater Swamps, and Pocosins are present but represented a small portion of the existing wetlands in the watershed.

The NCDCM wetland classification system also utilizes modifiers to evaluate alteration of these habitats: Human Impacted Cleared, Cutover, or Drained. The definitions of these modifiers are presented below from the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS).

Human Impacted Wetlands **–** Areas of human impact have physically disturbed the wetland, but the area is still a wetland. Impoundments and some cutovers are included in this category, as well as other disturbed areas such as power lines.

Drained Wetlands **–** Any wetlands system described above that is, or has been, partially drained/ditched according to the U.S. Fish and Wildlife National Wetlands Inventory Maps.

Cleared Wetlands **–** Areas of hydric soils for which satellite imagery indicates a lack of vegetation in both 1988 and 1994. These areas are likely to no longer be wetlands.

Cutover wetlands - Areas for which satellite imagery indicates a lack of vegetation in 1994. These areas are likely to still be wetlands, however, but they have been recently cut (NCDCM, 1999).

Drained wetlands, as indicated by the NCDCM, were prominent within the local watershed planning area (41%), while cleared and cutover wetlands were far less frequent (1 and 2 % respectively). Drained wetlands may provide substantial wetland restoration potential within the watershed.

The NCDCM developed the Coastal Region Evaluation of Wetland Significance (NC-CREWS) for evaluating the ecological significance of wetlands within the state (NCDCM 1999). This data set evaluates various functional wetland values including nonpoint source, hydrology, habitat, and primary wetland functions. Through an analysis of these values, wetlands are classified into the three different Overall Wetland Rating System Categories: Exceptional (performs water quality hydrologic and/or wildlife habitat functions at well above normal levels), Substantial (performs three primary wetland functions at normal or slightly above normal levels), or Beneficial (performs three primary wetland functions at below normal levels, or in some cases not at all). Figure 8 depicts the wetlands of ecological significance as defined by NC-CREWS. This identification and ranking system of functions will be used in the Functional Rehabilitation Model (described in a subsequent report).

Within the Pasquotank River Local Watershed Planning Area the wetlands of Exceptional ecological significance were found mainly in the Great Dismal Swamp, northern Camden County, and along the main channel of the Pasquotank River. However wetlands of Exceptional ecological significance were found in every subcatchment.

Wetlands of Substantial ecological significance were found throughout the watershed with representative areas in each of the 16 subcatchments. However, wetlands of Substantial ecological value were concentrated in the Pasquotank, Newland, Great Dismal Swamp, Joyce Creek, and Hales Lake Subcatchments. Wetlands of Beneficial ecological significance were rare within the Pasquotank River Local Watershed Planning Area.

The NCDCM has also developed a data set of Potential Wetland Enhancement and Restoration Sites for the Coastal Plain of North Carolina (NCDCM, 2000). Potential restoration types were evaluated using soils data, Landsat data, and National Wetlands Inventory (NWI) data to prioritize restoration opportunities. Potential restoration areas were categorized first by the Wetland Enhancement and Restoration Category (WERC). These categories are listed below and depicted in Figure 9.

0. Not a potential enhancement or restoration type
1. Drained and Cleared (Generally prior converted farmland)
2. Drained and Cleared, NWI wetlands area which are ditched/drained and are cleared according to the landsat data
3. Drained and Cleared, NWI wetlands area which are not ditched/drained but are cleared according to the landsat data
4. Enhancement, NWI wetland areas which are ditched/drained according to NWI
5. Managed Pineland, site is currently in pine production
6. NWI impounded area
7. NWI excavated area
8. Enhancement; NWI upland areas on hydric soils which overlap areas containing ditches
9. Enhancement; NWI wetlands areas which overlap areas containing ditches.

Within the Local Watershed Planning Area the most prominent WERC ratings were Drained and Cleared categories 1 and 9. The Great Dismal Swamp Subcatchment and eastern Newland Subcatchment were mainly in category 1, while prominent areas of category 9 are found throughout the remainder of the watershed.

Potential restoration areas are also categorized by expected restoration type. The restoration types found in the Pasquotank River Watershed Planning Area include the following:

- ♦ Swamp Forest
- ♦ Bottomland Hardwood/Headwater
- ♦ Wet Flat
- ♦ Pocosin

Swamp Forest and Wet Flat potential restoration sites were the most prominent in the Pasquotank Local Watershed Planning Area. Swamp Wetland potential restoration sites were found primarily in the Great Dismal Swamp Subcatchment, eastern Newland Subcatchment and eastern Knobbs Creek Subcatchment. Wet Flat potential restoration sites were found throughout the watershed with the exception of the Great Dismal Swamp Subcatchment. Bottomland Hardwood/Headwater Swamp potential restoration sites were found in southern Pasquotank County in the Newbegun Creek Subcatchment and Little Flatty Subcatchment. Some potential pocosin restoration sites were identified in the Hales Lake Subcatchment. Figure 10 illustrates the potential restoration types found in the Pasquotank River Watershed Planning Area.

The US Forest Service Publication *Forest Statistics for the Northern Coastal Plain of North Carolina* (Thompson, 1990) indicates that bottom-land forests (a type of wooded wetland) makes up 41% of the forest land in Camden, Gates, and Pasquotank Counties. The prevalent forested wetland type is the Oak-Gum-Cypress Forest Type and is described below (Thompson, 1990). Loblolly pine stands are also found in wetland areas, yet can also be found in non-wetland areas (See community discussion in forested Non-wetlands section).

> <u>Oak-Gum-Cypress Forest Type</u>- Bottom-Land Wetland Forests in which tupelo, black gum, oaks, or southern cypress, individually or in combination, constitute a plurality of the stocking, except where pines account for 25-50 percent, in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Emergent wetlands account for less than one percent of the Local Watershed Planning Area, and are typically located along the Pasquotank River with significant communities in the Raymond Creek, and Little Flatty Creek Subcatchments. The Potential Wetland Restoration and Enhancement coverages of the NCDCM showed no potential emergent wetland restoration areas.

5.2 Forested Non-Wetlands

Forested non-wetlands in the Local Watershed Planning Area represent 26% of the watershed by area and are distributed fairly evenly throughout. Statistics from the US Forest Service Publication's *Forest Statistics for the Northern Coastal Plain of North Carolina* (Thompson, 1990) were reviewed for data pertaining to Camden, Gates, and Pasquotank Counties. The publication indicates that non-wetland forest types in Camden, Gates, and Pasquotank Counties include the Oak-Hickory (21%) and Loblolly Shortleaf Forest Types (27%). Definitions of the prevalent forest types as described by the Forest Service are listed below (Thompson, 1990).

> <u>Oak-Hickory Forest Type</u>- Forests in which hardwoods (usually upland oaks) constitute a plurality of the stocking, except where pines account for 25 to 50 percent, in which case the stand would be classified as oak pine. Common associates include yellow poplar, elm, maple, and black walnut.

Loblolly Shortleaf Forest Type- Forests in which loblolly pine, shortleaf pine, or other southern yellow pines, except longleaf or slash pine, singly or in combination, constitutes a plurality of the stocking. Common associates include oak, hickory, and gum.

As reported in 1990, farmers or private individuals own the majority of the harvestable-forested lands within the three-county area. A new report will be issued later this year.

5.3 Federal Lands

The Great Dismal Swamp National Wildlife Refuge is located in northern Pasquotank County, northwest Camden County and northeast Gates County. This National Wildlife Refuge is located in both North Carolina and Virginia and contains approximately 24,600 acres of preserved wooded wetland. Significant features of the Refuge include several extensive stands of Atlantic White Cedar (*Chamaecyparis thoides*).

5.4 State Lands

The Great Dismal Swamp State Park is approximately 134,500 acres of forested wetlands in northwestern Camden County. The park has no facilities and is undeveloped. Significant features of the Park include a 300-acre stand of mature Atlantic White Cedar, and several hundred acres of pocosin vegetation, uncommon north of the Albemarle Sound.

5.5 Parks-Active Use

Major parks with active uses (playfields, golf etc.) within the Local Watershed Planning Area are mainly limited to Elizabeth City. These parks include two golf courses (Pine Lakes Country Club and the golf course at Knobbs Creek Park), a baseball complex (Camden Baseball fields), Boatramp Park at Camden, Waterfront Park on the Pasquotank River and Charles Creek Park at the mouth of Charles Creek.

5.6 Significant Natural Heritage Areas

The North Carolina Division of Parks and Recreation, Natural Heritage Program has defined a series of five Natural Heritage Areas of Significance within the Local Watershed. These areas were identified and described by the NC Natural Heritage Program as part of the Albemarle-Pamlico Estuarine Study. These areas were chosen "because of their ecological significance, in terms of quality and integrity of the natural communities, the population size and condition of features." These areas include the Great Dismal Swamp, the Green Sea, the Shipyard Landing Natural Area, Whitehall Shores Hardwood Forest, the Little Flatty Creek Forests and Marsh (Figure 11). With the exception of the Great Dismal Swamp National Wildlife Refuge and State Park, these areas are privately owned and are not protected from development. The *Pasquotank River Riparian Corridor Conservation Design* integrates the Significant Natural Heritage Areas, Federal lands, and wetlands within the 100-year floodplain to identify conservation areas along the main channel of the Pasquotank River (NCLT 2001).

6.0 Hydrology

The Local Watershed Planning Area's plumbing is centered around the Pasquotank River. The watershed area drains a 635 square miles and is located predominately within the State of North Carolina (455 square miles) and an estimated 180 additional square miles drain into the basin from Virginia. There is little topographic relief throughout the watershed.

6.1 Federal Emergency Management Agency Floodplains

Review of the Federal Emergency Management Agency (FEMA) floodplain maps indicate that there is no current 10 year flood plain data available for the Local Watershed Planning Area. FEMA Flood Insurance Rate Maps (FIRMs) for the three counties that encompass the Pasquotank River Local Planning Area can be found in Appendix G and are also available at www.ncfloodmaps.com. The FEMA 100-year floodplain maps for the Local Watershed indicate that a large portion of Elizabeth City is located within the 100-year flood plain. The 100-year flood plain is expansive throughout the following areas:

- Lower portions of Charles and Knobbs Creeks in Elizabeth City
- The entire Great Dismal Swamp
- A large portion of Weeksville near Newbegun Creek
- The area along Small Drive at the mouth of Newbegun Creek
- The Little Flatty Subcatchment
- The area surrounding the confluence of Joyce Creek
- Sawyers Creek west and south west of the intersection of SR 34 and 158
- The majority of the Raymond Creek Subcatchment and south to the Albemarle Sound
- Low lands along all streams and the Pasquotank River

Flooding issues can be widespread in the Local Watershed Planning Area. With little topographic relief, the capacity of receiving waters is limited. The extensive acreage of hydric soils within the watershed indicates that soils typically do not drain quickly. Flooding may occur due to heavy rains, and/or heavy winds combined with tidal influences. Particular flooding issues have been addressed formally by Elizabeth City due to the number of properties affected by flooding events. Flooding issues in Elizabeth City are discussed in more detail as part of Section 8.1.

The North Carolina Cooperating Technical State Flood Mapping Program revealed limitation in North Carolina's Flood Insurance Rate Maps (FIRMs) as a result of Hurricane Floyd. There was a need to update flood data using more precise methods. To address this issue, digital FIRMs were developed, which allows analysis by GIS technologies and on-line distribution. The digital FIRMs were created by overlaying base maps with precise digital topography (Light Detection and Ranging, LIDAR) and flood data (North Carolina Flood Mapping Program www.ncfloodmaps.com) The maps were field verified and represent consistent reliable data (Appendix G). Areas within the Pasquotank River watershed to be studied in detail are:

- 7.6 miles of Joyce Creek and Joyce Creek tributaries
- 4.1 miles of Pasquotank River
- 3.4 miles of Knobbs Creek
- 4.4 miles of Folly Swamp in Gates County

The re-delineation will exclude:

- All areas currently shown as Zone A1-30/AE or V1-30/VE
    - Zone A1-30/AE – Flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations (BFE) derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.
    - Zone V1-30/VE – Flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. In Zone V,

approximate hydraulic analyses are performed and no BFEs are shown within this zone. For Zone VE, Base Flood Elevations (BFEs) are shown at selected intervals derived from detailed hydraulic analyses. Mandatory flood insurance purchase requirements apply.

- All areas shown as Zone A will not be studied in detail
  - Zone A – Flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.
- FIRM data will not be used to update base maps for any communities in the Pasquotank River Basin

The LIDAR topographic information will be incorporated in the Pasquotank River Watershed Functional Rehabilitation Model and used to calculate slope.

6.2 Streams Characteristics

Stream lengths and the prevalence of riparian buffers were analyzed using a combination of the U.S. Geological Survey (USGS) 1:24,000 hydrology GIS coverages, infrared aerial photography, and ground truthing. Total stream lengths and lengths of un-buffered streams were calculated for the entire Local Watershed Planning Area and within each subcatchment. Buffered and unbuffered streams were determined by review of aerial photography. Streams were identified as buffered if the stream had vegetation surrounding the stream. A stream with adjoining vegetation 50 feet in width or greater was considered a buffered stream. A vegetative buffer of less than 50 feet was considered unbuffered. A review of the aerial photography indicated that most streams within the Local Watershed Planning Area either had an extensive forested buffer far in excess of the 50 foot width, or no buffer at all. Many streams running through agricultural areas have cleared banks. Buffered and un-buffered streams in the watershed are illustrated in Figure 12.

Of the 882 miles of streams in the Local Watershed Planning Area, 374 miles (42 %) are unbuffered and 508 miles (58 %) are buffered (Table 14). Agricultural lands contained 209 miles (55 %) of all unbuffered streams. The Great Dismal Swamp Subcatchment has the greatest number of total stream miles with 168 miles of stream (Table 14). Cooper Creek has the fewest stream miles with 5.3 miles of stream identified within the subcatchment. Subcatchments with the greatest number of buffered stream miles included the Great Dismal Swamp (131 miles), the Pasquotank (87.5 miles), and Newbegun Creek (49.8 miles). Subcatchments with the greatest length of unbuffered streams include Newland Drainage Canal (63.4 miles), Newbegun Creek (53.9 miles), and the Pasquotank Subcatchments (64.1 miles).

Seven of 16 subcatchments have 50% or more of their streams unbuffered. Thirteen of 16 subcatchments have 40% or more of their streams unbuffered. Subcatchments with the highest percentage of unbuffered streams include Cooper Creek (77%), Charles Creek (67%), and Beaverdam Creek (63%). Subcatchments with the highest percentage of buffered streams include the Great Dismal Swamp Subcatchment (78%), Raymond Creek (75%), and Little Flatty Creek (60%).

Table 14
Total, Buffered, and Unbuffered Stream Lengths by Subcatchment.

	Subcatchment	Streams with Buffers (miles)	Streams with out buffers (miles)	Streams Total (miles)	Percent with Buffers	Percent with out Buffers
1	Little Flatty Creek	16.7	11.2	27.9	60%	40%
2	Newbegun Creek	49.8	53.9	103.7	48%	52%
3	Charles Creek	3.8	7.8	11.6	33%	67%
4	Knobbs Creek	35.7	15.0	50.7	70%	30%
5	Newland Drainage Canal	46.5	63.4	109.9	42%	58%
6	Great Dismal Swamp	131.0	37.6	168.6	78%	22%
7	Joyce Creek	37.4	31.0	68.4	55%	45%
8	Hales Creek	29.2	23.5	52.7	55%	45%
9	Cooper Creek	1.2	4.1	5.3	23%	77%
10	Sawyers Creek	28.9	23.2	52.2	55%	45%
11	Milldam Creek	12.1	9.6	21.7	56%	44%
12	Areneuse Creek	12.2	13.4	25.6	48%	52%
13	Portohonto Creek	6.3	9.5	15.8	40%	60%
14	Raymond Creek	7.3	2.5	9.8	75%	25%
15	Beaverdam Creek	2.4	4.2	6.7	37%	63%
16	Pasquotank Subcatchment	87.5	64.1	151.6	58%	42%
Total	Local Watershed Area Total	508.1	374.0	882.1	58%	42%

United States Geological Survey (USGS) topographic maps are used to broadly delineate perennial streams by the NCDWQ and the NCDCM. These streams are identified as "blue lines" and channelized streams are frequently recognized by long, straight, blue line segments. Although topographic map blue lines are cartographic generalizations that portray a stream network using the cartographer's subjective judgment, these depictions will be used in the Pasquotank River Watershed Functional Rehabilitation Model to identify potential restoration/rehabilitation sites. Site assessments of these streams will result in determinations of whether these depictions are accurate.

As previously mentioned in Section 3.5.3, there are two Water Management Districts in the watershed; Newland Special Use Water Management District and Joyce Creek Water Management District. These water management districts are intended to improve drainage from agricultural fields and retain runoff to reduce irrigation needs. Water Management Districts are often associated with channelized, unbuffered portions of streams.

7.0 Water Quality Data and Other Related Information

7.1 Basinwide Assessment Report and Basinwide Water Quality Plan

NC Division of Water Quality has published the *Basinwide Assessment Report for the Chowan and Pasquotank River Basins* (NCDENR, 2002 see http://www.esb.enr.state.nc.us/bar.html) and the *Pasquotank River Basinwide Water Quality Management Plan* (http://h2o.enr.state.nc.us/basinwide/Pasquotank/2002/2002_plan.htm) which both discuss the Local Watershed Planning Area, known as Subbasin 50 in these documents. The Basinwide Assessment Report includes data collected for benthic macroinvertebrates, fish, and whole effluent toxicity. The Basinwide

Water Quality Management Plan contains information about basin water quality conditions, use support ratings and stream designations.

The NC DWQ conducted preliminary benthic macroinvertebrate sampling in the Pasquotank River during 2000 to assess the potential for water quality problems within the basin, as part of the previously mentioned Basinwide Assessment Report. Benthic macroinvertebrate sampling was found to be fairly ineffective in identifying water quality problems due to the influence of Swamp Water in the watershed. Naturally occurring Swamp Waters normally have a low pH and low dissolved oxygen which is characteristic of waters within this basin. Benthic macroinvertebrate sampling yielded little information since few species can tolerate the low pH and low dissolved oxygen conditions typical of Swamp Waters. Reference sites established in other coastal basins could not be used to set criteria in the Pasquotank River Basin.

Although the results were limited, the study described water quality in the Sawyers Creek Subcatchment as “best” water quality, the Areneuse Subcatchments as “worst” and water quality in Newbegun Subcatchment as “moderate.” One algal bloom was reported within the last five years within the Areneuse Creek and Newbegun Creek Subcatchments.

7.2 Designated Uses and Water Quality Classification

Designated uses in the Local Watershed Planning Area range from Class C Waters to Water Supply Waters. Designated uses and descriptions are listed in Table 15 (NCCGIA, 2001 and NCDWQ, 2000). A total of 51.8 miles of streams in the watershed have been assigned designated uses. Seventy percent of classified streams possess the Swamp Water designation modifier (SW). Ten percent of the Swamp Water streams are associated with areas designated for possible potable water supply usage. The remaining balance of Swamp Waters is designated for secondary recreation (C). Water Supply (WS) waters make up 16% of the designated streams (WS-IV, WS-IV Sw, and WS-V Sw), and Tidal Salt waters make up 19% of the designated streams in the Local Watershed Planning Area (SB and SC). NC Division of Water Quality’s *Pasquotank River Basinwide Water Quality Management Plan* identifies streams within the Local Watershed Planning Area as “Fully Supporting” their designated uses or as “Not Rated.” Table 16 depicts the Use Support Ratings for the Local Watershed Planning Area / Subbasin 50.

Table 15
Designated Uses and Descriptions

Designated Uses	Description of Designated Uses	Percent in Watershed
C	Fresh surface waters reserved for Secondary Recreation (Activities which involve incidental or infrequent contact with the body), fishing, wildlife, fish, aquatic life propagation and survival, agriculture.	4%
C Sw	Class C waters which occur in natural swamp areas where Dissolved Oxygen and pH may be naturally less than typical water quality standards.	60%
SB	Tidal salt waters reserved for Primary Recreation, Secondary Recreation.	7%
SC	Tidal salt waters reserved for secondary recreation, aquatic life propagation, and survival, and wildlife.	12%
WS-IV	Waters used as sources of potable water, occurring in moderately to highly developed watersheds or protected areas.	6%
WS-IV Sw	Class WS-VI waters which occur in natural swamp areas where Dissolved Oxygen and pH may be naturally less than typical water quality standards.	2%
WS-V Sw	Swamp waters protected as water supplies, which are upstream of WS-IV waters, or waters formerly used as water supply.	8%

Table 16
Use Support Ratings for Subbasin 50

Category	Use Support Ratings for Subbasin 50				Total
	Fully Supporting	Partially Supporting	Not Supporting	Not Rated	
Aquatic Life/Secondary Recreation Use Support Ratings Monitored, Evaluated and Not Rated Waters (1195-2000)	28,665.8 mi estuarine acres	0	0	132.4 mi 23,208.9 estuarine acres	132.4 mi 51,874.7 estuarine acres
Fish Consumption Use Support Ratings for Monitoring Waters (1995-2000)	0	0	0	0	0
Primary Recreation Use Support Ratings for Monitored Waters (1995-2000)	37,851.5 estuarine acres	0	0	93.3 estuarine acres	37,994.8 estuarine acres
Shellfish Harvesting Use Support Ratings for Monitored Waters (1995-2000)	0	0	0	0	0

(Pasquotank Basinwide Water Quality Management Plan, Chapter 4 "*Water Quality and Use Support Ratings in the Pasquotank River Basin,* NCDWQ, 2003)

Although no waters in the subbasin were sampled for fish tissue, the report states that all waters are considered impaired for the Fish Consumption Use Support category due to regional fish consumption advisory for bowfin, large mouth bass and chain pickerel. Because this is a regional advisory, there are no impaired stream miles specifically noted in the above table.

Swamp Waters may have been previously listed as impaired waters due to depressed dissolved oxygen and/or pH levels, although these characteristics can naturally occur within swamp water systems. These waters will remain on the 303(d) list (see http://h2o.enr.state.nc.us/tmdl/General_303d.htm for more information) of impaired waters until swamp studies, biological and chemical, have been completed and use support rating has been re-assessed. This, coupled with gently sloping topography subject to wind tides resulting in reversing flows, makes sampling and analysis using water quality standards not derived for coastal waters ineffective in assigning support ratings for designated use. Low salinities, highly acidic swamp waters further compound the difficulty of assessing the biological habitat. NC Division of Water Quality has developed draft biological criteria that may be used in the future to assign bio-classifications to Swamp Waters. At this time, there are no specific impaired waters listed or noted within the Local Watershed Planning Area (Subbasin 50) based on Division of Water Quality monitoring samples collected within the watershed area.

7.3 Additional Water Quality Monitoring

In order to gain greater insight into potential water quality and habitat degradation issues, the North Carolina Wetlands Restoration Program (NCWRP), worked with the NCDWQ to collect water quality samples along several tributaries within the Local Watershed Planning Area for a period of approximately one year (2002-2003). Sampled tributaries were chosen based on dominant landuses (agricultural, urban and undeveloped). Water quality monitoring results can be found in Appendix H. Half way through the monitoring process, recommendations were made for additional sampling locations, including two new monitoring locations; one in the Milldam Subcatchment and one in the Portohonto Subcatchment. In addition, CH2MHILL provided recommendations on testing parameters, which would enhance the data needed for the hydrological monitoring within the Local Watershed Planning Area (Appendix I).

7.4 US Geological Survey (USGS) Surface Water Sampling Data

The USGS has performed extensive site specific and project specific sampling within the watershed. Sampling data relating to nitrogen and phosphorus were analyzed and results are included in Appendix J. Much of the sampling data is limited to one or two sampling events or limited to one or two sampling parameters. Data were collected and reviewed from the online database. No trends or exceedances of standards were observed within the data set. The USGS also maintains a stream flow water gauge (USGS 0204382800) in the Pasquotank River near South Mills in Camden County, which may aid in determining in-channel and out-of-channel differentiation. Stream flow data from this water gauge is published on the USGS web page at www.waterdata.usgs.gov.

7.5 Elizabeth City Stormwater Sampling Data

Storm water sampling began just after the renovations to the Elizabeth City Waste Water Treatment Plant in 1997. Data were collected and analyzed from 1997 to 1999. Ambient water quality data was collected from eight points within Elizabeth City. Sampling stations are identified in Figure 13. Of these sampling points, four were located in the main stem of the Pasquotank River (2, 4, 6, and 8), two are located on Charles Creek (1 and 7), and two were located at storm water pump stations near the Pasquotank River (3 and 5). These results have been collected and summarized in Appendix K. These data results were not gathered using methodologies approved by the NCDWQ. Therefore the results are not useful in determining if the sites achieved state water quality standards.

Overall, there was no trend between the location of sampling sites and the parameters measured. A review of the data does reveal, however, elevated fecal coliform, total nitrogen, and total phosphorus values in the Pasquotank River, Charles Creek, and at both pump stations.

Data from the two pump stations (3 and 5), showed elevated fecal coliform values as high as 2,100,000 cfu/100ml. Dissolved oxygen values were as low as 0.52 mg/l. This water is known to be stagnant frequently and would not be expected to have typical dissolved oxygen values. The data indicates that sources of fecal coliform exist within Elizabeth City, and are being discharged into the Pasquotank River by means of these pump stations. Such conditions are generally typical of suburban and urban areas.

The greatest frequency of elevated fecal coliform values within the Pasquotank River is found at stations 8 and 4 immediately downstream of pump stations 3 and 5. The highest fecal coliform value was 3,348 cfu/100ml at station 8. Typically station 8 had fecal coliform values higher than those of site 6 upstream and sites 4 and 2 downstream. Station 8 is located downstream of both the Elizabeth City Waste Water Treatment Plant and the two pump stations.

Dissolved oxygen and pH tend to be low at all sampling locations along the Pasquotank, pump stations, and Charles Creek, with the exception of station 2 where mixing with the waters of the Albemarle Sound is greatest.

The two sampling stations on Charles Creek (1 and 7) have reported fecal coliform values as high as 5,150 cfu/100ml (Station 7), dissolved oxygen as low as 1.4 mg/l (Station 1), and pH as low as 5.2 (Station 1). This data indicates that Charles Creek could be contributing fecal coliform to the Local Watershed Planning Area. Low dissolved oxygen and pH conditions also exist in Charles Creek.

Overall the sampling data reviewed show that the Pasquotank River has elevated fecal coliform, nitrogen, and phosphorus levels upstream and downstream of Elizabeth City. Charles Creek and the two pump stations are sources of fecal coliform, nitrogen, phosphorus, and water with low concentrations of dissolved oxygen.

7.6 Closed Shellfish Harvest Areas

There are 395,177.3 acres of shellfish harvesting waters (Class SA) within the Pasquotank River basin. Of these acres, 4,729.9 are considered impaired and are prohibited shellfish harvesting areas. These impaired acres are located outside the Local Watershed Planning Area for this project. The shellfish resource within the Local Watershed Planning Area is mostly centered around Rangia clams which are freshwater clam species not commercially harvested.

The entire Albemarle Sound including the Pasquotank River was closed to shellfish harvesting in 1972. The closure was a consequence of the *Evaluation of Shellfish Waters* (July 21, 1972 Shellfish Sanitation Section) for the following reasons.

1. Runoff from many acres of farmland, woodland, and cities and towns.
2. Boat harborages and marinas.
3. Considerable wildlife located along the banks in certain areas.

The following comment was also noted from the 1972 evaluation:

> "Also this area is not a producer of oysters and salt water clams thereby not affecting the economics of the area- only fresh water clams (*Rangia sp.)* are present in this area and at present, there is no market for such."

In 1980 an area of 10,800 acres of the lower Pasquotank River was opened to shellfish harvesting while 10,200 acres in the upper reaches remains closed today. The reopening of the Shellfish Harvest Areas was due to a shoreline survey that revealed "few sources of pollution outside of the populated headwaters of some of the rivers" which included the Pasquotank River (Shellfish Sanitation Section 1980).

7.7 Fisheries Data

The North Carolina Division of Marine Fisheries (NCDMF) conducted a study of Anadromous fish Spawning Areas in 1973. Three species of fish were found to utilize the Pasquotank River and its tributaries for spawning: river herring, blueback herring, and alewife. Three areas were identified as spawning areas for river herring, just upstream of Elizabeth City on the mainstem of the Pasquotank River, Knobbs Creek, and Newbegun Creek. The blueback herring, and alewife were found to utilize many of the tributaries of the Pasquotank River for spawning. These tributaries included Newbegun Creek, Areneuse Creek, Knobbs Creek, Sawyers Creek, an unnamed creek just downstream of Goats Island on the Pasquotank River, the Dismal Swamp Canal, and Joyce Creek.

Commercial fisheries within the Pasquotank River include crab, flounder, Atlantic croaker, striped bass, river herring, and American shad. Other fisheries include; hickory shad, catfish, red drum, and weak fish. The largest source of revenue comes from blue crabs, followed by flounder and Atlantic croaker (NC DENR, 2000).

7.8 Submerged Aquatic Vegetation (SAV) Data

Over 200,000 acres of SAV beds have been identified in North Carolina waters, including 13,638.37 acres within the Albemarle Sound. SAV beds provide important ecosystem functions related to coastal fisheries including aquatic habitat for spawning, nurseries and foraging. SAV beds are typically found in subtidal and intertidal areas, which are sheltered from open waters and higher water velocities, contain unconsolidated substrate and are shallow enough to allow adequate light exposure on the bottom (*Draft*

North Carolina Coastal Habitat Protection Plan, 2000). Some limiting factors, which control distribution of SAV beds, include salinity, turbulence, nutrients and light. SAV habitats are found throughout the Albemarle-Pamlico estuarine system and provide numerous ecosystem functions in estuarine and riverine systems in North Carolina. A SAV distribution map can be found in Appendix L, and identifies several SAV beds within areas of Big Flatty Creek; however, this area is west of the areas considered to be within the Local Watershed Planning Area.

8.0 Studies Related to Watershed Improvements

8.1 Elizabeth City Stormwater Management Plan

The *Elizabeth City Stormwater Management Plan* (2000) has been developed to create a comprehensive approach to storm water management in Elizabeth City. Issues identified in this document include a storm water sampling program, a Corps of Engineers study to reduce flood damage, a proposed drainage project in the Charles Creek Subcatchment near Roanoke Avenue, and a proposed Greenway Project (Figure 13).

In 1996, the Corps of Engineers performed a hydrology study in Elizabeth City to assess the effects of a six-foot floodwall to protect the City from hurricanes and other tropical depressions. This study was completed, but the project currently remains unfunded.

The proposed Roanoke Avenue Drainage Project includes a series of culvert retrofits to help alleviate flooding within the Roanoke Avenue area. The plan also includes two new wet ponds, or stormwater best management practices (BMP's) that will collect runoff and provide treatment for storm water runoff as well as drainage ditch maintenance and improvement. The location of these improvements is illustrated in Figure 13. This project is currently unfunded.

A study was also completed to identify a greenway within the City. Funding is projected to be available within the next year or so. The proposed greenway would create a loop by following the southeastern branch of Knobbs Creek and the southern branch of Charles Creek (Figure 13). This greenway can be effective in allowing connected habitat for wildlife and serve as a non-structural BMP for control of storm water by providing vegetated areas to slow the overland flow of stormwater to the Pasquotank River. This vegetative buffer may also enhance infiltration of stormwater into the water table and allow for absorption of pollutants from stormwater runoff by plants.

The storm water sampling program (Section 7.5) consists of a series of eight sampling stations near the Pasquotank River in Elizabeth City (Figure 13). The storm water sampling program is designed to provide a better understanding of nonpoint source pollution inputs to the Pasquotank River from urban runoff.

8.2 Pasquotank River Riparian Corridor Conservation Design

The North Carolina Coastal Land Trust has completed *The Pasquotank River Riparian Corridor Conservation Design* for the Conservation Trust for North Carolina through a North Carolina Clean Water Management Trust Fund grant (NCLT, 2001). This study gathered information regarding water quality, agricultural practices, and landuse within the watershed and used this information to identify parcels of land along the Pasquotank River as prime opportunities for protecting the natural riparian buffers along the Pasquotank River. The study defined riparian areas as those lands within the 100-year floodplain. This corridor if preserved can serve as habitat for local wildlife and as a nonstructural BMP to filter stormwater before reaching the Pasquotank River. Of the sites identified as priority parcels for riparian corridor design, 15 were identified as high priority and 14 were identified as low priority. Three of these sites were identified as containing lands that have potential to be developed. All preservations sites are illustrated in Figure 14.

8.3 NC Department of Transportation (NCDOT) Pasquotank River Basin Wetland Mitigation Site Search

In 1998, LandMark Design Group conducted a wetland mitigation site search for the NCDOT. This site search identified four marsh and three hardwood flats mitigation sites within the Local Watershed Planning Area.

The site search was conducted by initially contacting several resource agencies, organizations, and government installations to inventory any previously identified potential sites. Additional restoration sites were identified from review of maps and aerial photography. Natural Resources Conservation Service (NRCS) Soil Surveys for each of the counties were reviewed and compared to NCDOT and NRCS aerial photos to locate areas of hydric soil greater than 100 acres in size within prior converted croplands. Preference was given to those sites bordering areas of interest identified by the groups mentioned above and other natural resources such as National Wildlife Refuges, National Forests, rivers and perennial creeks.

As of 1998 one of the seven landowners was unwilling to sell their land, and six had not responded to telephone calls or letters. All of the three hardwood flat mitigation sites were located in the Newland Drainage Subcatchment, while marsh preservation sites were located in the Pasquotank Subcatchment near the Portohonto Subcatchment, with one potential site located in the Little Flatty Subcatchment (See Figure 14). In the Newland Drainage Subcatchment a total of 410 acres of potential wetland restoration sites and 79 acres of wetland preservation sites were identified. The sites near Portohonto Creek and Little Flatty Creek were not field assessed, and no data regarding acres of potential restoration were available.

8.4 Federal Emergency Management Agency (FEMA) Pasquotank River Basin Plan

Through the North Carolina Cooperating Technical State Flood Mapping Program, FEMA has chosen a series of flood mapping projects within the Pasquotank Local Watershed Planning Area (Section 6.1). Flood mapping will be conducted in the following areas:

- Joyce Creek- From its confluence with Dismal Swamp Canal to a point approximately 5.6 miles upstream of the confluence.
- Joyce Creek Tributary - From its confluence with Joyce Creek to a point approximately 2.0 miles upstream of the confluence.
- Knobbs Creek – From Creek Road to a point approximately 3.4 miles upstream of Creek Road.

The Pasquotank River – From a point approximately 8.7 miles upstream of its confluence with Knobbs Creek to a point approximately 12.8 miles upstream of the confluence.

When mapping has been completed it will replace the existing 100-year floodplain mapping. This new mapping will be developed using LIDAR technology to create topographic maps. The topographic maps will then be used to perform hydrologic modeling, assemble digital base maps, and then create digital firm panels. These digital firm panels will then be stored in a statewide database at www.ncfloodmaps.com.

8.5 Wildlife Resource Commission Modified Index of Biotic Integrity

The NC Wildlife Resource Commission (NCWRC) has recently completed a study comparing the utilization of shoreline habitats by native fish. The study concluded that although maintaining and protecting natural shorelines is the best means of maintaining aquatic habitats, riprap shoreline stabilization is more readily utilized by native fish species for habitat than bulkheads. At the time of this characterization the report has not been published (Chad Thomas, Personal Communication, March, 2002).

The NCWRC is also preparing to conduct a study of fish species in the Pasquotank River. A study to characterize the fish species solely in the Pasquotank River has never been conducted. The study will also utilize a modified Index of Biotic Integrity that is designed to identify sources of stress to fish communities from nonpoint source pollution. This study will serve two purposes: to identify fish communities in the basin and to gain more information regarding water quality impacts to the fisheries of the Pasquotank River.

8.6 Albemarle Soil and Water Conservation District Planned Improvements

The Albemarle Soil and Water Conservation District (ASWCD) has a series of projects underway and planned which are geared toward improving agricultural drainage and water quality within the Newland Special Use Water Management District.

The Newland Special Use Water Management District was established to finance drainage and water quality projects and enhance local decision making regarding prioritizing these projects. Property owners within the District pay a tax that is used to finance projects within the District. The following summary was derived from a meeting with Mr. Dwane Hinson of the Natural Resources Conservation Service and the ASWCD newsletter The Northeaster (Spring 2001).

Drainage improvements must now include methods to improve the water quality of runoff from agricultural lands. The District has implemented projects since 1998. The objective is to improve agricultural drainage while reducing runoff on an annual basis between 30 and 50 percent. Snags and debris were removed from the Pasquotank River to insure unimpeded drainage to the river and its floodplain. Newland Dike has been rebuilt since the damage of Hurricane Floyd in 1999. The Route 158 ditch and Newland ditch have also been improved. The ditches have been cleared and permanent rock weirs (low dams) have been constructed to maintain water within the ditches. These weirs hold agricultural runoff, thereby reducing the nutrient and sediment loads reaching the Pasquotank River. The increased water elevations allows wetlands to be constructed in the ditches to take up nutrients from the water. This higher water level also better maintains soil moisture within the adjoining farm fields, thereby reducing the need for irrigation (and thus runoff). Detailed drainage studies were conducted, and the ditches were widened as needed to insure that the weirs did not increase the elevation of waters during storm events. A 30-foot wide buffer is also maintained along the top of bank of these ditches through a perpetual conservation easement. Shepherds Ditch will be the next drainage system to be improved.

Interior ditches are spaced relatively close together (250 feet) because of the high clay content in soils. Buffers cannot be used in this situation due to the small width of each field, and the corresponding large proportion of land made unavailable due to buffers, compared to remaining tillable land. As an alternative to buffers, managed water control structures are being constructed within the interior ditches of fields. These structures have adjustable weirs to allow farmers to increase water storage in the ditches during dry periods and decrease water storage during severe storms. The purpose of these structures is to better manage soil moisture and reduce the discharge of nutrients and sediments to the Pasquotank River.

8.7 Great Dismal Swamp National Wildlife Refuge, Comprehensive Conservation Plan

Implementation of the Refuge Improvement Act of 1997 requires the United States Fish and Wildlife Service to create a Comprehensive Conservation Plan for the Great Dismal Swamp National Wildlife Refuge. A component of the Comprehensive Conservation Plan will be a Water Management Plan. This plan will help make decisions in water management for the entire refuge. The Water Management Plan for the Great Dismal Swamp National Wildlife Refuge is a plan to restore natural hydrology to the Wildlife Preserve while protecting the land of the surrounding residents from flooding. The Water Management Plan cannot be developed until the priorities of the Refuge are resolved. The Comprehensive Conservation Plan is scheduled to be completed in 2004.

9.0 Summary of Major Stakeholder Issues

Through the course of developing a Local Watershed Restoration Plan for the Pasquotank River Watershed Planning Area, input from various stakeholder interests has been valuable. This section summarizes issues identified by the stakeholders and provides a preliminary overview of potential restoration alternatives using the functional approach associated with the NC-CREWS Model developed by the NCDCM.

The three primary functions identified in the NC-CREWS Model include Water Quality (Nonpoint Source Pollution, Floodwater Cleansing), Hydrology (Surface Runoff, Floodwater Storage, Shoreline Stabilization), and Wildlife Habitat (Terrestrial Wildlife, Aquatic Life). A copy of the functional definitions can be found in Appendix M. This section will discuss the top three degradation issues identified by stakeholders by subcatchment, which will be addressed in greater detail in the Functional Assessment Report. Appendix N contains the Stakeholder Issue Book, which includes the various documents that capture the detailed information provided by stakeholders.

The prioritized issues raised by the stakeholders were identified to determine which of the functions were the most degraded in each subcatchment. This information is utilized to determine which Restoration/Rehabilitation practices will have the greatest impact to overall watershed functional quality by highlighting priority issues and directing those actions towards improving specific functions. This information will be further verified through field assessment.

9.1 Areneuse Creek Subcatchment

Residential development, sedimentation, and impervious surfaces were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development, sedimentation, and impervious surfaces each increase the level of nonpoint source pollution in this subcatchment, thereby impacting the water quality in the area.
- Sedimentation further indicates a deficiency in floodwater cleansing capabilities of the subcatchment, which also contributes to water quality degradation. Residential development along with impervious surfaces reduces the surface runoff and floodwater storage capabilities within the subcatchment, impacting the hydrology function in the area.

9.2 Beaverdam Creek Subcatchment

There were no issues identified by the stakeholders for this subcatchment. This does not, however, indicate that this subcatchment will be excluded from the final Local Watershed Restoration Plan.

9.3 Charles Creek Subcatchment

Agricultural drainage, residential development, and flooding were identified as the three greatest threats to watershed function in this subcatchment.

- ♦ Agricultural drainage and residential development impact water quality in this subcatchment through nonpoint source pollution. Hydrology function is also degraded by surface runoff storage deficiencies.
- ♦ Flooding impacts this subcatchment due to a deficiency in floodwater storage capabilities in this area.

9.4 Cooper Creek Subcatchment

There are no issues identified by the stakeholders for this subcatchment. This does not, however, indicate that this subcatchment will be excluded from the final Watershed Restoration Plan.

9.5 Great Dismal Swamp Subcatchment

Agricultural drainage, dike effects, and flooding were identified as the three greatest threats to watershed function in this subcatchment.

- ♦ Agricultural drainage from the surrounding areas impacts the water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- ♦ Dike effects caused by road crossings and dam structures impact water quality by degrading floodwater cleansing abilities and also impact hydrology by limiting the available areas for floodwater storage and surface runoff storage. Aquatic habitats are also impacted by impeded flows and road crossings.
- ♦ Flooding impacts the hydrology function of this subcatchment due to deficiencies in floodwater storage capabilities.

9.6 Hales Lake Subcatchment

Sedimentation, bulkheading, and beaverdams were identified as the three greatest threats to watershed function in this subcatchment.

- ♦ Water quality is impacted as nonpoint source pollution and point source pollution increases sedimentation in this subcatchment. These types of water quality degradation also impact the aquatic habitats found this area.
- ♦ Bulkheading impacts the hydrology function by altering the surface runoff storage capabilities of the subcatchment. Terrestrial and aquatic habitats are also impacted by the placement of bulkheads throughout this subcatchment.
- ♦ Beaverdams impact hydrology by increasing the floodwater storage capabilities which leads to flooding.

9.7 Joyce Creek Subcatchment

Residential development, sedimentation, and channelized streams were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development and sedimentation impact the water quality function of the subcatchment through nonpoint source pollution, and aquatic habitats are also impacted by increased sedimentation through its addition into the subcatchment through both nonpoint and point source pollution.
- Channelized streams degrade water quality by reducing the floodwater cleansing potential in the area's agricultural lands. Hydrology is also degraded by the inability to provide for surface runoff and floodwater storage.

9.8 Knobbs Creek Subcatchment

Residential development, flooding, and sedimentation were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development impacts water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Flooding impacts the hydrology function of this subcatchment due to deficiencies in floodwater storage capabilities.
- Sedimentation, due to degradation in the area's floodwater cleansing subfunction, impacts the water quality function.

9.9 Little Flatty Creek Subcatchment

Agricultural drainage, residential development, and bulkheading were identified as the three greatest threats to watershed function in this subcatchment.

- Agricultural drainage and residential development impact water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Bulkheading impacts hydrology by altering the surface runoff storage capabilities of the subcatchment. Terrestrial and aquatic habitats are also impacted by the existence of bulkheads throughout this subcatchment.

9.10 Milldam Creek Subcatchment

Residential development, impervious surfaces, and lawn practices were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development impacts water quality in this subcatchment through increased nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Impervious surfaces compound the problem of increased nonpoint source pollution, which in turn impacts the water quality function, while degrading surface runoff and floodwater storage capabilities which impact the hydrology function of the subcatchment.
- Lawn practices in this subcatchment further contribute to water quality degradation by increasing the amount of nonpoint source pollution in the area.

9.11 Newbegun Creek Subcatchment

Residential development, bulkheading, and lawn practices were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development and its associated lawn practices impact water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Bulkheading impacts hydrology by altering the surface runoff storage capabilities of the subcatchment. Terrestrial and aquatic habitats are also impacted by the existence of bulkheads throughout this subcatchment.

9.12 Newland Drainage Canal Subcatchment

Agricultural drainage, dike effects, and flooding were identified as the three greatest threats to watershed function in this subcatchment.

- Agricultural drainage from the surrounding areas impacts the water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Dike effects caused by road crossings and dam structures impact water quality by degrading floodwater cleansing abilities and also impact hydrology by limiting the available areas for floodwater storage and surface runoff storage. Aquatic habitats are also impacted by impeded flows and road crossings.
- Flooding impacts the hydrology function of this subcatchment due to deficiencies in floodwater storage capabilities.

9.13 Pasquotank River Subcatchment

Residential development, impervious surfaces, and channelized streams were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development and impervious surfaces each increase the level of nonpoint source pollution in this subcatchment, thereby impacting the water quality in the area.
- Channelized streams degrade water quality by reducing the floodwater cleansing potential in the area's agricultural lands.
- Each of these issues reduces the surface runoff and floodwater storage capabilities within the subcatchment, impacting the hydrology function in the area.

9.14 Portohonto Creek Subcatchment

Residential development, impervious surfaces, and channelized streams were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development and impervious surfaces each increase the level of nonpoint source pollution in this subcatchment, thereby impacting the water quality in the area. Channelized streams degrade water quality by reducing the floodwater cleansing potential in the area's agricultural lands.
- Each of these issues reduces the surface runoff and floodwater storage capabilities within the subcatchment, impacting the hydrology function in the area.

9.15 Raymond Creek Subcatchment

Residential development, impervious surfaces, and lawn practices were identified as the three greatest threats to watershed function in this subcatchment.

- Residential development, impervious surfaces, and lawn practices all combine to impact water quality through the addition of nonpoint source pollution.
- Residential development and impervious surfaces further impact hydrology through a reduction in surface runoff and floodwater storage potential.

9.16 Sawyer's Creek Subcatchment

Agricultural drainage, residential development, and impervious surfaces were identified as the three greatest threats to watershed function in this subcatchment.

- Agricultural drainage and residential development impact water quality in this subcatchment through nonpoint source pollution. The hydrology function is also degraded by surface runoff storage deficiencies.
- Impervious surfaces throughout this subcatchment increase nonpoint source pollution, which impacts the water quality function. This issue also degrades surface runoff and floodwater storage capabilities, which impacts the hydrology function of the subcatchment.

10.0 Watershed Plan Modeling Toolset

10.1 Purpose and Overview

A watershed planning toolset is under development for the Pasquotank River Watershed through a computer-assisted decision support system built within *Community Viz* software. This toolset will collectively be called the Pasquotank River Rehabilitation Model and will be described in more detail in a subsequent report. The Rehabilitation Model / toolset was designed to be a user friendly system to develop and analyze the primary objectives of the Pasquotank River Local Watershed Restoration Plan which include accounting for nonpoint source pollution load inputs.

One component of the Rehabilitation Model / toolset is a watershed loading model, called **Arc View Generalized Watershed Loading Function (AVGWLF),** which will quantify the relative magnitude of nonpoint source pollutant loading for subcatchments within the project area. This model will be important in:

- Evaluating of future landuse planning and water quality management strategies to address nonpoint source pollution;
- Evaluating ecosystem restoration alternatives; and
- Assisting in landuse decisions.

This model was helpful in estimating potential nonpoint source pollution loads since conclusive water quality data was not available for this Local Watershed Planning Area. The results this watershed loading model provided are summarized on pages 45-48 of this report.

Another tool which will be integrated into the toolset later in the assessment process is a multipurpose environmental analysis system called **Better Assessment Science Integrating Point and Nonpoint Sources (BASINS),** which integrates data on water quality and quantity, landuses, and point and nonpoint source loadings, with supporting nonpoint and water quality models, providing the ability to perform comprehensive assessments of any watershed (EPA, 1997).

BASINS is normally applied to support development of Total Maximum Daily Loads (TMDLs) for 303(d) Listed waterbodies. Although there are no 303(d) listed waters with TMDL requirements within the Local Watershed Planning Area, the BASINS model is considered to be a more predictive tool than AVGWLF. Because of the NC Wetlands Restoration Program's shift to focusing on functional assessment through Local Watershed Planning, it was concluded that the BASINS modeling results would compliment the AVGLWF modeling results, and provide a more predictive outcome focused on functional analysis of watershed components. Both the AVGWLF and BASINS modeling tools are described in more detail below.

10.2 Watershed Loading Model Objectives and Considerations

In general, there are two principal objectives for utilizing watershed loading models:

- ♦ Describe present water quality conditions (i.e., in terms of total average annual pollutant loads, pollutant concentrations, and pollutant load per acre) in each of the watershed subcatchments to identify water quality inputs in the watershed.

- ♦ Identify relative contribution of pollutant loads from different landuses within the watershed to help prioritize water quality improvement projects within the Local Watershed Planning Area.

Development of a modeling approach and selection of an appropriate tool must be closely linked to the decision-making needs and objectives of the end user. There are four key considerations that went into model selection and development:

- ♦ Clearly defined project objectives, water quality issues and project constraints.
- ♦ Use simplest method that satisfies project objectives.
- ♦ Use method consistent with available data.
- ♦ Predict only parameters that are of interest and over a suitable temporal and spatial scale.

10.3 Parameters of Interest

Based on a review of data collected within the Pasquotank River Basin (NCDWQ, 1999) and regional assessments encompassing the receiving waters (USGS, 1995), three pollutants of concern were selected for modeling – Total Nitrogen (TN), Total Phosphorous (TP), and Sediment. Nutrients (nitrogen and phosphorous) were selected because they provide the best indications of overall water quality and other potential pollutant sources. Nutrients are essential for phytoplankton growth, which supports the rest of the food web. However, an overabundance of nutrients or imbalance may alter the trophic state of an aquatic ecosystem causing algal blooms, fish kills and overall water quality and aquatic habitat degradation. Nutrient inputs are evident within the Local Watershed Planning Area based on noted algal blooms.

Sediment was also selected due to its potential effects on water quality. Erosion of soils leads to the increase of suspended sediment and bed load in the receiving streams. Sediment may affect physical, chemical, and biological processes. Sedimentation may directly affect habitats of fish and other aquatic species. Suspended sediment can reduce photosynthesis and alter stream ecology. Sediment transport may facilitate transport of attached nutrients and organic matter and may also transport herbicides or insecticides that may be toxic to aquatic plants or animals.

10.4 Arc View Generalized Watershed Loading Function Overview (AVGWLF)

AVGWLF is a GIS based software application of the GWLF model developed by Haith and Shoemaker (1987). AVGWLF was developed by Penn State for the State of Pennsylvania Department of Environmental Protection to facilitate pre and post processing data for the GWLF model. CH2MHILL utilized AVGWLF for the Pasquotank River Watershed Planning Area and the Technical Memorandum illustrating the existing conditions based on the model can be found in Appendix I of this report.

GWLF is considered to be a mid-range watershed loading model, offering the user more capabilities than a simple screening model such as PLOAD. However, the tool is user friendly and may be developed and applied without the data and resources of a complex model such as HSPF (Hydrologic Simulation Program – Fortan) or AGNPS (Agricultural Nonpoint Source Pollution Model).

AVGWLF has the ability to:

- Simulate Hydrologic Rainfall and Runoff (with a water balance subroutine).
- Quantify sediment erosion with Universal Soil Loss Equation (USLE) equation.
- Estimate both point and nonpoint sources of Nitrogen and Phosphorous.
- Utilize a GIS interface to facilitate pre- and post processing of data.
- Estimate water quality response to future landuse scenarios.
- Be developed without water quality data.
- Quantify monthly and average annual conditions.

AVGWLF is appropriate for simulating pollutant loading for both rural and urban watersheds. It is user friendly and easily transferable to stakeholders for future water quality planning efforts.

AVGWLF has the following limitations:

- Cannot simulate in-stream chemical or physical processes.
- Is a lumped-parameter model and therefore not capable of simulating loading at particular points within each subcatchment.
- Cannot simulate hydrologic storage and hydraulic routing.
- Cannot be calibrated to specific hydrologic events.

10.5 AVGWLF Water Balance

The AVGWLF model was applied for a nine-year period, from 1991 to 2000. Average annual rainfall for the period simulated was 47.9 inches. The water balance varied among each of the subcatchments based on land cover and soil type. The quantity of evapotranspiration simulated ranged from 24-28 inches; amount of groundwater discharge varied from 11 to 13 inches; and runoff ranged from 10 to 13 inches. For example, for Knobbs Creek Subcatchment, approximately 48% of the average annual rainfall was returned to the atmosphere via evapotranspiration, 27% permeated into the shallow water aquifer and discharged to the stream as groundwater, 25% discharge in the form of surface water runoff. The quantity of evapotranspiration is within the range of values collected by field investigations at North Carolina State University (NC State Water Quality Group, 2000 and Skaggs et al, 1980) in the outer coastal plain. Surface water runoff is on the order of 20-30% lower than values recorded for similar regions; comparably the groundwater discharge is on the order of 20-30% higher than values reported in the literature. Although field investigations would be required to precisely characterize the hydrology for the project area, the model adequately approximates the water balance for purposes of this investigation.

10.6 AVGWLF Loading Summaries and Conclusions

During the nine-year period, from 1991 to 2000, AVGWLF was used to assess the nutrient loading and erosion for each of the 16 subcatchments. Average annual nutrient loading is summarized in Figure 15 and Table 17 by subcatchment.

Figure 15
Average Annual Nutrient Loading per Acre

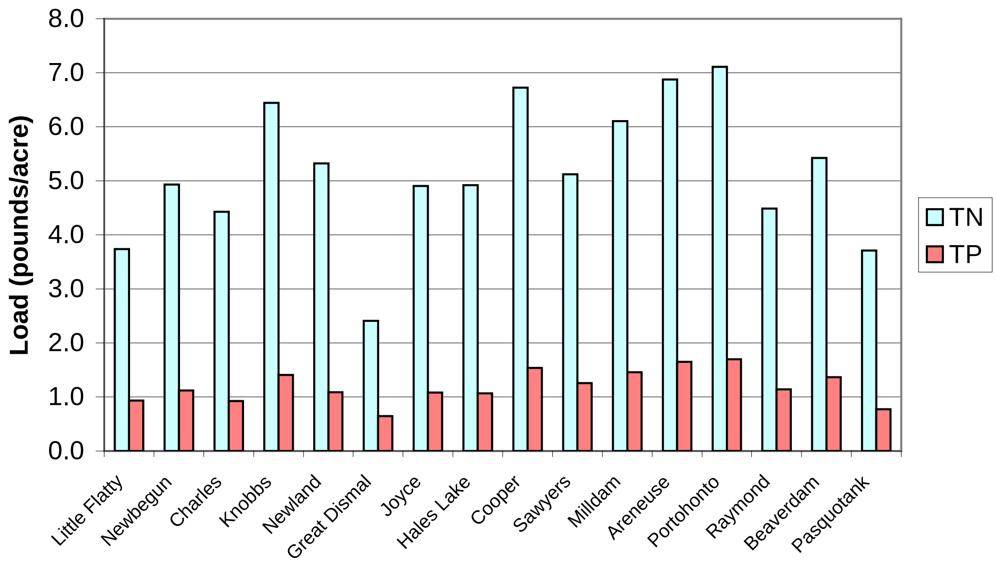


TABLE 17
Summary of Average Annual Loading for Period from January 1991 to July 2000

	Subcatchment	Acres	sediment delivered (lb)	Sediment delivered (lb/acre)	TN (lb)	TN (lb/acre)	TP (lb)	TP (lb/acre)
1	Little Flatty Creek	3371	575416	171	12590	3.7	3148.0	0.93
2	Newbegun Creek	14051	2208560	157	69315	4.9	15751.5	1.12
3	Charles Creek	2118	257807	122	9377	4.4	1951.5	0.92
4	Knobbs Creek	19729	1875386	95	127072	6.4	27793.4	1.41
5	Newland Drainage Canal	29761	2463377	83	158334	5.3	32367.9	1.09
6	Great Dismal Swamp	70277	1802656	26	169155	2.4	45151.0	0.64
7	Joyce Creek	24283	1799832	74	119132	4.9	26296.7	1.08
8	Hales Lake	17144	1766609	103	84306	4.9	18294.5	1.07
9	Cooper Creek	998	184403	185	6718	6.7	1534.2	1.54
10	Sawyers Creek	8253	1357078	164	42270	5.1	10361.4	1.26
11	Milldam Creek	3820	824627	216	23331	6.1	5556.0	1.45
12	Areneuse Creek	4136	1101222	266	28432	6.9	6827.7	1.65
13	Portohonto Creek	2567	710812	277	18258	7.1	4361.1	1.70
14	Raymond Creek	2491	467210	188	11178	4.5	2834.8	1.14
15	Beaverdam Creek	900	184002	205	4879	5.4	1226.6	1.36
16	Pasquotank	32863	1075681	33	121931	3.7	25366.4	0.77

10.7 Nutrients

The total loading identified in Table 17 includes both point and nonpoint sources as discussed in prior sections of this study. Subcatchments with the highest Total Nitrogen (TN) and Total Phosphorous (TP) loading include Great Dismal Swamp, Newland Drainage Canal, Knobbs Creek, Joyce Creek, and the Pasquotank River. These subcatchments contribute about 120,000 lbs/year of TN or greater, with total of 20,000 lbs/year or greater TP (Table 17). The magnitude of these values is primarily a function of watershed size and does not reflect concentration of loading from sources. Table A-4 of Appendix I provides a summary of nutrient loading by source for each subcatchment.

10.8 Nitrogen

The contribution of Total Nitrogen (TN) loading normalized by the subcatchment areas is depicted in Figure 15. TN loading is estimated to range from 2.4 to 7.4 lbs/acre with a median value of 5.1 lbs/acre. Portohonto, Areneuse, Knobbs, Milldam, and Cooper Creek Subcatchments maintain the highest TN loading rates (all greater than 6 lb/acre/year). Cropland makes up 60% or greater of the landuse in each of these five subcatchments.

Groundwater discharge, nonpoint surface water runoff, point sources (e.g. waste water treatment plants), and septic tanks are all potential sources of TN in the project area. Table A-4, located in Appendix I identifies the TN loading by source estimated for each of the subcatchments. The primary source of TN is surface water runoff, accounting for 51% to 87% of the TN for each of the subcatchments. Runoff from cropland constituted from 40% to 85% of the TN for each of the subcatchments. The contribution of TN from groundwater and septic systems ranged from 12% to 43% and 2% to 6% respectively. The City of Elizabeth City waste water treatment plant accounted for approximately 3% of the TN loading for the Knobbs Creek Subcatchment.

10.9 Phosphorous

Total Phosphorous (TP) loading, by subcatchment area, is depicted in Figure 15. TP loading is estimated to range from 0.64 to 1.7 lbs/acre with a median loading of 1.26 lbs/acre. Similar to the TN loading, the Portohonto, Areneuse, Knobbs, Milldam, Cooper, and Beaverdam Creek Subcatchments maintain the highest area TP loading rates (all greater than 1.4 lb/acre/year).

Groundwater discharge, nonpoint surface water runoff, point sources (e.g. waste water treatment plants), and septic tanks are all sources of TP in the project area. The primary sources of TP are surface water runoff and groundwater discharge. The surface water runoff accounts for 32% to 87% of the TP for each of the subcatchments. The contribution of TP from groundwater ranged from 16% to 68%. Septic systems accounted for less than 1% of the TP. The Elizabeth City waste water treatment plant accounted for approximately 10% of the TP loading for the Knobbs Creek Subcatchment.

10.10 Sediment

The total erosion from subcatchments is depicted in Figure 16. Using the Universal Soil Loss Equation (USLE) method, soil loss was estimated to range from 476 to 11,402 tons per subcatchment, representing the amount of soil available for transport. The portion of this soil that will be transported will depend on a number of factors including but not limited to local topography, distance to the nearest streams, drainage practices, and frequency and magnitude of storm events. The fraction of sediment that is estimated to be delivered to the streams is estimated to range from 8% to 29%, based on the parameters simulated in the model runs. Of the landuse types in the project area, cropland has the highest propensity for soil erosion. As may be expected the subcatchment with the largest amount of cultivated lands, Newland Drainage Canal, has correspondingly the greatest amount of erosion and estimated sediment transported (1,232 tons).

10.11 Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) 3.0

Based on the modeling objectives identified previously, available data, and input by NCWRP staff, the BASINS (Better Assessment Science Integrating Point and Nonpoint Sources) model was an additional tool selected to address the need for watershed functional assessment. The results of this more detailed modeling analysis will be described in the Functional Assessment Report, a subsequent report to the Watershed Characterization Report.

BASINS, designed by the U.S. Environmental Protection Agency (www.epa.gov/waterscience/basins/basinsv3.htm), is a multipurpose environmental analysis system for use by regional, state, and local agencies in performing watershed and water quality based studies. It integrates a geographic information system (GIS), national watershed and meteorological data, and state-of-the-art environmental assessment and modeling tools into one convenient package. This software makes it possible to quickly assess large amounts of point source and nonpoint source data in a format that is easy to use and understand. Installed on a personal computer, BASINS allows the user to assess water quality at selected stream sites or throughout an entire watershed. It is an invaluable tool that integrates environmental data, analytical tools, and modeling programs to support development of cost-effective approaches to environmental protection.

BASINS provides three key features that contribute to the Local Watershed Planning assessment work:

(1) Facilitates examination of environmental information,
(2) Provides an integrated watershed and modeling framework, and

(3) Supports analysis of point and nonpoint source management alternatives.

Overcoming the lack of integration, limited coordination, and time-intensive execution typical of more traditional assessment tools, BASINS makes watershed and water quality studies easier by bringing key data and analytical components together "under one roof." It can support the analysis of a variety of pollutants at multiple scales, using tools that range from simple to sophisticated.

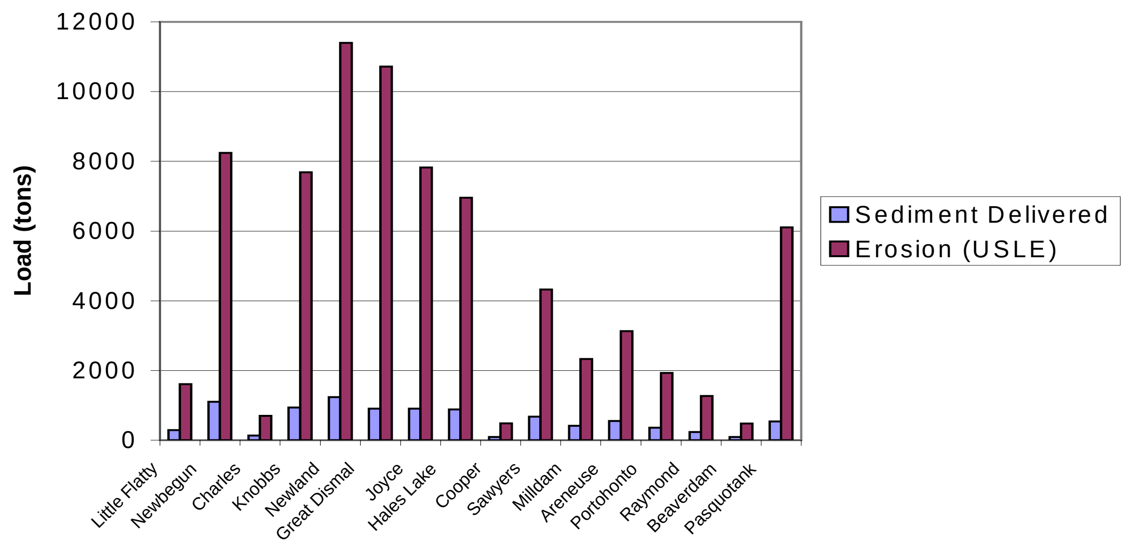
The heart of BASINS is its suite of interrelated components essential for performing watershed and water quality analysis (Appendix O, Existing Data Included in EPA BASINS for 8-Digit Watershed 03010205 and BASINS GIS Data Dictionary, and Appendix P, BASINS HSPF Data Requirements and BASINS HSPF and Meteorological Data Dictionary provides additional details for modeling the Pasquotank Basin).

These components are grouped into several categories:

1. Nationally derived environmental and GIS databases (the 48 continuous states and the District of Columbia);
2. Assessment tools (TARGET, ASSESS, and DATA MINING) for evaluating water quality and point source loadings at a large or small scales;
3. Utilities including local data import and management of local water quality observation data;
4. Two watershed delineation tools;
5. Utilities for classifying elevation (LIDAR), landuse, soils, and water quality data;
6. An in-stream water quality model (QUAL2E);
7. A simplified GIS based nonpoint source annual loading model (PLOAD);
8. Two watershed loading and transport models (HSPF and SWAT);
9. A postprocessor (GenScn) of model data and scenario generator to visualize, analyze, and compare results from HSPF and SWAT; and
10. Many mapping, graphing, and reporting formats for documentation.

BASINS' databases and assessment tools are directly integrated within an ArcView GIS environment. By using GIS, a user can fully visualize, explore, and query to bring a watershed to life. The simulation models run in a Windows environment, using data input files generated in ArcView. A Data Dictionary and Gap Analysis found in Appendix Q, outline the data sets needed for BASINS. BASINS will use data from the AVGWLF modeling tool to model and analyze watershed functions.

Figure 16
Average Annual Sediment Loading



11.0 Watershed Goals and Potential Management Strategies

11.1 Pasquotank River Watershed Rehabilitation Goal

The overreaching goal for the Pasquotank River Local Watershed Planning Area is:

> To measurably improve and protect the watershed functions within the Pasquotank River Local Watershed Planning Area. Accomplishing this goal will involve addressing water quality, hydrological, and habitat functions within the Local Watershed Planning Area.

Detail descriptions of watershed functions can be found in Appendix M. Specific objectives and potential watershed management strategies will differ somewhat within each subcatchment because of differences in landuse, extent of functional degradation, and opportunities for improvement and protection.

During the assessment process, degraded functions will be identified and potential strategies based on available information will be provided to address and rehabilitate those functions. Functional assets which merit protection will also be identified. In addition to the potential watershed management strategies listed under each key watershed objective below, potential management strategies are also listed by subcatchment on pp 54-69.

11.2 Pasquotank River Watershed Objectives and Potential Strategies

Based on the overreaching goal for the Pasquotank River Local Watershed Planning Area and the results and information summarized in this document, specific objectives and potential management strategies were developed for each main watershed function including water quality, hydrology and habitat.

Potential management strategies listed to address described objectives may focus on the rehabilitation of one specific function but may also indirectly benefit and rehabilitate other functions. Therefore, the specific objectives listed below may result in rehabilitation of all identified functions of the watershed.

1. Protect and rehabilitate the water quality function within the Pasquotank River Local Watershed Planning Area by reducing the nitrogen, phosphorous, sediment, and other nonpoint sources of pollutants.

Potential Management Strategies

- Work with local governments and landowners to implement landuse practices that will reduce the source of nonpoint source pollution. This strategy can range from promotion of education and economic incentives to reduce sediment runoff by practicing no-till farming, to local government consideration of Low-Impact Development (LID) design strategies.
- Reduce nutrients and sediment that are the result of landuse practices and other nonpoint sources from reaching the water by implementing projects that will revegetate converted wetlands, restore forested riparian buffers, and stabilize eroding shorelines.
- Involve local governments, conservation groups, and landowners in identifying and protecting intact environments.

2. Improve the hydrological function of the Pasquotank River Local Watershed Planning Area by implementing projects that restore surface runoff retention, flood water storage, and shoreline stabilization.

Potential Management Strategies

- Implement projects that use detention ponds, bioretention areas, constructed wetlands, and riparian buffers to restore hydrological functions to retain and treat surface water runoff.
- Revegetate converted wetlands and forested riparian buffers within the watershed floodplain to reestablish flood water storage resulting in a gradual release of water from storms and flood events.
- Undertake projects to provide vegetative shoreline stabilization along eroding shorelines.

3. Restore and protect terrestrial and aquatic habitat

Potential Management Strategies

- Removal of impediments that balance the need for flood management with preservation of instream habitats
- Implement projects that restore and protect submerged aquatic vegetation and other sensitive marine habitats.
- Provide incentives to maintain vegetative field corridors for wildlife migration and cover.
- Promote landuse planning that prevents segmentation of large tracts, which are used by wide-ranging wildlife.
- Support incentives to plan for and implement “Greenways” in urban areas.

4. Promote recognition that functional rehabilitation of the Pasquotank River Local Watershed Planning Area must be accomplished through a collaboration of local, state, and federal initiatives.

Potential Management Strategies

- Provide information derived from functional modeling that demonstrates the positive impact on watershed function derived from traditional and non-traditional restoration and rehabilitation practices.
- Produce public relations information regarding implementation of projects identified, funded, or promoted by the Pasquotank River Local Watershed Restoration Plan
- Promote collaboration of funding sources to accomplish projects that will address numerous functional rehabilitation goals.
- Provide incentives and support for local governments to learn and use the Watershed Functional Rehabilitation Model.
- Continue to support the Pasquotank River Watershed Stakeholders to ensure that priority projects are identified, funded, and implemented.
- Provide contact information for funding sources of identified projects or initiatives in the Pasquotank River Local Watershed Restoration Plan.

11.3 Measurable Watershed and Subcatchment Reduction Targets

In order to achieve measurable results through functional rehabilitation it is necessary to provide pollutant reduction targets and specific recommendations for each subcatchment to achieve nutrient/sediment reduction goals. Nutrients and sediment impact water quality, aquatic habitat and are influenced by hydrologic dynamics, which capture the three key functions under evaluation through the Local Watershed Planning assessment process. Literature links improvements to less easily measured functions (hydrology and habitat functions) with reductions in nutrients and sediment. Ideally, reduction of these pollutants will involve some aspect of each watershed function, and thus we assume that these reduction targets will work to improve all watershed functions.

Nutrients and sediment were the chosen measurable indicator pollutants to be used as one component of determining the condition of watershed functions. These indicators were chosen because there is evidence in the watershed to suggest that these pollutants are a problem and because monitoring has provided baseline data for these functions. Literature also provides anticipated reduction rates for these parameters based on specific restoration/rehabilitation practices.

The Pasquotank River Watershed has not been the subject of a process to develop a nutrient reduction strategy such as those developed for the Tar-Pamlico and Neuse River Basins, which both contain designated Nutrient Sensitive Waters. However, because of their similar nature and geographic proximity to the Pasquotank River Basin, reduction goals identified in the Tar-Pamlico and Neuse Nutrient Reduction Strategies will be applied to this Local Watershed Planning Area. The nutrient/sediment reduction goals for the watershed and each subcatchment in the Local Watershed will be based on a target 30% reduction of nitrogen influx levels. Although phosphorus loading levels are proposed to be maintained and sediment level reduction was not addressed in the Tar-Pamlico and Neuse Nutrient Management Strategies, these pollutants are a problem in the Pasquotank River Watershed as documented in Section 10.3. The restoration/rehabilitation strategies identified for the Pasquotank Local Watershed Planning Area later in the assessment process will help reduce the introduction of phosphorus and sediments. Therefore, as specific removal targets are identified for nitrogen, reduction of sediment and phosphorus will result by implementation of restoration/rehabilitation practices.

There are five major categories of restoration/rehabilitation practices available to address the issues identified by the Stakeholders and the Watershed Characterization Report Goals and Potential Management Strategies. The restoration and rehabilitation practices and associated removal efficiencies (Table 18) were derived from the North Carolina Division of Water Quality (NCDWQ) *Neuse River Basin: Model Stormwater Program for Nitrogen Control* (http://dem.ehnr.state.nc.us/su/PDF_Files/Neuse/FinalModel_Plan.pdf), the United States Environmental Protection Agency (USEPA) *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (www.epa.gov/owow/nps/MMGI/index.html) and other sources referenced in this document. These efficiencies will be utilized to calculate the reduction of nutrients and sediment based on the quantities (acres) of proposed restoration and rehabilitation practices. The quantities of restoration/rehabilitation practices necessary to achieve the watershed goals will be determined by the Functional Rehabilitation Model and documented in the Functional Assessment Report. The reduction goals will be reported as those required for each year over a 10-year period. The percent of removal for sediment and phosphorus reflects the benefits derived from the implementation of the restoration/rehabilitation practices for nitrogen removal, which also affects phosphorous and sediment removal.

This information should be used by the Pasquotank River Local Watershed Stakeholders as guidance to encourage identification of potential projects necessary to meet the specific reduction goals in each subcatchment. Decision Support Professionals, Inc. (DSPro) will also use this information to assist in the identification of specific project opportunities within each subcatchment and to help identify the most appropriate and meaningful target projects.

Table 18:
Effectiveness of Functional Restoration and Rehabilitation Practices for Control of Runoff in Wetlands and Riparian Areas

Removal Efficiency (%)							
Restoration or Rehabilitation Practice	**Total Suspended Solids**		**Total Nitrogen**		**Total Phosphorous**		**References**
	Range	**Average**	**Range**	**Average**	**Range**	**Average**	
R&R1 – Constructed Wetland	50-90	65	0-40	20	0-80	25	Wotzka and Oberts, 1988; Oberts et al., 1989; Rhodes et al., 1985; Barten, 1987; Rushton and Dye, 1990; Glick, et al.; 1991; Reed, 1991; Schiffer, 1990
R&R2 – Vegetated Filter Strip	40-90	65	20-60	40	30-80	40	Barten, 1987; Hartigen et al., 1989; EPA, 1983; Casman, 1990; Glick, et al., 1991; Dilaha et al., 1989
R&R3 – Wet/Dry Detention Pond	50-90	60	10-90	40	10-90	45	Schueler, 1987; Scheuler, et al., 1992; Martin, 1988; MWCOG, 1983; Wotzka and Oberts, 1988; Holler, 1989
R&R4 – Forested Riparian Buffer (30m)	80-90	80	60-90	60	25-60	25	Phillips 1989; Corell and Weller, 1989; Cooper, et al., 1987; Lowrence, et al., 1983, 1984; Jacobs and Gilliam, 1985; Cooper and Gilliam, 1987
R&R5 – Revegetation of Former Wetland	60-90	70	40-90	60	20-80	50	Wotzka and Oberts, 1988; Oberts et al., 1989; Rhodes et al., 1985, Barten, 1987; Rushton and Dye, 1990; Hay and Barrett, 1991; Glick, et al., 1991; Schiffer, 1990

12.0 Subcatchment Summaries and Potential Management Strategies

Analysis of the data and information compiled within the Watershed Characterization Report (including the summaries below), stakeholder input, and the Watershed Objectives (Section 11.3) allows for management strategies to be developed for each subcatchment. These objectives will be used in the Pasquotank River Watershed Rehabilitation Model and the Watershed Functional Assessment to identify potential projects, which address the specific needs for functional rehabilitation in each subcatchment.

12.1 Areneuse Creek Subcatchment Summary

Spawning area for the blueback herring and the alewife
NCDWQ Benthic Monitoring Station, 2000, indicated "worst" water quality of three sites sampled.
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	4,211
Forested Non-Wetlands (Acres)	666
Forested Wetlands (Acres)	469
Wetlands (Acres)	1
Agriculture (Acres)	2,911
Developed (Acres)	165
Hydric Soils (Acres)	3231
Forested Non-Wetlands (%)	16%
Forested Wetlands (%)	11%
Wetlands (%)	0%
Agriculture (%)	69%
Developed (%)	4%
Hydric Soils (%)	77%

Stream Parameters

Streams Total (miles)	25.6
Streams With Buffers (miles)	12.2
Streams Without Buffers (miles)	13.4
Percent With Buffers	48%
Percent Without Buffers	52%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	266
Total Nitrogen (lb/acre)	6.9
Total Phosphorous (lb/acre)	1.65
Sediment Delivered (lb)	1,101,222
Total Nitrogen (lb)	28,432
Total Phosphorus (lb)	6,827

Potential Management Strategies:

- Wetlands of Exceptional Ecological value should be preserved.
- Work with local governments and landowners to implement landuse practices that will reduce the source of nonpoint source pollution.
- Restore stream buffers and prior converted hydric soils to forested wetlands to increase floodwater storage capacities and removal of sediment.

12.2 Beaverdam Creek Subcatchment Summary

NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	912
Forested Non-Wetlands (Acres)	80
Forested Wetlands (Acres)	118
Wetlands (Acres)	0
Agriculture (Acres)	665
Developed (Acres)	48
Hydric Soils	604
Forested Non-Wetlands (%)	9%
Forested Wetlands (%)	13%
Wetlands (%)	0%
Agriculture (%)	73%
Developed (%)	5%
Hydric Soils (%)	66%

Stream Parameters

Streams Total (miles)	6.7
Streams With Buffers (miles)	2.4
Streams Without Buffers (miles)	4.2
Percent With Buffers	37%
Percent Without Buffers	63%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	205
Total Nitrogen (lb/acre)	5.4
Total Phosphorous (lb/acre)	1.36
Sediment Delivered (lb)	184,002
Total Nitrogen (lb)	4,879
Total Phosphorus (lb)	1,226

Potential Management Strategies:

- Restore stream buffers and forested wetlands to reduce sediment and nutrient input and increase wildlife habitat.

12.3 Charles Creek Subcatchment Summary

Elizabeth City Proposed Roanoke Avenue Drainage Project
Proposed Elizabeth City Greenway
Elizabeth City Wastewater Treatment Plant Service Area
NCWRP Wetland and Buffer Restoration Project at Charles Creek
NCWRP Wetland and Buffer Preservation Project at Morganview Subdivision
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	2,104
Forested Non-Wetlands (Acres)	152
Forested Wetlands (Acres)	155
Wetlands (Acres)	0
Agriculture (Acres)	743
Developed (Acres)	702
Hydric Soils (Acres)	1,522
Forested Non-Wetlands (%)	7%
Forested Wetlands (%)	7%
Wetlands (%)	0%
Agriculture (%)	35%
Developed (%)	33%
Hydric Soils (%)	72%

Stream Parameters

Streams Total (miles)	11.6
Streams With Buffers (miles)	3.8
Streams Without Buffers (miles)	7.8
Percent With Buffers	33%
Percent Without Buffers	67%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	122
Total Nitrogen (lb/acre)	4.4
Total Phosphorous (lb/acre)	0.92
Sediment Delivered (lb)	257,807
Total Nitrogen (lb)	9,377
Total Phosphorus (lb)	1,951.5

Potential Management Strategies:

- ♦ Provide support for the Elizabeth City Greenway Project to address residential and agricultural runoff and wildlife habitat.
- ♦ Restore stream buffers to improve floodwater storage capacity.
- ♦ Promote Low-Impact Development (LID) strategies to aid in prevention of stormwater runoff.

12.4 Cooper Creek Subcatchment Summary

NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	1,005
Forested Non-Wetlands (Acres)	91
Forested Wetlands (Acres)	198
Wetlands (Acres)	0
Agriculture (Acres)	688
Developed (Acres)	28
Hydric Soils (Acres)	859
Forested Non-Wetlands (%)	9%
Forested Wetlands (%)	20%
Wetlands (%)	0%
Agriculture (%)	68%
Developed (%)	3%
Hydric Soils (%)	86%

Stream Parameters

Streams Total (miles)	5.3
Streams With Buffers (miles)	1.2
Streams Without Buffers (miles)	4.1
Percent With Buffers	23%
Percent Without Buffers	77%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	185
Total Nitrogen (lb/acre)	6.7
Total Phosphorous (lb/acre)	1.54
Sediment Delivered (lb)	184,403
Total Nitrogen (lb)	6,718
Total Phosphorus (lb)	1,534

Potential Management Strategies:

- Establish vegetative filter strips and riparian buffers within agricultural lands to provide wildlife corridors and stormwater cleansing.
- Wetlands of Exceptional Ecological Value should be preserved.

12.5 Great Dismal Swamp Subcatchment Summary

Spawning Areas for blueback herring and alewife
Great Dismal Swamp National Wildlife Area
Great Dismal Swamp State Park
NPDES Permit-Sprint Carolina Telephone
NC-CREWS Wetlands of Exceptional Ecological Value
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration – Swamp Forest

Landuse Parameters

Total Acres	71,157
Forested Non-Wetlands (Acres)	23,183
Forested Wetlands (Acres)	34,960
Wetlands (Acres)	1
Agriculture (Acres)	12,302
Developed (Acres)	710
Hydric Soils (Acres)	62,229
Forested Non-Wetlands (%)	33%
Forested Wetlands (%)	49%
Wetlands (%)	0%
Agriculture (%)	17%
Developed (%)	1%
Hydric Soils (%)	87%

Stream Parameters

Streams Total (miles)	168.6
Streams With Buffers (miles)	131
Streams Without Buffers (miles)	37.6
Percent With Buffers	78%
Percent Without Buffers	22%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	26
Total Nitrogen (lb/acre)	2.4
Total Phosphorous (lb/acre)	0.64
Sediment Delivered (lb)	1,802,656
Total Nitrogen (lb)	169,155
Total Phosphorus (lb)	45,151

Potential Management Strategies:

- Encourage preservation of wetlands of Exceptional Ecological Value.
- Address dike effect of road crossings and dam structures to improve floodwater storage capabilities and aquatic habitat.
- Restore Swamp forest and preserve black bear habitat.

12.6 Hales Lake Subcatchment Summary

NC-CREWS Wetlands of Exceptional Ecological Value
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat and Pocosin

Landuse Parameters

Total Acres	17,488
Forested Non-Wetlands (Acres)	6,196
Forested Wetlands (Acres)	2754
Wetlands (Acres)	2
Agriculture (Acres)	8,259
Developed (Acres)	277
Hydric Soils (Acres)	15,873
Forested Non-Wetlands (%)	35%
Forested Wetlands (%)	16%
Wetlands (%)	0%
Agriculture (%)	47%
Developed (%)	2%
Hydric Soils (%)	91%

Stream Parameters

Streams Total (miles)	52.7
Streams With Buffers (miles)	29.2
Streams Without Buffers (miles)	23.5
Percent With Buffers	55%
Percent Without Buffers	45%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	103
Total Nitrogen (lb/acre)	4.9
Total Phosphorous (lb/acre)	1.07
Sediment Delivered (lb)	1,766,609
Total Nitrogen (lb)	84306
Total Phosphorus (lb)	18,294.5

Potential Management Strategies:

- Reestablish historic drainage patterns to improve hydrological function.
- Promote installation of vegetated filter strips to reduce sediment influx and improve aquatic habitat.
- Address beaverdam impacts on hydrology which has lead to floodwater storage, which is causing flooding upstream.
- Promote alternatives to bulkheading to reduce sediment influx while reducing impacts to terrestrial and aquatic habitats.

12.7 Joyce Creek Subcatchment Summary

Spawning area for the blueback herring and the alewife
Green Sea Natural Heritage Area
Town of South Mills
Joyce Creek Drainage District
NC-CREWS Wetlands of Exceptional Ecological Value
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration - Swamp Forest and Wet Flat

Landuse Parameters

Total Acres	24,693
Forested Non-Wetlands (Acres)	5,073
Forested Wetlands (Acres)	7,597
Wetlands (Acres)	0
Agriculture (Acres)	11,274
Developed (Acres)	749
Hydric Soils (Acres)	22,877
Forested Non-Wetlands (%)	21%
Forested Wetlands (%)	31%
Wetlands (%)	0%
Agriculture (%)	46%
Developed (%)	3%
Hydric Soils (%)	93%

Stream Parameters

Streams Total (miles)	68.4
Streams With Buffers (miles)	37.4
Streams Without Buffers (miles)	31
Percent With Buffers	55%
Percent Without Buffers	45%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	74
Total Nitrogen (lb/acre)	4.9
Total Phosphorous (lb/acre)	1.08
Sediment Delivered (lb)	1,799,832
Total Nitrogen (lb)	119,132
Total Phosphorus (lb)	26,296.7

Potential Management Strategies:

- Reestablish historic drainage ways to improve hydrological function.
- Restore channelized streams to improve floodwater cleansing potential.
- Assist local government in promoting residential development guidelines which would reduce subcatchment impacts.
- Promote preservation of the Green Sea Natural Heritage Area and Wetlands of Exceptional Ecological Value.
- Work with Joyce Creek Drainage District to address floodwater storage.

12.8 Knobbs Creek Subcatchment Summary

Spawning Area for the river herring
NCDOT Proposed Roadway Project
Elizabeth City
Proposed Elizabeth City Greenway
Elizabeth City Wastewater Treatment Plant
Elizabeth City Wastewater Treatment Plant Service Area
Pasquotank Commerce Park
Pasquotank County Wastewater System
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Swamp Forest and Wet Flat

Landuse Parameters

Total Acres	19,779
Forested Non-Wetlands (Acres)	2,579
Forested Wetlands (Acres)	2,345
Wetlands (Acres)	0
Agriculture (Acres)	12,330
Developed (Acres)	2,525
Hydric Soils (Acres)	16,839
Forested Non-Wetlands (%)	13%
Forested Wetlands (%)	12%
Wetlands (%)	0%
Agriculture (%)	62%
Developed (%)	13%
Hydric Soils (%)	85%

Stream Parameters

Streams Total (miles)	50.7
Streams With Buffers (miles)	35.7
Streams Without Buffers (miles)	15
Percent With Buffers	70%
Percent Without Buffers	30%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	95
Total Nitrogen (lb/acre)	6.4
Total Phosphorous (lb/acre)	1.41
Sediment Delivered (lb)	1,875,386
Total Nitrogen (lb)	127,072
Total Phosphorus (lb)	27,793.4

Potential Management Strategies:

- Address potential impacts from NCDOT roadway projects.
- Support Elizabeth City Greenway Project to enhance wildlife corridors.
- Preserve Wetlands of Exceptional Ecological Value.
- Promote Low-Impact Development (LID) strategies and restoration of forested wetlands to address stormwater runoff.

12.9 Little Flatty Creek Subcatchment

Little Flatty Natural Area
NC-CREWS Wetlands of Exceptional Ecological Value
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat and Bottomland Hardwood/Headwater

Landuse Parameters

Total Acres	3,390
Forested Non-Wetlands (Acres)	968
Forested Wetlands (Acres)	1,011
Wetlands (Acres)	23
Agriculture (Acres)	1,307
Developed (Acres)	81
Hydric Soils (Acres)	3,197
Forested Non-Wetlands (%)	29%
Forested Wetlands (%)	30%
Wetlands (%)	1%
Agriculture (%)	39%
Developed (%)	2%
Hydric Soils (%)	91%

Stream Parameters

Streams Total (miles)	27.9
Streams With Buffers (miles)	16.7
Streams Without Buffers (miles)	11.2
Percent With Buffers	60%
Percent Without Buffers	40%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	171
Total Nitrogen (lb/acre)	3.7
Total Phosphorous (lb/acre)	0.93
Sediment Delivered (lb)	575,416
Total Nitrogen (lb)	12,590
Total Phosphorus (lb)	3,148

Potential Management Strategies:

- ♦ Reference subcatchment for landuse and stream parameters for other subcatchments.
- ♦ Preserve Wetlands of Exceptional Ecological Value.
- ♦ Promote Low-Impact Development (LID) strategies to prevent water quality degradation from residential development.
- ♦ Promote alternatives to bulkheading to reduce sediment influx while reducing impacts to terrestrial and aquatic habitats.

12.10 Milldam Creek Subcatchment Summary

Whitehall Shores Hardwood Forest
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	3,875
Forested Non-Wetlands (Acres)	749
Forested Wetlands (Acres)	731
Wetlands (Acres)	0
Agriculture (Acres)	2,295
Developed (Acres)	100
Hydric Soils (Acres)	3,317
Forested Non-Wetlands (%)	19%
Forested Wetlands (%)	19%
Wetlands (%)	0%
Agriculture (%)	59%
Developed (%)	3%
Hydric Soils (%)	85%

Stream Parameters

Streams Total (miles)	21.7
Streams With Buffers (miles)	12.1
Streams Without Buffers (miles)	9.6
Percent With Buffers	56%
Percent Without Buffers	44%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	216
Total Nitrogen (lb/acre)	6.1
Total Phosphorous (lb/acre)	1.45
Sediment Delivered (lb)	824,627
Total Nitrogen (lb)	23,331
Total Phosphorus (lb)	5,556

Potential Management Strategies:

- Promote installation of vegetative filter strips and revegetation of prior converted wetlands to reduce nutrient influx and increase stormwater storage.
- Support education concerning lawn practices to reduce influx of nutrients and herbicides.
- Protect Whitehall Shores Hardwood Forest.
- Preserve Wetlands of Exceptional Ecological Value.

12.11 Newbegun Creek Subcatchment Summary

Spawning Area for the river herring
NCDWQ Benthic Monitoring Station, 1998 and 2000 indicated, "moderate water quality"
NPDES Permit- Pasquotank County
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat and Bottomland Hardwood/Headwater

Landuse Parameters

Total Acres	14,102
Forested Non-Wetlands (Acres)	1,707
Forested Wetlands (Acres)	2,335
Wetlands (Acres)	6
Agriculture (Acres)	9,478
Developed (Acres)	575
Hydric Soils (Acres)	9,308
Forested Non-Wetlands (%)	12%
Forested Wetlands (%)	17%
Wetlands (%)	0%
Agriculture (%)	67%
Developed (%)	4%
Hydric Soils (%)	63%

Stream Parameters

Streams Total (miles)	103.7
Streams With Buffers (miles)	49.8
Streams Without Buffers (miles)	53.9
Percent With Buffers	48%
Percent Without Buffers	52%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	1571
Total Nitrogen (lb/acre)	4.9
Total Phosphorous (lb/acre)	1.12
Sediment Delivered (lb)	2,208,560
Total Nitrogen (lb)	69,315
Total Phosphorus (lb)	15,751.5

Potential Management Strategies:

- ♦ Promote Low-Impact Development (LID) strategies for this area to reduce nutrient influx from residential development and subsequent lawn practices.
- ♦ Promote alternatives to bulkheading to reduce sediment influx while reducing impacts to terrestrial and aquatic habitats.
- ♦ Preserve Wetlands of Exceptional Ecological Value.

12.12 Newland Drainage Canal Subcatchment Summary

Newland Special Use Water Management District
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration –Swamp Forest and Wet Flat

Landuse Parameters

Total Acres	29,884
Forested Non-Wetlands (Acres)	12,401
Forested Wetlands (Acres)	2,241
Wetlands (Acres)	10
Agriculture (Acres)	15,198
Developed (Acres)	34
Hydric Soils (Acres)	27,139
Forested Non-Wetlands (%)	41%
Forested Wetlands (%)	7%
Wetlands (%)	0%
Agriculture (%)	51%
Developed (%)	0%
Hydric Soils (%)	91%

Stream Parameters

Streams Total (miles)	109.9
Streams With Buffers (miles)	46.5
Streams Without Buffers (miles)	63.4
Percent With Buffers	42%
Percent Without Buffers	58%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	83
Total Nitrogen (lb/acre)	5.3
Total Phosphorous (lb/acre)	1.09
Sediment Delivered (lb)	2,463,377
Total Nitrogen (lb)	158,334
Total Phosphorus (lb)	32,367.9

Potential Management Strategies:

- Address dike effects of roadways and dam structures which impact water quality, hydrology, and aquatic habitats.
- Restore forested wetlands and riparian buffers to address sedimentation.
- Work with the Newland Special Use Water Management District to address floodwater storage.

12.13 Pasquotank River Subcatchment Summary

Spawning areas for the river herring, blueback herring, and alewife.
NCDWQ Benthic Monitoring Station, 1998 and 2000
NPDES Permit-South Mills Water Association
NPDES Permit-US Coast Guard Support Center
Municipal Airport
Coastal Marinas (Elizabeth City Docks, The Pelican, Pasquotank River Yacht Club, Riverside Boat Works, Elizabeth City Boat Works)
Shipyard Landing Natural Area
Closed Shellfish Harvesting Area
Pasquotank River Riparian Conservation Design Study
NC-CREWS Wetlands of Exceptional Ecological Value
NC-CREWS Wetlands of Substantial Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	33,880
Forested Non-Wetlands (Acres)	6,181
Forested Wetlands (Acres)	13,033
Wetlands (Acres)	65
Agriculture (Acres)	10,874
Developed (Acres)	3,728
Hydric Soils (Acres)	26,623
Forested Non-Wetlands (%)	18%
Forested Wetlands (%)	38%
Wetlands (%)	0%
Agriculture (%)	32%
Developed (%)	11%
Hydric Soils (%)	81%

Stream Parameters

Streams Total (miles)	151.6
Streams With Buffers (miles)	87.5
Streams Without Buffers (miles)	64.1
Percent With Buffers	58%
Percent Without Buffers	42%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	33
Total Nitrogen (lb/acre)	3.7
Total Phosphorous (lb/acre)	0.77
Sediment Delivered (lb)	1,075,681
Total Nitrogen (lb)	121,931
Total Phosphorus (lb)	25,366.4

Potential Management Strategies:

- Prevent the introduction of fecal coliform into the watershed by identifying and rectifying the source and/or installation of urban Best Management Practices (BMPs).
- Support for the Pasquotank River Riparian Conservation Design Study to address stormwater issues.
- Restore channelized streams to improve floodwater cleansing.
- Address water quality impacts from marinas and shipyard.

12.14 Portohonto Creek Subcatchment Summary

NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	2,603
Forested Non-Wetlands (Acres)	465
Forested Wetlands (Acres)	157
Wetlands (Acres)	13
Agriculture (Acres)	1,893
Developed (Acres)	74
Hydric Soils (Acres)	2,338
Forested Non-Wetlands (%)	18%
Forested Wetlands (%)	6%
Wetlands (%)	1%
Agriculture (%)	73%
Developed (%)	3%
Hydric Soils (%)	90%

Stream Parameters

Streams Total (miles)	15.8
Streams With Buffers (miles)	6.3
Streams Without Buffers (miles)	9.5
Percent With Buffers	40%
Percent Without Buffers	60%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	277
Total Nitrogen (lb/acre)	7.1
Total Phosphorous (lb/acre)	1.7
Sediment Delivered (lb)	710,812
Total Nitrogen (lb)	18,258
Total Phosphorus (lb)	4,361.1

Potential Management Strategies:

- Restore channelized streams to improve floodwater cleansing potential.
- Preserve Wetlands of Exceptional Ecological Value.
- Restore buffers along streams to remove pollutants from residential development.

12.15 Raymond Creek Subcatchment Summary

NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	2,579
Forested Non-Wetlands (Acres)	583
Forested Wetlands (Acres)	480
Wetlands (Acres)	68
Agriculture (Acres)	1,386
Developed (Acres)	62
Hydric Soils (Acres)	1,838
Forested Non-Wetlands (%)	23%
Forested Wetlands (%)	19%
Wetlands (%)	3%
Agriculture (%)	54%
Developed (%)	2%
Hydric Soils (%)	71%

Stream Parameters

Streams Total (miles)	9.8
Streams With Buffers (miles)	7.3
Streams Without Buffers (miles)	2.5
Percent With Buffers	75%
Percent Without Buffers	25%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	188
Total Nitrogen (lb/acre)	4.5
Total Phosphorous (lb/acre)	1.14
Sediment Delivered (lb)	467,210
Total Nitrogen (lb)	11,178
Total Phosphorus (lb)	2,834.8

Potential Management Strategies:

- Reference subcatchment for landuse and stream parameters for other subcatchments.
- Preserve Wetlands of Exceptional Ecological Value.
- Promote Low-Impact Development (LID) strategies to prevent water quality degradation from residential development.

12.16 Sawyers Creek Subcatchment Summary

Spawning area for the blueback herring and the alewife
NCDWQ Benthic Monitoring Station, 1998 and 2000 Indicated "best" water quality of three sites sampled.
NPDES Permit-Camden County Grandy Primary
Town of Camden
Registered Swine Operation
NC-CREWS Wetlands of Exceptional Ecological Value
Significant Potential Wetland Enhancement or Restoration – Wet Flat

Landuse Parameters

Total Acres	8,353
Forested Non-Wetlands (Acres)	1,071
Forested Wetlands (Acres)	1,408
Wetlands (Acres)	0
Agriculture (Acres)	5,632
Developed (Acres)	241
Hydric Soils (Acres)	6,255
Forested Non-Wetlands (%)	13%
Forested Wetlands (%)	17%
Wetlands (%)	0%
Agriculture (%)	67%
Developed (%)	3%
Hydric Soils (%)	75%

Stream Parameters

Streams Total (miles)	52.2
Streams With Buffers (miles)	28.9
Streams Without Buffers (miles)	23.2
Percent With Buffers	55%
Percent Without Buffers	45%

Existing Conditions Modeling Results

Sediment Delivered (lb/acre)	164
Total Nitrogen (lb/acre)	5.1
Total Phosphorous (lb/acre)	1.26
Sediment Delivered (lb)	1,357,078
Total Nitrogen (lb)	42,270
Total Phosphorus (lb)	10,361.4

Potential Management Strategies:

- Installation of bioretention area at Camden County High School to address stormwater runoff and as a demonstration project.
- Restore forest wetlands to improve stormwater storage and nonpoint source pollution.
- Protect and Preserve Wetlands of Exceptional Ecological Value

13.0 Functional Stressors

The Pasquotank Local Watershed Planning Area is relatively undeveloped (development is 4% of the land area), and possesses a number of unique natural areas (in public and private ownership). The predominant landuse/land cover is currently agriculture (41%), followed by forested wetlands (29%), and forested non-wetlands (26%). Landuse in the Local Watershed Planning Area will continue its shift to residential and industrial development followed by commercial development to support new residents. Growth is occurring in the region due to the existing and proposed expansion of the infrastructure in the Local Watershed Planning Area, together with its proximity to Virginia's Hampton Roads metropolitan area, and North Carolina's Albemarle Sound and Outer Banks.

As identified through the water quality modeling, the primary source of existing nonpoint source pollution is attributable to agriculture. Those subcatchments with the greatest proportion of agriculture generally had the greatest pollutant loading (pounds/acre). The absence of naturally vegetated buffers along streams in agricultural areas is substantial, and contributes to the loadings. Almost 60% of all streams in the watershed (374 miles) have no vegetated buffer. Agricultural land contains approximately 55% of all unbuffered streams in the watershed (209 miles).

Consequently, those subcatchments with higher proportions of agriculture and unbuffered streams generally produced the greatest pollutant loadings of nitrogen, phosphorus, or sediment. Those subcatchments with the greatest loading of pollutant are; Areneuse Creek, Portohonto Creek, Cooper Creek, Knobbs Creek, and Milldam Creek (Table 17). Opportunities to improve water quality should be pursued in these subcatchments.

Those subcatchments experiencing development or are expected to experience development in the near future were identified through a visual reconnaissance of the watershed and discussions with stakeholders. These subcatchments included; Charles Creek, Knobbs Creek, Newland Drainage Canal, Joyce Creek, Areneuse Creek, Little Flatty Creek, Milldam Creek, Newbegun Creek, Portohonto Creek, Raymond Creek, Sawyer's Creek and the Pasquotank River (Table 20). As these subcatchments increase in development, loadings of additional nonpoint source pollutants (e.g. petroleum compounds, metals, fecal coliform etc.) will likely increase as well. The Newland Drainage subcatchment also receives excess stormwater runoff from that portion of the Great Dismal Swamp that historically drained to the Perquimans River. Opportunities to improve or maintain watershed functions should be pursued in these subcatchments. Watershed improvements in these subcatchments should include stream buffers, stormwater Best Management Practices (BMP's), ordinance revisions to mandate or create incentives for buffers and BMP's, greenways, and stream restoration. Other alternatives such as wetland restoration and enhancement should be explored based on specific attributes within each subcatchment

There are a number of natural resources in the Local Watershed Planning Area that are either protected through public ownership or are classified as Natural Heritage Areas and located on private properties. It would be an ecological benefit if these areas were either protected or buffered by watershed improvement projects as the watershed continues to develop. It is recommended that areas within subcatchments containing unique natural habitats should be preserved and protected. These subcatchments include Little Flatty Creek, Great Dismal Swamp, Joyce Creek, and the Pasquotank River north of the crossing of US 17 (Figure 11 and Table 20). Watershed improvements in these subcatchments should focus on wetland restoration, wetland enhancement, and stream restoration bordering or near these natural resources. The preservation of wetlands and lands within the 100-year floodplain will aid in reducing the impacts of future development. Passive recreational parks could be located in these subcatchments to provide buffers or linkages to Natural Heritage or other unique habitats in these subcatchments. Stormwater controls and buffering of riparian areas could be considered for these subcatchments. Other opportunities for watershed protection or enhancement should also be explored based on specific opportunities available.

Two subcatchments were identified in the WCR, which could be used as reference ecosystems to establish realistic goals for landuse. Little Flatty Creek and Raymond Creek Subcatchments are representative of the general landuse of the watershed (except for urban areas) and seem to represent attainable goals for sediment, total nitrogen, and total phosphorous. The average of total nitrogen influx (from AVGWLF model) for the two reference subcatchments (4.1 lbs/acre) is 29% less than the average for the remaining 14 subcatchments (5.3 lbs/acre) [Table 19]. This corresponds to the reduction goals identified in the Tar/Pamlico Nutrient Strategies (30% reduction of Total Nitrogen) and adopted as a goal for the Pasquotank River Watershed (Section 11.4).

Table 19:
Comparison of Nutrients and Sediment Inputs of Reference Subcatchments to the Remaining 14 Subcatchments

Subcatchment	Sediment (lbs/acre)	Total Nitrogen (lbs/acre)	Total Phosphorous (lbs/acre)
Little Flatty Creek	171	3.7	0.93
Raymond Creek	188	4.5	1.14
Average of remaining 14 Subcatchments	244	5.3	1.22

These findings will be tested with the conclusions reached during the Pasquotank River Watershed Functional Rehabilitation Modeling and Assessment.

Table 20
Functional Stressors per Subcatchments

Subcatchment	Water Quality Impairment	Significant Natural Resources	Pressures from Landuse	Other
Little Flatty Creek		Yes	Yes	Little Flatty Natural Heritage Sites
Newbegun Creek			Yes	N/A
Charles Creek			Yes	N/A
Knobbs Creek	N		Yes	Commerce Park Mega Site
Newland Drainage Canal			Yes	Obstructed Drainage
Great Dismal Swamp		Yes		Great Dismal Swamp Federal & State Parks
Joyce Creek		Yes	Yes	The Green Sea Natural Heritage Site
Hales Lake				N/A
Cooper Creek	N P			N/A
Sawyers Creek			Yes	Regulated Swine Operation
Milldam Creek	N		Yes	Whitehall Shores Hardwood Forest
Areneuse Creek	N P S		Yes	N/A
Portohonto Creek	N P S		Yes	N/A
Raymond Creek			Yes	N/A
Beaverdam Creek				N/A
Pasquotank River		Yes	Yes	Waterfront Development

Note: N, P, and S, indicate these subcatchments posses the greatest rates of nitrogen, Phosphorus and sediment loading in the Local Watershed

14.0 References

Atkins, J.B. *Agricultural Nonpoint Source Control Case Studies in North Carolina*. 1984.

Boull, Stan. *Correspondence Regarding Background Values of Soil Phosphorous Concentration*, 2002.

Breve, M.A., Skaggs, R.W., Parsons, J.E., and Giliam, J.W. *DRAINMOD-N, A Nitrogen Model for Artificially Drained Soils*. Trans of the ASAE, Vo. 40(4): 1067-1075. 1997.

Breve, M.A. *Modeling Movement and Fate of Nitrogen in Poorly Drained Soils*. PhD Thesis, North Carolina State University, Raleigh, 225p. 1994.

Center for Watershed Protection, *Derivations of Impervious Cover for Suburban Land Uses in the Chesapeake Bay Watershed*, Center for Watershed Protection, 2000.

CH2M HILL. *Stormwater Management Manual Prepared for the State of North Carolina Division of Water Quality*. 2002.

Camp, Dresser, and McKee, Inc. *Watershed Management Study: Lake Michie and Little River Reservoirs*. Report to Durham County. 1986.

Corbit, R.A. Standard Handbook of Environmental Engineering, McGraw-Hill, New York, New York, pp. 7.50-7.57. 1990.

Division of Water Quality. *Basinwide Assessment Report Chowan and Pasquotank River Basins.* January 2002.

Division of Water Quality. *Guidelines for Riparian Buffer Restoration.* January 2001.

Evans, B.A., Sheeder, S.A., Corradini, K.J. AVGWLF Users Guide Environmental Resources Research Institute Pennsylvania State University. November 2001.

Frink, C.R. *Estimating Nutrient Exports to Estuaries*. Journal of Environmental Quality 20:717-724. 1991.

Gilliam, Wendell. Telephone Correspondence Regarding Modeling Assumptions for Dissolved Nutrients. 2002.

Gilliam, Wendell. Unpublished Summary Table of TN and TP Loading for Corn-Soybean Rotation as a Function of Soil Type. 1986.

Haith, D.A., Mandel, R., and Wu, R.S. Generalized Watershed Loading Functions (GWLF) Users Manual Version 2.0. Department of Agricultural and Biological Engineering Cornell University. January 1996.

Hubbasr, R.K., Leonard, R.A. and Johnson, A.W. *Nitrate Transport on a Sandy Coastal Plain Soil Underlain by Planthite*. Transactions of the ASAE 34(3) 802-808.

Jacobs, T.C., J.W. Gilliam. *Nitrate Loss From Agricultural Drainage Waters: Implications for Non-point Source Control*. Water Resources Research Institute, Report #209. 1983.

Klein, R. "Urbanization and Stream Quality Impairment." American Water Resources Association, Water Resources Bulletin 15(4). 1979.

Langdale, G.W., Leonard, R.A, and Thomas, A.W. *Conservation Practice Effects on Phosphorus Losses From southern Piedmont watersheds*. J. Soil and Water Conservation 40(1) 157-60.

McDowell & Associates, PA. "Elizabeth City Storm water Management Plan." September 2000.

McMahon, G. and M.D. Woodside. *Mass Balance of Nutrients for the Albermarle-Pamlico Basin*. United States Geological Society (USGS). 1979.

NCDEM. *Nationwide Urban Runoff Program*: Winston Salem, NC. Water Quality Section. 1983.

North Carolina Center for Geographic Information and Analysis (NCCGIA); "Hydrography (1:24,000); Raleigh, NC; 2001.

North Carolina Division of Coastal Management " NC-CREWS: North Carolina Coastal Region Evaluation of Wetland Significance" ArcView Coverage, Raleigh North Carolina, 1999.

North Carolina Division of Coastal Management "Potential Wetland Enhancement and Restoration Sites – North Carolina Coastal Area" ArcView Coverage, Distributed by the NCCGIA, Raleigh, NC, 1999b.

North Carolina Division of Coastal Management "DCM Wetland Mapping In Coastal North Carolina" ArcView Coverage, Distributed by the NCCGIA, Raleigh, NC, 1999a.

North Carolina Division of Water Quality (NCDWQ), "Neuse River Basin: Model Stormwater Program for Nitrogen Control." Water Quality Section, Raleigh, NC, August 30, 1999.

North Carolina Division of Water Quality (NCDWQ), "Water Quality Progress in North Carolina 1998-1999 305(b) Report." Water Quality Section, Raleigh, NC, March 2000.

North Carolina Department of Agriculture. Soils Testing Data Compiled for Pasquotank, Camden, and Gates Counties. 1998-2000.

North Carolina Department of Agriculture, Agricultural and Consumer Statistics Division. www.NCAGR.com/stats/. Accessed November 2001.

North Carolina Department of Environment and Natural Resources. "Basinwide Assessment Report, Chowan River and Pasquotank River Basins." January 2002.

North Carolina Department of Natural Resources and Community Development. "Regional Inventory for Critical Natural Areas, Wetland Ecosystems, and Endangered Species Habitats of the Albemarle-Pamlico Estuarine Region: Phase 1, Albemarle-Pamlico Estuarine Study" Project No. 90-01. January 1990.

North Carolina Department of Environment and Natural Resources. "An Economic Analysis of Commercial Fisheries In the Albemarle Sound Management Area, North Carolina." Division of Marine Fisheries, Morehead City, NC 28557, June 2000.

North Carolina Land Trust (NCLT). *Pasquotank River Riparian Corridor Conservation Design*. December 2001.

Personal Communication, J.C. Roundtree dated December 2001 –*Joyce Creek Management District, Camden County*-Snag and Obstruction Removal Project within Drainage ways.

Personal Communication, Mr. Freddie O'Neil and Mr. Al Wood of the *North Carolina Cooperative Extension Service*, dated December 2001 – Distribution of crop types by subcatchment and fertilizer use by local farmers of the Pasquotank Watershed

Schueler, T. *The Importance of Imperviousness*. Watershed Protection Techniques. 1(3): 100-111. 1994.

Shellfish Sanitation Program, North Carolina Division of Health Services. *Report of Sanitary Survey, Albemarle Sound Area, Areas I-1 through I-15, 1978-1980*. July 10, 1980.

Shellfish Sanitation Branch, North Carolina Division of Environmental Health. *Report of Sanitary Survey, Albemarle/Currituck Sound Areas, Areas I-1 thru I-16, December 1989-May 1990*. June 1990.

Shellfish Sanitation Branch, North Carolina Division of Environmental Health. *Report of Sanitary Survey, Albemarle/Currituck Sounds Areas, Areas I-1, I-3 through I-16, June 1990-May 1993*. September 1993.

Shellfish Sanitation Section, North Carolina Division of Environmental Health. *Report of Sanitary Survey Albemarle/Currituck Sounds Areas, Areas I-1, I-3 through I-16, July 1991-September 1997*. February 1998.

Shellfish Sanitation Section, North Carolina Division of Environmental Health. *Report of Sanitary Survey, Albemarle/Currituck Sounds Areas, Areas I-1, I-3 through I-16, January 1995-April 2001*. October 2001.

Shellfish Sanitation Section, North Carolina Division of Environmental Health. *Evaluation of Shellfish Waters, July 21, 1972*.

Skaggs, Gilliam, Sheets, and Barnes. *Effect of Agricultural Land Development in Drainage Waters in the North Carolina Tidewater Region*. Water Resources Research Institute. Report #159. 1980.

Spruill, T.B., Eimers, J.L., Morey, A.E. *Nitrate-Nitrogen Concentrations in Shallow Groundwater of the Coastal Plain of the Albermarle-Pamlico Drainage Study Unit*, North Carolina and Virginia. Fact Sheet 241-96. United States Geological Survey. 1996.

Stanley, D. *Historical Trends in Nutrient Loading to the Neuse River Estuary*. Proceedings of Symposium on Coastal Water Resources. 1988.

Thompson, Michael T. *Forest Statistics for the Northern Coastal Plain of North Carolina*, 1990. Resource Bulletin SE-113, US Dept. of Agriculture Forest Service. 1990.

Tyler, E.L. *Re-Authorization of the Clean Water Act*, The Universities Council on Water Resources, Water Resources Update, Spring 1992, Issue No. 88, pp. 1992.

United States Environmental Protection Agency, Office of Water Quality. "Stressor Identification Guidance Document", EPA 822-B-00—25, Washington DC 20460. December 2000.

United States Geological Society (USGS). *National Water- Quality Assessment of the Albemarle-Pamlico Drainage Basin, North Carolina and Virginia- Characterization of Suspended Sediments, Nutrients and Pesticides*. Open-File Report 95-191. 1995.

United States Geological Society (USGS). *Water Quality in the Albermarle-Pamlico Basin 1992-95*. Circular 1157. 1995.

United States Geological Society (USGS). Water Quality Surface and Groundwater Monitoring Data. 1995- present.

Zarbock, H, Janicki, A., Wade, D., Janicki, S., and Pribble, R. *Model Based Estimates of Total Nitrogen Loading to Tampa Bay*. *Technical publication 05-96*. Prepared for Tampa Bay National Estuary Program. St. Petersburg, Florida. 1996.

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Appendix A - US Army Corps of Engineers Regulatory Letter No. 02-2

Please refer to the US Army Corps of Engineers web page:
http://www.saw.usace.army.mil/wetlands/Mitigation/stream_mitigation.html

Functions	*Subfunctions*	*Indicators*	*Objective*	*Explanation*	*Attributes*	*Constraints*	*Explanation*	*Data Req'ts*
I. WATER QUALITY	IA. Nonpoint Source Function - Prevention or removal of particulates, nutrients, or toxins from surface water runoff.	Runoff - Proximity to Source (A1)	Prevention	Proximity to sources considers the likelihood of polluted runoff entering the wetland based on predominant adjacent land uses. The more of the perimeter of the wetland surrounded by nonpoint-source-producing land uses, the higher the rating.	H - >20% perimeter agriculture + developed; M - >20% perimeter agriculture + developed + pine plantation; L - </= 20% perimeter agriculture + developed + pine plantation.	Runoff Prevention	Proposed restoration or enhancement site is not located in areas where land use activities can be modified to reduce sources of NPS pollution.	Proximity of surrounding land uses
		Runoff - Proximity to Water Body (A2)	Retention	Proximity to surface water body is an indicator of the likelihood that polluted runoff entering the wetland would otherwise enter surface water. Wetlands close to permanent surface water are rated High; those close to intermittent streams are rated Moderate; and those not close to any surface water are rated Low.	H - Within 300 ft. of permanent surface water; M - Within 300 ft. of intermittent surface water; L - > 300 ft. from permanent or intermittent surface water.	Runoff Retention	Proposed restoration or enhancement site is not located within 300 ft. of a permanent or intermittent surface water body. Retention of runoff function will not be achieved.	Water body: permanent and intermittent surface water

		Runoff - Proximity to Headwaters; stream order (A3)	Removal	The "higher" in its watershed a wetland lies. The greater is the potential effect of NPS removal on overall watershed quality.	H - Intermittent or first order stream; M - Second or third order stream; L - Higher than third order stream.	Runoff Removal	Proposed restoration or enhancement site does not contain wetlands that will enhance water quality by acting as traps for nutrients and sediments in polluted runoff.	Stream order classification
		Runoff - Site Conditions, Wetland Type (A4a)	Removal	Site conditions are determined by the biotic and physical structure typical of the wetland type and by the properties of the predominant underlying soil. Wetland type (4a) breakdowns are based on field data on indicators of wetland capacity for nutrient transformation and processing and removal of sediment and dissolved materials.	H - Bottomland hardwood, swamp forest, headwater swamp; M - Freshwater marsh, pine flat, hardwood flat, pocosins, maritime forest; L - Pine plantations, altered sites	Runoff Removal	Proposed restoration or enhancement site does not contain a wetland capacity for nutrient transformation and processing and removal of sediment and dissolved materials.	Wetland Type

		Runoff - Site Conditions, Soil (A4b)	Removal	The finer the texture and the higher the organic matter content of the soil, the higher its cation exchange capacity and the more effective it is in retaining transforming nutrients.	H - Histosol or frequently flooded mineral soil with high clay and organic matter; M - Infrequently flooded mineral soil with high clay and organic matter; L - Infrequently flooded mineral soil with low clay and organic matter.	Runoff Removal	Proposed restoration or enhancement site is not located in an area where organic matter content of the soil and its cation exchange capacity would be effective in retaining or transforming nutrients.	Soils: Histosols, frequently flooded with high clay and organic matter
	IB. Floodwater Cleansing Function	Flooding - Water Source (B1a)	Removal of sediments, nutrients, toxins that have already entered surface water.	Water source and proximity to sources indicates whether pollutants are likely to be present in a stream.	H - In floodplain of Piedmont-draining stream or upstream HU > 50% agricultural + developed; M - In floodplain of coastal plain draining stream w/ upstream HU < 50% agricultural + developed; L - Not in floodplain.	Pollutant removal	Proposed restoration or enhancement site is not located adjacent to degraded streams (arising in Piedmont) and would not have the capacity to intercept and cleanse sediments, nutrients, and toxins in surface waters that enter a wetland through overbank flow.	Location of stream in HU; Surrounding land use

		Flooding - Water Source (B1b)	Removal of sediments, nutrients, toxins that have already entered surface water.	Water source and proximity to sources indicates whether pollutants are likely to be present in a stream.	H - > 25% of stream length in HU bordered by agricultural or developed land; M - 5-25% of stream length bordered by agricultural or developed land; L - < 5% of stream length bordered by agricultural or developed land.	Pollutant removal	Proposed restoration or enhancement site is not located adjacent to degraded streams (from local upstream sources) and would not have the capacity to intercept and cleanse sediments, nutrients, and toxins in surface waters that enter a wetland through overbank flow.	Location of stream in HU; Surrounding land use
		Flooding - Duration (B2)	Removal	The longer floodwater remains in a wetland, the greater is the level of pollutant removal that occurs.	H - Wetland is flooded 'long to very long' periods; M - Wetland is flooded 'brief' periods; L - Wetland is flooded 'very brief' periods or not at all.	Pollutant removal	Same	Floodplain boundaries

		Site Conditions - Wetland Type and Soil (B3a)	Removal	Wetland type breakdowns are based on field data of indicators of capacity for nutrient transformation and processing, removal of dissolved materials, organic carbon transport, and retention of woody materials to provide onsite energy sources for microbial activity.	H - Bottomland hardwood, swamp forest; L - Other wetland types.	Pollutant removal	Same	Wetland type
		Site Conditions - Wetland Type and Soil (B3b)	Removal	The finer the texture and the higher the organic matter content of the soil, the higher is its cation exchange capacity and the more effective it is in retaining and transforming nutrients and toxins.	H - Histosol or frequently flooded mineral soil with high clay and organic matter; M - Infrequently flooded mineral soil with high clay and organic matter; L - Infrequently flooded mineral soil with low clay and organic matter.	Pollutant removal	Proposed restoration or enhancement site is not located in an area where organic matter content of the soil and its cation exchange capacity would be effective in retaining or transforming nutrients.	Soils: Histosols, frequently flooded with high clay and organic matter

		Width of Wetland Perpendicular to Stream (B4)	Removal	The wider a wetland is along a stream, the more area there is available for water retention and pollutant removal.	H - > 100 ft.; M - 50-100 ft.; L < 50 ft.	Pollutant removal	Proposed restoration or enhancement site is not located adjacent to degraded streams (from local upstream sources) and would not have the capacity to intercept and cleanse sediments, nutrients, and toxins in surface waters that enter a wetland through overbank flow.	Wetland size

II. HYDROLOGY	IIA. Surface Runoff Storage	Watershed Position (A1)	Storage	Wetlands along headwater streams receive proportionately more overland runoff than downstream wetlands, and their position high in the watershed results in their water storage capacity having greater impact on overall watershed hydrology.	H - Intermittent or first order stream; M - second or third order stream; L - > third order stream.	Runoff Storage	Proposed restoration or enhancement site is not adjacent to a permanent or intermittent surface water body. Storage of runoff function will not be achieved.	Wetland location
		Wetland Size (A2)	Storage	Based on hydrologic modeling, the water storage capacity of a wetland equal in size to .54% of total wetland area will result in a decrease in peak discharge of 1%. Water storage in a wetland less than .05% of the watershed area will result in a decrease in peak discharge of less than .1%	H - Wetland is >.54% of total HU area; M - Wetland is .05 - .54% of HU area; L - Wetland is < .05% of HU area.	Runoff Storage	Proposed restoration or enhancement site does not contain sufficient wetland area to decrease peak floodwater discharge.	Wetland size

		Site Condition, Wetland Type (A3a)	Storage	Wetland type breakdown are based on field data on such indicators of surface water storage capacity as microtopographic complexity, evidence of soil reduction, and evidence of standing water.	H - Bottomland hardwood, swamp forest, headwater swamp, freshwater marsh; M - Hardwood flat, pocosin, maritime forest; L - Pine flat, pine plantation, altered site.	Runoff Storage	Proposed restoration or enhancement site does not contain a wetland with sufficient storage capacity for nutrient transformation and processing and removal of sediment and dissolved materials.	Wetland type
		Site Condition, Soil Infiltration (A3b)	Storage	The infiltration capacity of the underlying soil determines the amount of water the soil can receive and store before additional water will run off. Hydrologic groups are used in soil surveys to indicate a soil's capacity for water intake when the soils are wet and receive precipitation from long-duration storms.	H - Soil Hydrologic group A, B, or A/D; M - Soil Hydrologic group C, or B/D; L - Soil Hydrologic group D.	Runoff Storage	Proposed restoration or enhancement site does not have soils with sufficient storage capacity for nutrient transformation and processing and removal of sediment and dissolved materials.	Soils: hydrologic group

	IIB. Floodwater Storage	Duration of Flooding (B1)	Storage	Duration of flooding is a measure of the length of time the soil surface is covered by flowing water from flowing streams. The longer the time during which the wetland holds flood water, the greater its significance in performing this subfunction.	H - Wetland is flooded 'long to very long' periods; M - Wetland is flooded 'brief' periods; L - Wetland is flooded 'very brief' periods or not at all.	Floodwater Storage	Proposed restoration or enhancement site does not store flood waters for sufficient time to alleviate downstream flooding.	Floodplain boundaries
		Wetland Size (B2)	Storage	Even if a wetland is relatively narrow along a stream, if it is of considerable length and thus large size, it can store significant amounts of water.	H - Wetland is >.54% of total HU area; M - Wetland is .05 - .54% of HU area; L - Wetland is < .05% of HU area.	Floodwater Storage	Proposed restoration or enhancement site does not contain sufficient wetland area to store peak flood water.	Wetland size
		Watershed Position (B3)	Storage	Wetlands along large streams further downstream in a watershed are the most significant in receiving and holding in-stream flood waters.	H - > third order stream; M - second or third order stream; L - intermittent or first order stream.	Floodwater Storage	Proposed restoration or enhancement site does not store flood waters for sufficient time to alleviate downstream flooding.	Wetland location
		Width of Wetland Subject to Flooding (B4)	Storage	The wider a wetland is along a stream, the more area is available over which flood waters can spread.	H - > 100 ft.; M - 50-100 ft.; L < 50 ft.	Floodwater Storage	Proposed restoration or enhancement site does not store flood waters for sufficient time to alleviate downstream flooding.	Wetland size

	IIC. Shoreline Stabilization Function	Proximity to Water Body (C1)	Erosion	If a wetland occupies a shoreline, the larger the stream or the greater the fetch of open water, the more erosive force is likely to be present.	H - < 50 ft. from shoreline of a second or higher order stream or of an estuary or lake shoreline; M - < 50 ft. from an estuary shoreline; L - >/= 50 ft. from any stream or > 300 ft. from an estuary shoreline.	Erosion Control	Proposed restoration or enhancement site is not located on a shoreline and cannot reduce the energy of water movement in the watershed.	Wetland location and classification
		Length of Wetland Border Exposed to Open Water (C2)	Erosion	The longer the length of shoreline that the wetland occupies, the more significant is this function in relation to other wetland functions.	H - > 500 ft. of wetland perimeter borders open water; M - 100-500 ft. of perimeter borders open water; L - < 100 ft. of perimeter borders open water.	Erosion Control	Proposed restoration or enhancement site does not border on open water.	Wetland location and classification
		Watershed Land Use (C3)	Erosion	The flow rate and erosive force of a stream are increased by more rapid runoff of storm water from cleared and developed land than from forested land.	H - >/= 1% developed <u>or</u> > 20% developed + agriculture; L - < 1% developed <u>or</u> < 20% developed + agriculture.	Erosion Control	Proposed restoration or enhancement site is not located near developed or agricultural land.	Wetland location and classification

III. HABITAT	IIIA. Endangered Species/Significant Natural Areas	Exceptional Habitat Functions (A)	Habitat Function	If threatened or endangered species on either federal or state lists are verified as present or if the area is identified as exemplary or unique natural ecosystem or special wildlife habitat by the State Natural Heritage Program, the wetland as a whole is rated as having Exceptional functional significance.	H - Presence of threatened or endangered species on either federal or state lists or area is identified as exemplary or unique natural ecosystem or special wildlife habitat.	Protected Species and Habitats	Proposed restoration or enhancement site contains the potential presence of threatened or endangered species, exemplary or unique natural ecosystem. or special wildlife habitat.	Federal and State lists of threatened and endangered species; NC Natural Heritage database

	IIIB. Terrestrial Wildlife Habitat	Internal Habitat (B1a)	Habitat Function	For interior dwelling species, as opposed to 'edge' species, the larger the area of unbroken habitat the better.	H - > 74 acres; M - 0-74 acres; L - No interior habitat.	Habitat Function	Proposed restoration or enhancement site limited or no interior habitat.	Interior habitat is calculated as the area remaining after the total size of the habitat complex is reduced inward 100 meters from its boundaries to compensate for edge effects.
		Association with surface water (B1b)	Habitat Function	Availability of surface water is important to many species and limiting to some. Even if species live elsewhere and visit the wetland to drink, the presence of water results in the area being more heavily used and having high habitat significance.	H - Adjacent to permanent surface water; M - Adjacent to intermittent streams; L - Not adjacent to surface water.	Habitat Function	Proposed restoration or enhancement site is not adjacent to permanent surface water or intermittent stream.	Wetland location
		Internal Heterogeneity of Habitat Complex (B1c)	Habitat Function	Areas with higher internal heterogeneity generally provide suitable habitat for more species and often better habitat for individual species due to greater food sources, nesting sites and cover. Internal heterogeneity is measured by the number of vegetation types present in the habitat complex.	H - > 8 vegetation types within complex; M - 5-8 vegetation types within complex; L - 1-4 vegetation types within entire complex.	Habitat Function	Proposed restoration or enhancement site does not provide sufficient internal heterogeneity.	Vegetation type

		Wetland Type (B1d)	Habitat Function	1d. The wetland type breakdown is based on analysis of field data for food and cover values typical of different wetland environments and on available literature on the habitat value of different wetland types.	H - Bottomland hardwood, freshwater marsh, hardwood flat, swamp forest; M - Headwater swamp, pocosin, pine flat, maritime forest; L - Pine plantation, altered site.	Habitat Function	Proposed restoration or enhancement site provides relatively little natural habitat value.	Wetland type
		Landscape Habitat, Wetland Juxtaposition (B2a)	Habitat Function	Compatible adjacent habitats provide animals access to additional food and cover, safer dispersal into other areas, and refuge from temporarily adverse in the wetland.	H - > 50% of wetland bordered by other wetlands; M - < 50% of wetland bordered by other wetlands; L - Isolated from other wetlands.	Habitat Connectivity	Proposed restoration or enhancement site does not provide habitat through connections with a wetland complex.	Wetland and vegetative cover type.
		Landscape Habitat, Surrounding Habitat (B2b)	Habitat Function	Same.	H - > 50% of land cover w/in 1/2 mile composed of natural vegetation; M - of land cover w/in 1/2 mile buffer composed of combination of natural vegetation, pine plantation, and agriculture; L - > 20% of land w/in 1/2 mile developed or < 10% natural vegetation.	Habitat Connectivity	Proposed restoration or enhancement site does not have compatible habitat within 1/2 mile.	Wetland and vegetative cover type.

		Movement System Value, Corridor Value (B3a)	Habitat Function	A wildlife corridor is a potential movement pathway through areas of unsuitable habitat such as agricultural or developed land. The corridor can include natural upland vegetation as well as wetland.	H - Corridor > 600 ft. wide connected to contiguous natural vegetation; M - Corridor < 600 ft. wide connected to contiguous natural vegetation; L - Isolated from other natural vegetation.	Wildlife Movement	Proposed restoration or enhancement site is isolated from other wetlands or contiguous natural vegetation.	Wetland and vegetative cover type.
		Movement System Value, Wetland Island Function (B3b)	Habitat Function	Non-continuous islands of habitat can also provide movement pathways for wildlife, provided that these islands are of sufficient size and within reasonable travel distance of one another.	H - Isolated wetland > 5 acres in size w/in 1/2 mile of the same; M - Isolated wetland > 5 acres in size w/in 1/2 mile of the same; L - Wetland < 1 acre or > 1/2 mile from nearest wetland.	Wildlife Movement	Proposed restoration or enhancement site is isolated from other wetlands or contiguous natural vegetation.	Wetland and vegetative cover type.

	IIIC. Aquatic Life Habitat	Anadromous Fish (C1)	Aquatic Habitat Function	Wetlands along streams harboring anadromous fish can provide breeding habitat for these important species. Anadromous species often move far up tributary streams to breed. Floodwater must enter the wetland, however, to provide access and habitat, and channelization inhibits this process. Streams that are not channelized, diked, or impounded or otherwise artificially altered are assumed to flood annually.	H - Adjacent to a river or tributary of a river harboring anadromous fish; annual flooding; not channelized; M - Adjacent to a river or tributary of a river harboring anadromous fish; stream is channelized; L - Not adjacent to a river or tributary of a river harboring anadromous fish.	Habitat Function	Proposed restoration or enhancement site is not adjacent to a river or tributary of a river harboring anadromous fish.	Aquatic species inventories; stream types and geometry
		Other Fish Species (C2)	Aquatic Habitat Function	Many stream dwelling fish species utilize flooded wetlands for food, cover, and breeding. The larger the stream, the more significant is this function due to the greater numbers of fish and longer periods of flooding.	H - Adjacent to > third order stream w? annual flooding; M - Adjacent to a first to third order stream w? annual flooding or a channelized stream of > third order; L - Not adjacent to a stream or stream has infrequent or nonexistent flooding.	Habitat Function	Proposed restoration or enhancement site is not adjacent to a stream or stream has infrequent or nonexistent flooding.	Aquatic species inventories; stream types and geometry

		Amphibians and Vertebrates, Wetland Type (C3a)	Aquatic Habitat Function	Best habitat for amphibians and aquatic invertebrates exists in areas that provide water for egg-laying and larval development yet exclude predatory fish. This occurs in wetlands where isolated vernal pools persist long enough to allow larval development to maturity. Optimum habitat must also include adjacent non-aquatic areas for adult stages.	H - Bottomland hardwood, swamp forest, headwater swamp, freshwater marsh; M - Hardwood flat, pocosin, maritime forest; L - Pine flat, pine plantation, altered site.	Habitat Function	Proposed restoration or enhancement site does not provide water for egg-laying and larval development for amphibians and aquatic invertebrates.	Wetland type, vegetative cover, aquatic species inventories
		Amphibians and Vertebrates, Surrounding Habitat (C3b)	Aquatic Habitat Function	Same	H - > 50% of land cover w/in 1/2 mile composed of natural vegetation; M - of land cover w/in 1/2 mile buffer composed of combination of natural vegetation, pine plantation, and agriculture; L - > 20% of land w/in 1/2 mile developed or < 10% natural vegetation.	Habitat Function	Proposed restoration or enhancement site is not adjacent to non-aquatic areas for adult stages of amphibians and aquatic invertebrates.	Wetland type, percent vegetative cover by type

IV. POTENTIAL RISK OF WETLAND LOSS	Landscape Character (IVA)	Wetland Extent and Rarity - Percent Wetlands (A1a)	Management	Wetland extent and rarity measures how common wetlands are in the landscape. The higher the proportion of a watershed's land area that is occupied by wetlands, the less vital to the watershed's integrity is one particular wetland. Values are based on conditions in the NC coastal area, where wetlands often comprise 50% or more of the land area. Values would be different for other landscapes with fewer wetlands.	H - < 20%; M - 20-50%; L - > 50%.	Wetland Risk	Proposed restoration or enhancement site in a HU with wetland area > 20%. Restoration or enhancement of wetland function, particularly in areas where the percent of HU is < 20%.	Percent land use cover by category
		Wetland Extent and Rarity - Percent Wetlands (A1b)	Management	This is a rating of this type of wetland in the larger landscape. In terms of its contributions to landscape diversity, the rarer the wetland type, the greater is its significance.	H - < 10%; M - 10-25%; L - > 25%.	Wetland Risk	Proposed restoration or enhancement site is	Percent land use cover by category
		Land Use in Hydrographic Unit, Percent of Land in Agricultural Use (A2a)	Management	Agricultural land is a significant source of nonpoint source pollution. The more agricultural land in the landscape, the more significant are the wetlands in removing pollutants before they enter surface waters.	H - > 40%; M - 10-40%; L - < 10%.	Wetland Extent	Proposed restoration or enhancement site is located in agricultural areas.	Percent land use cover by category

		Land Use in Hydrographic Unit, Percent of Land in Pine Plantations (A2b)	Management	Pine plantations are the most common form of intensive forest management. During the harvest and the regeneration stages of the management cycle, they can be significant sources of nonpoint source pollution.	H - > 30%; M - 10-30%; L - < 10%.	Wetland Extent	Proposed restoration or enhancement site is located in areas containing extensive pine plantations.	Percent land use cover by category
		Land Use in Hydrographic Unit, Percent of Land in Urban/Developed Use (A2c)	Management	Land development increases surface runoff, increases pollutant loadings, and destroys wildlife habitat. As development increases, all the functions of remaining wetlands become more significant. Since this is the most intensive land use with the most adverse impacts, only a small proportion of the landscape needs to be developed to give wetlands a High rating.	H - >1%; M - 0.1-1%; L - < 0.1%.	Wetland Extent	Proposed restoration or enhancement site is located in areas with intensive urban and other development types.	Percent land use cover by category

	Watershed Water Quality Characteristics (IVB)	Classification of Major Water Body in Watershed (B1)	Management	Maintaining the quality of water bodies with high water quality classification is an important consideration. Water bodies that are subject to high nutrient concentrations or have been identified as impaired where uses can be restored, prevention of pollutant additions are significant to maintaining wetland functions.	H - SA, ORW, HQW, WS-I, WS-II, NSW, URW; M - B, WS-III, SB; L - C, CS.	Water Quality	Proposed restoration or enhancement site is subject to high nutrient concentrations or has been identified as impaired.	Water quality classification, on-site data collection
		Use Support of Water Bodies in Watershed (B2)	Management	Use support designations indicate water quality impairment in relation to use classification. The more impaired waters exist in a watershed, the more significant wetland functions in maintaining water quality.	H - > 25% of stream miles or water body area in watershed less than fully supporting; M - 10-25% of stream miles or water body area in watershed less than fully supporting; L - < 10% of stream miles or water body area in watershed less than fully supporting.	Water Quality	Proposed restoration or enhancement site is characterized as to indicate water quality impairment in relation to use classification.	Water quality classification, on-site data collection

		Classification of Water Body Receiving Watershed output (B3)	Management	If the water body receiving the output from the watershed is classified such that prevention of additional pollutant loading is highly significant, then wetlands in the watershed are of greater significance in maintaining water quality.	H - SA, ORW, HQW, WS-I, WS-II, NSW, URW; M - B, WS-III, SB; L - C, CS.	Water Quality	Proposed restoration or enhancement site receiving the output from the watershed is classified such that prevention of additional pollutant loading is highly significant.	Water quality classification, on-site data collection
	Replacement Difficulty for Wetland Functions (IVC)	Wetland Type (C1)	Replacement, Revegetation	Wetland types in the lowest group are relatively easy to restore. Those in the middle group are more difficult to restore hydrologically, and their vegetation takes a long time to mature. Wetlands in the highest group are very difficult to restore due to the peculiar nature of their hydrology and the unique site requirements of their vegetation.	H - Pocosin, maritime forest; M - Bottomland hardwood, swamp forest, headwater swamp, hardwood or pine flat; L - Freshwater marsh, pine plantation.	Functional Enhancement or Replacement	Wetlands in the highest group are very difficult to restore due to the peculiar nature of their hydrology and the unique site requirements of their vegetation.	Wetland Type

		Replacement Site Availability (C2)	Replacement	If degraded wetland of the same type exists in the watershed, it would be relatively simple to restore it to replace this wetland's functions. Restoring a sire that has been completely converted but is otherwise suitable is more difficult, but still possible. If there is no suitable restoration site in the watershed, replacing this wetland's functions is essentially impossible. Potential restoration sites are located and classified by DCM's restoration site mapping which is done in conjunction with mapping existing wetlands.	H - No replacement site identified in watershed; M - Non-wetland restoration site available in watershed; L - Degraded wetland site of same types identified in watershed.	Functional Enhancement or Replacement	There is no suitable restoration site in the watershed, replacing this wetland's functions is essentially impossible.	Wetland: Site Availability

	Enhancement Potential of Site (IVD)		Enhancement	If a wetland has low functional significance because it is degraded due to drainage or other disturbance, it may still have the potential to be restored to higher levels of function to replace functions lost elsewhere. The closer the wetland is to its fully functioning state, i.e., the less it has been disturbed, the more practical is its restoration and the higher is its significance as a potential restoration site.	H - Drained or partially drained wetland w/ natural vegetation intact; M - Drained or partially drained and converted to pine plantation or other intensively managed forest type; L - wetland intact but low functional significance.	Functional Enhancement or Replacement	Proposed restoration or enhancement site has a high potential to replace functions lost elsewhere.	Wetland field evaluation

Appendix C Table 1

Grandy Primary School, Camden County, NPDES Monitoring Data, 1999-2001

Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	Temperature (°C)	pH (Standard Units)	Total Suspended Residue (mg/l)	BOD 20°C	Ammonia Nitrogen (mg/l)	Fecal Coliform #/100ML
Jan-99	0.0039	10.3	7.2	9.9	17.2	3.53	1
Feb-99	0.0036	11.8	7.2	11	18	4.01	1
Mar-99	0.0036	12	7.38	6.8	9	4.59	1
Apr-99	0.0034	15.4	7.35	11.4	5.5	4.78	21.5
May-99	0.0041	18.8	7.25	8.9	5.1	5.37	1
Jun-99	0.0038	23.1	7.3				
Jul-99							
Aug-99		24.9	7.5		1.1		
Sep-99	0.0035	22.5	6.66	5.6	6.7	2.06	77.5
Oct-99	0.0039	18.4	7.2	19.6	5.9	1.77	9.8
Nov-99							
Dec-99	0.0035	13.1	6.8	5.3	2.6	5.46	1
Jan-00	0.0036	12.3	6.85	6.6	12	9.73	1
Feb-00	0.0033	8.2	7.02	7.9	12.5	8.07	7.3
Mar-00	0.0037	14	6.85	3.8	8.1	3.88	1
Apr-00	0.0035	15.8	6.8	2.9	2.3	1.8	1
May-00	0.0041	19.6	7	5.7	6.9	5.52	3.2
Jun-00	0.0039	20					
Jul-00							
Aug-00	0.0043	23.2	6.3	2.2	2.7	1.74	<1
Sep-00	0.0032	21.3	6.35	2.5	2	2.01	4.5
Oct-00	0.0039	18.4	6.7	2.4	2.5	1.42	1
Nov-00	0.0038	13.2	6.52	35	3.5	5.22	1
Dec-00	0.0036	10.1	6.3	8.4	4.9	5.49	1
Jan-01	0.0039	7.3	6.62	5.4	7.7	7.27	1
Feb-01	0.0041	9.3	6.35	16	5.1	4.99	1
Mar-01	0.0042	9.8	6.57	20	5.5	1.56	94.3
Apr-01	0.004	14.7	6.15	5.5	8.3	5.61	1.4
May-01	0.0039	18	6.3	5.2	5	5.93	1
Jun-01							
Jul-01							
Aug-01	0.0042	25	6.44	8.9	4.7	3.8	16.4
Sep-01	0.0032	22.8	6.2	3.2	3.6	2.72	1
Oct-01	0.0032	17.6	6.32	3.7	2.4	4.37	3.2
Nov-01							
Dec-01							

Appendix C Table 2

Elizabeth City Waste Water Treatment Plant, NPDES Monitoring Data, 1999-2001

Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	Temperature (°C)	pH (Standard Units)	Total Suspended Residue (mg/l)	BOD 20°C	COD	Ammonia Nitrogen (mg/l)	Fecal Coliform #/100ML	Disolved Oxygen (mg/l)
Jan-99	3.839	16	7.15	5	2		0.2	6	
Feb-99	3.16	16	7.2	6	2		0.1	16	
Mar-99	2.25	15	7	6	2		0.2	4	
Apr-99	2.23	18	7	7	2		0.1	14	
May-99	1.966	21	7	17	5		0.4	55	8.2
Jun-99	2.04	24	7.25	7	3		0.1	64	7.59
Jul-99									
Aug-99	2.19	26.59	7.35	5.273	3		0.57	29	7.58
Sep-99	4.33	23.7	7	13.86	3		0.57	106	7.34
Oct-99	3.102	21.9	7.1	12.52	3		0.1	66	7.923
Nov-99									
Dec-99									
Jan-00	2.28	13.99	7	23.39	4.15		1.1	32	9.16
Feb-00	2.42	14.3	7	12.14	3		1.1	40	9.27
Mar-00	2.06	17.46	6.95	8.774	3.3		0.79	229	8.942
Apr-00	2.3	18.76	6.9	7.211	3.15		0.16	32	8.574
May-00	3.08	22.5	7	13.82	5.69		0.065	42	8.1
Jun-00	3.762	25.314	7	9.09	4.85		0.363	41	7.943
Jul-00									
Aug-00	3.399	26.6	7.1	7.6	2.9		0.93	29	7.58
Sep-00	4.086	24.9	7	8.1	2.8		0.005	37	7.63
Oct-00									
Nov-00	1.76	19.1	6.9	5.3	2.2		0.02	21	8.45
Dec-00	1.67	15.4	6.9	9.1	2.4		0.09	21	8.98
Jan-01	1.68	13.9	6.75	7.6	3		0.21	10	9.21
Feb-01	1.907	15.3	6.9	8.6	3.7		0.42	11	8.6
Mar-01	2.17	16	7	17.3	4.5		0.04	75	9.39
Apr-01	2.19	18.7	6.75	10.8	4		0.04	39	8.72
May-01	2.302	22.5	6.7	15.3	5.1		0.24	37	7.91
Jun-01	3.079	25.2	6.75	8	2.9		0.094	21	7.78
Jul-01	2.609	26.4	7.15	5.5	2.06		0.01	25	7.5
Aug-01	3.041	26.9	7.2	4.8	3.3		0.119	28	7.41
Sep-01	2.343	25	7.15	3.6	2.8		0.26	41	7.58
Oct-01	1.8		7.25	12.1	10.2		10.7	25	7.5
Nov-01									
Dec-01									

Appendix C Table 2 (cont.)
Elizabeth City Waste Water Treatment Plant, NPDES Monitoring Data, 1999-2001
Pasquotank River Local Watershed Restoration Plan

Date	Total Nitrogen (mg/l)	Total Phosphorous (mg/l)	Total Cyanide (ug/l)	Arsenic (mg/l)	Cadmium (mg/l)	Chromium (mg/l)
Jan-99	8.52	0.72	<5			
Feb-99	8.19	0.09	<5			
Mar-99	13.61	0.17	<5			
Apr-99	7.01	0.32	<5			
May-99	13.52	2.92	5			
Jun-99	11.26	0.73				
Jul-99						
Aug-99	7.22	1.95				
Sep-99	3	0.2				
Oct-99	7.99	0.36				
Nov-99						
Dec-99						
Jan-00	9.95	1.31				
Feb-00	8.34	0.48				
Mar-00	9.07	0.26				
Apr-00	8.58	0.25				
May-00	10.83	0.97				
Jun-00	6.66	0.22				
Jul-00						
Aug-00	9.8	0.21				
Sep-00	6.62	0.52				
Oct-00						
Nov-00	12.15	0.08				
Dec-00	11.62	0.35				
Jan-01	10.49	0.2				
Feb-01	11.6	0.26				
Mar-01	10.59	0.4				
Apr-01	9.78	0.3				
May-01						
Jun-01	9.19	0.57				
Jul-01	8.31	0.24				
Aug-01	1.6	0.2				
Sep-01						
Oct-01	18.7	0.63				
Nov-01						
Dec-01						

Appendix C Table 3

Elizabeth City WTP, NPDES Monitoring Data, 1999-2001

Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	Temperature (°C)	pH (Standard Units)	Total Suspended Residue (mg/l)	BOD 20°C	Ammonia Nitrogen (mg/l)	Fecal Coliform #/100ML	Disolved Oxygen (mg/l)
Jan-99	0.062		10.4	12.25				
Feb-99	0.074		10.4	15				
Mar-99								
Apr-99	0.065		10.5	10.75				
May-99	0.033		10.3	10.5				
Jun-99	0.028		9.9	6				
Jul-99	0.023		10	4.5				
Aug-99								
Sep-99	0.029		7.4	14				
Oct-99	0.033		7.1	14				
Nov-99	0.28		8.1	9.5				
Dec-99	0.027		8.15	15.5				
Jan-00	0.036		7.5	18.75				
Feb-00	0.031		7.8	16.5				
Mar-00	0.042		7	12.5				
Apr-00								
May-00	0.051		8.4	15				
Jun-00	0.029		8.7	21.25				
Jul-00	0.033		8.15	13.5				
Aug-00	0.026		8.9	18				
Sep-00	0.052		8.6	15				
Oct-00	0.029		8.9	12.5				
Nov-00	0.042		8.8	13				
Dec-00	0.035		8.8	3				
Jan-01								
Feb-01								
Mar-01	0.083		8.8	27.5				
Apr-01	0.053		7.85	20				
May-01	0.052		8.8	25				
Jun-01	0.06		8.9	23.5				
Jul-01	0.06		8.9	21.5				
Aug-01	0.066		8.6	23				
Sep-01	0.0585		8.57	23.75				
Oct-01	0.075		8.75	20				

Appendix C Table 3

Elizabeth City WTP, NPDES Monitoring Data, 1999-2001

Pasquotank River Local Watershed Restoration Plan

Date	Total Nitrogen (mg/l)	Total Phosphorous (mg/l)
Jan-99		
Feb-99		
Mar-99		
Apr-99		
May-99		
Jun-99		
Jul-99		
Aug-99		
Sep-99		
Oct-99		
Nov-99		
Dec-99		
Jan-00		
Feb-00		
Mar-00		
Apr-00		
May-00		
Jun-00		
Jul-00		
Aug-00		
Sep-00		
Oct-00		
Nov-00		
Dec-00		
Jan-01		
Feb-01		
Mar-01		
Apr-01		
May-01		
Jun-01		
Jul-01		
Aug-01		
Sep-01		
Oct-01		

Appendix C Table 4
South Mills WTP, NPDES Monitoring Data, 1999-2001
Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	Temperature (°C)	pH (Standard Units)	Total Suspended Residue (mg/l)	Total Fe (mg/L)
Jan-99	0.165	16	8	15	5798
Feb-99	0.0166	10	8.05	14	3205
Mar-99	0.0159	17	8.05	8.3	2248
Apr-99	0.0159	16	8.05	2.7	866
May-99	0.0166	17	8.1	2.3	1759
Jun-99	0.016	20	8	1.5	1247
Jul-99	0.0156	21	8	3.3	1347
Aug-99	0.0158	0.17	8	6.1	1764
Sep-99	0.0155	20	8	5.5	5210
Oct-99	0.0155	0.21	5.7	3.6	3635
Nov-99	0.014	0.21	5.7	2.4	3021
Dec-99					
Jan-00	0.014	0.17	6.1	4.4	6988
Feb-00	0.0146	0.16	5.57	3.6	4185
Mar-00	0.0144	0.16	5.45	3	2373
Apr-00	0.015	0.17	5.7	4.6	2854
May-00	0.0146	0.2	5.65	1.75	2181
Jun-00	0.0154	0.2	6.36	3.3	2313
Jul-00	0.0145	21	6.56	3.8	1786
Aug-00	0.015	23.25	6.65	2	36935
Sep-00	0.0237	22	6.76	1.76	4230
Oct-00	0.02284	16.8	6.64	31	10673
Nov-00	0.02308	14.5	6.5	21	8555
Dec-00	0.0232	9	6.56	14	9139
Jan-01	0.023	11.2	6.60	25.3	10352
Feb-01	0.231	10.5	6.2	31.5	10108
Mar-01	0.236	11	7.3	21.6	7843
Apr-01	0.256	16.5	7.35	24	4764
May-01	0.227	18.2	7.36	9.6	668
Jun-01	0.273	27.6	7.43	7.15	904.6
Jul-01	0.273	28.8	7.42	5.5	965
Aug-01	0.261	28	7.3	5.5	965
Sep-01	0.0047	22.5	7.42	1.65	545
Oct-01	0.0386	18.4	7.24	18.9	2463
Nov-01	0.0218	17	7.1	17.4	8846
Dec-01					

Appendix C Table 5

U.S. Coast Guard Center, NPDES Monitoring Data, 1999-2000

Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	pH (Standard Units)
Jan-99	0.0008	7.08
Feb-99	0.0015	6.97
Mar-99	0.0012	6.79
Apr-99	0.0015	6.58
May-99	0.008	6.81
Jun-99	0.0025	6.73
Jul-99	0.0012	6.8
Aug-99	0.0025	6.64
Sep-99	0.0025	7.08
Oct-99	0.0025	5.4
Nov-99	0.0012	6.3
Dec-99	0.0008	6.8
Jan-00	0.008	6.8
Feb-00	0.0008	6.4
Mar-00	0.0017	6.34
Apr-00	0.0015	6.5
May-00	0.0018	6.4
Jun-00	0.0012	
Jul-00	0.003	6.5
Aug-00	0.0004	7.3

Appendix C Table 6
Pasquotank County WTP, NPDES Monitoring Data, 1999-2001
Pasquotank River Local Watershed Restoration Plan

Date	Flow (MGD)	pH (Standard Units)	Total Suspended Residue (mg/l)	Turbidity Upstream (NTU)	Turbidity Downstream (NTU)	Iron (mg/l)	Settleable Matter (mg/l)
Jan-99							
Feb-99	0.063	7.8	<1		4.6	0.8	0.01
Mar-99	0.051	7.9	<1		2.1	0.6	0.02
Apr-99	0.048	7.9	1.5		2.1	0.5	0.02
May-99	0.051	7.8	3		2.3	0.4	0.02
Jun-99	0.055	8.1	<1		1.8	0.5	0.01
Jul-99	0.067	7.8	3.5		1.3	0.5	0.01
Aug-99	0.049	7.5	5		1.5	0.6	0.01
Sep-99	0.063	7.6	9		1.8	0.7	0.01
Oct-99	0.072	7.6	1.5		2.7	0.8	0.02
Nov-99							
Dec-99	0.053	7.8	<1		3	0.9	0.02
Jan-00	0.041	7.7	1		2.6	1	0.01
Feb-00	0.075	7.6	1.5	3.6	3.6	0.9	0.01
Mar-00	0.086	7.7	1		2.9	0.7	0.01
Apr-00							
May-00	0.03		18.5	6.4	5.6	0.9	0.02
Jun-00	0.03		6.5	7	6.2	1.53	0.02
Jul-00	0.041		7	4	3.9	1.2	0.02
Aug-00							
Sep-00							
Oct-00	0.033		1.5	1.9	1.8	0.6	0.02
Nov-00	0.03		2	2.5	2.6	0.573	0.01
Dec-00							
Jan-01							
Feb-01							
Mar-01	0.04		10	5.3	4.7	1.13	0.02
Apr-01							
May-01	0.046		8.5	3.9	4.11	1.09	0.02
Jun-01	0.043		8	3.9	4.6	0.735	0.02
Jul-01	0.052		5.5	4.4	4.3	0.493	0.02
Aug-01							
Sep-01	0.049		4	4.3	4.4	0.598	0.01
Oct-01							
Nov-01	0.055		3.5	5	4.3	0.557	0.01

Appendix D - Elizabeth City Water Plant Backwash Discharge Data

Provided by the City of Elizabeth City, Water Treatment Plant (252)-338-3981

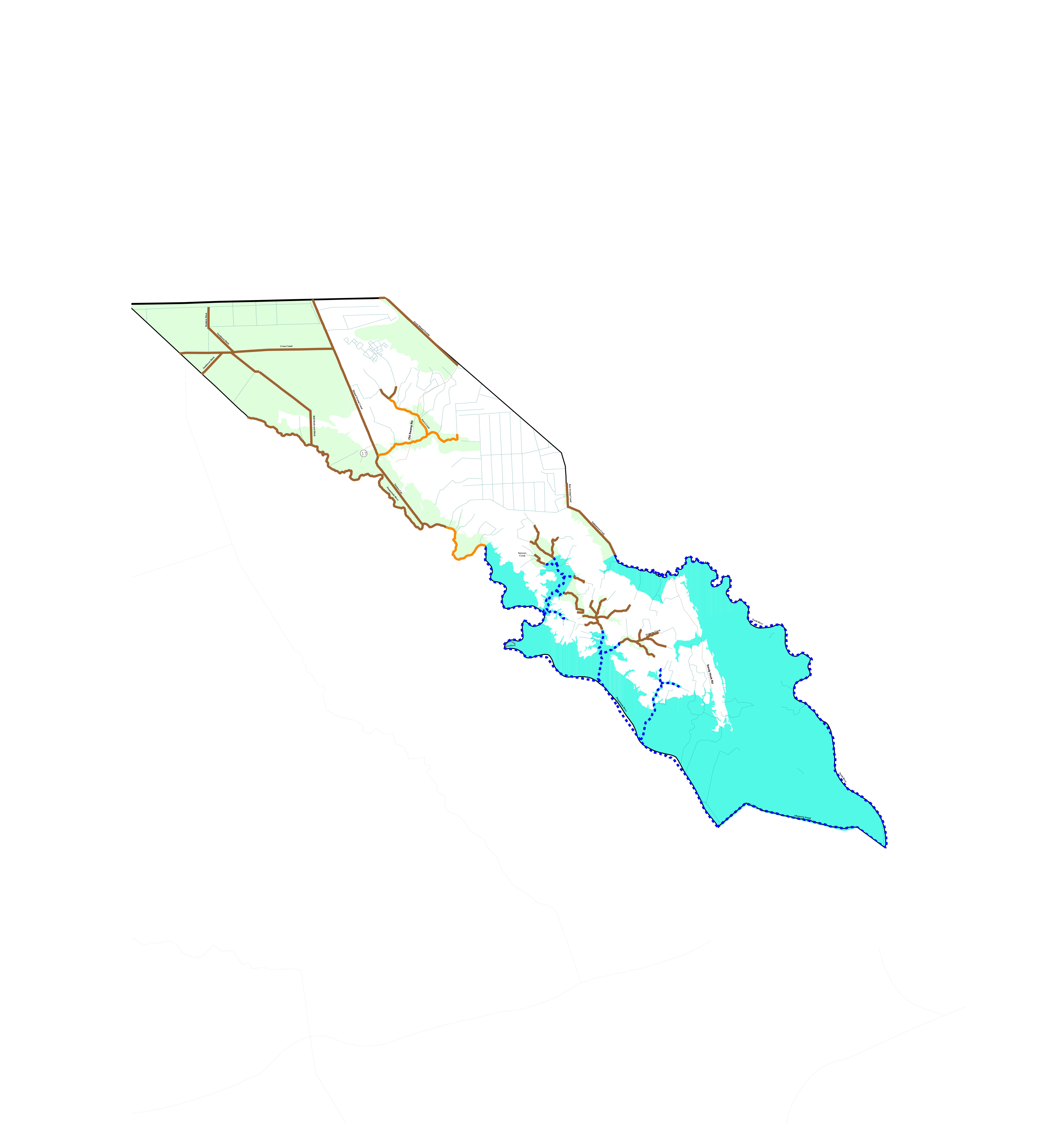
Appendix E - Pasquotank County Water Plant Backwash Discharge Data

Provided by Pasquotank County Water System (252) 330-4006

Appendix F - Monthly Water Quality Effluent Data for Camden County Reverse Osmosis Plant

Provided by County of Camden (252) 338-1919

APPENDIX G



Final Basin Plan

Pasquotank River Basin

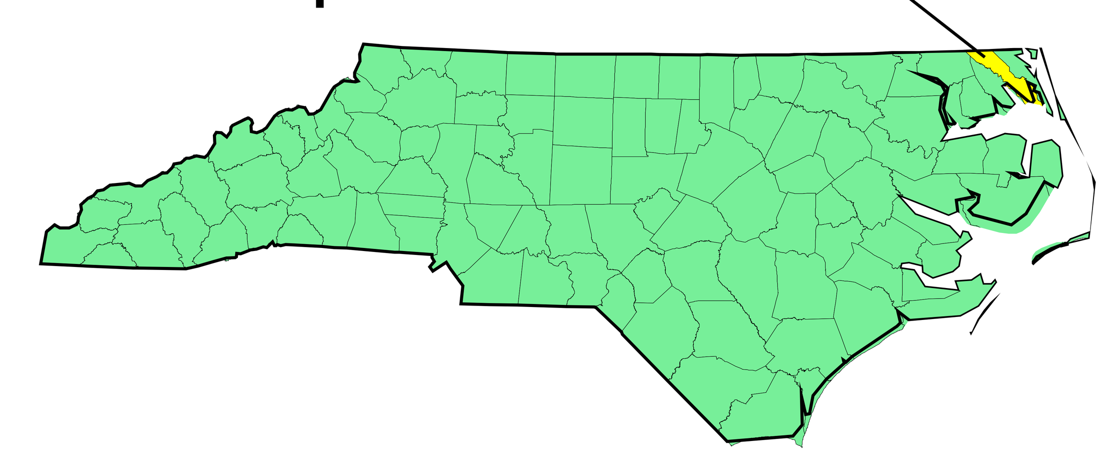
Camden County North Carolina (Attachment K)

Legend

Recommendation

- Approximate study
- Detailed study coastal
- Detailed study riverine
- Redelineate with updated topography
- County Boundary
- Community Boundary
- Watershed Boundary
- Stream/Shoreline
- Road
- 1% Annual Chance (100-Year) Floodplain with Base Flood Elevation (BFE)
- 0.2% Annual Chance (500-Year) Floodplain
- 1% Annual Chance (100-Year) Approximate Floodplain
- Coastal Flood Velocity Hazard with Base Flood Elevation (BFE)

North Carolina Locator Map



Data Sources

NHD and NC State Stream Data
FEMA Q3 Flood Hazard Data
NC State Community Boundaries
NC State County Boundaries
NC State River Basin Boundaries

N W E S

20000 0 20000 40000 Feet

Prepared for the:

State of North Carolina and the
Federal Emergency Management Agency
June 12, 2002

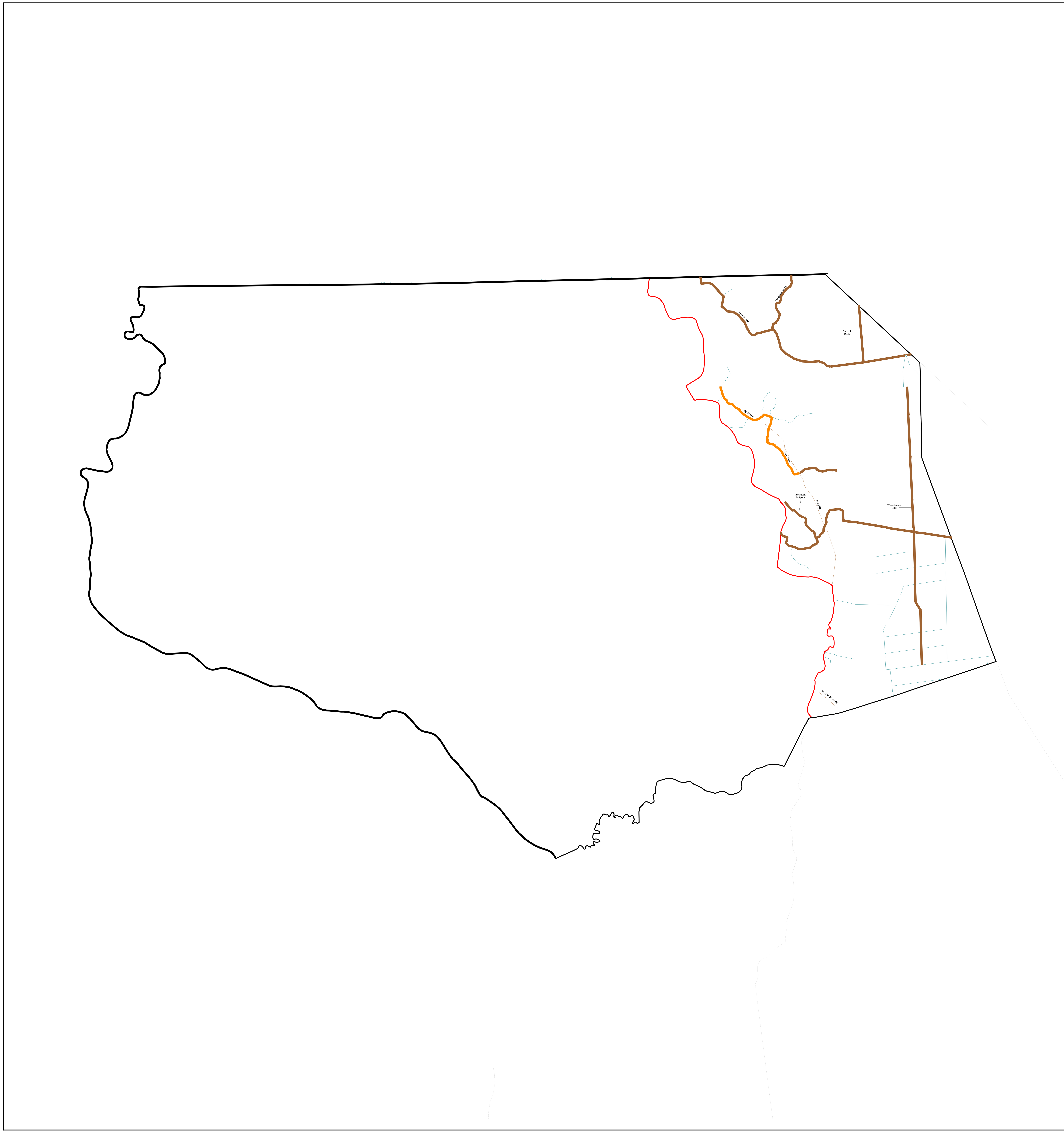
Prepared by:

Dewberry & Davis LLC
A Dewberry Company

Final Basin Plan

Pasquotank River Basin

Gates County
North Carolina
(Attachment O)



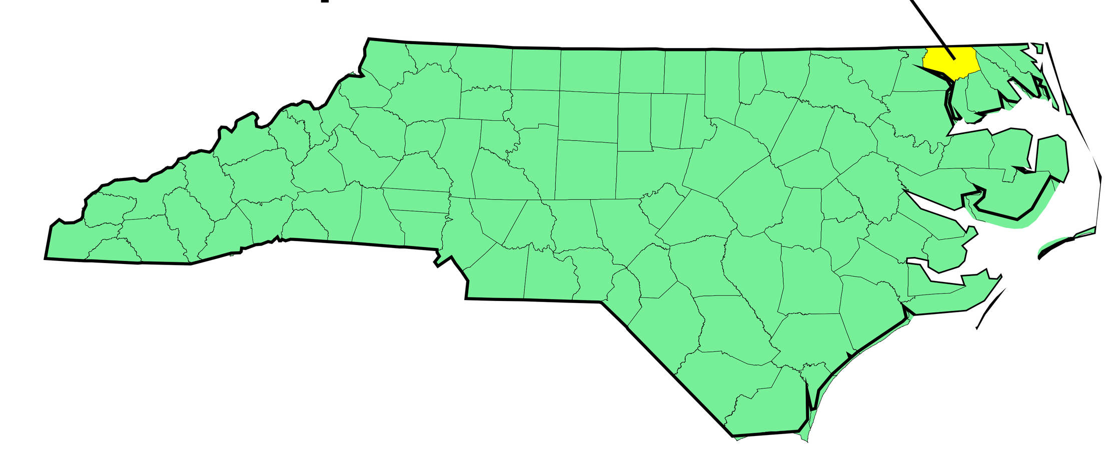
Legend

Recommendation

- Approximate study
- Detailed study coastal
- Detailed study riverine
- Redelineate with updated topography

- County Boundary
- Community Boundary
- Watershed Boundary
- Stream/Shoreline
- Road
- 1% Annual Chance (100-Year) Floodplain with Base Flood Elevation (BFE)
- 0.2% Annual Chance (500-Year) Floodplain
- 1% Annual Chance (100-Year) Approximate Floodplain
- Coastal Flood Velocity Hazard with Base Flood Elevation (BFE)

North Carolina Locator Map



Data Sources

NHD and NC State Stream Data
FEMA Q3 Flood Hazard Data
NC State Community Boundaries
NC State County Boundaries
NC State River Basin Boundaries

N W E S

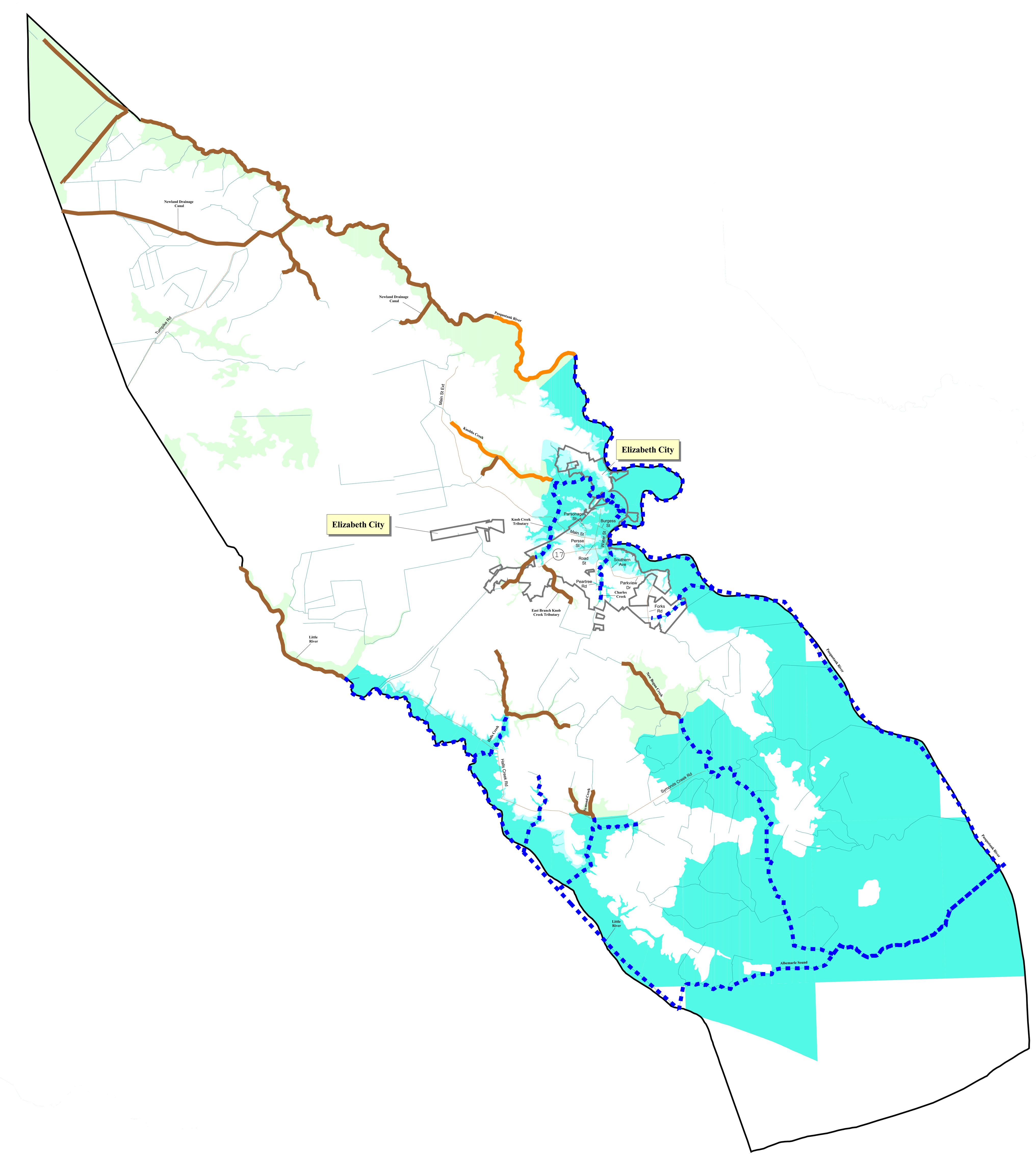
10000 0 10000 20000 30000 Feet

Prepared for the:

State of North Carolina and the
Federal Emergency Management Agency
June 12, 2002

Prepared by:

Dewberry & Davis LLC
A Dewberry Company



Final Basin Plan

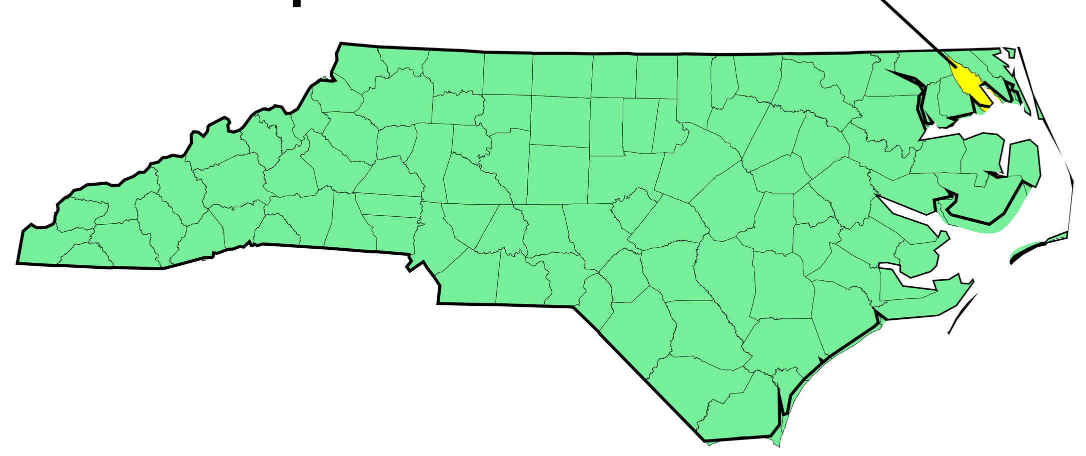
Pasquotank River Basin
Pasquotank County
North Carolina
(Attachment Q)

Legend

Recommendation

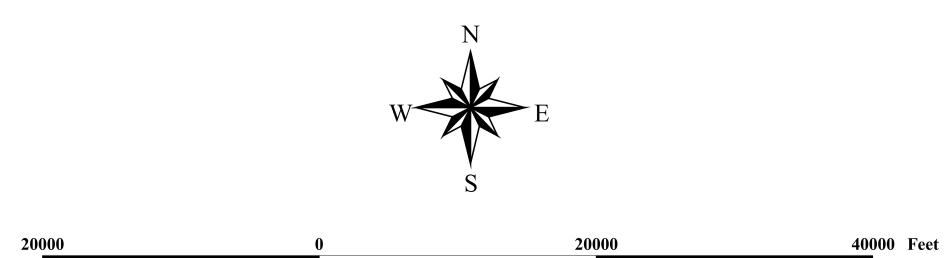
- Approximate study
- Detailed study coastal
- Detailed study riverine
- Redelineate with updated topography

- County Boundary
- Community Boundary
- Watershed Boundary
- Stream/Shoreline
- Road
- 1% Annual Chance (100-Year) Floodplain with Base Flood Elevation (BFE)
- 0.2% Annual Chance (500-Year) Floodplain
- 1% Annual Chance (100-Year) Approximate Floodplain
- Coastal Flood Velocity Hazard with Base Flood Elevation (BFE)



Data Sources

NHD and NC State Stream Data
FEMA Q3 Flood Hazard Data
NC State Community Boundaries
NC State County Boundaries
NC State River Basin Boundaries



Prepared for the:

State of North Carolina and the
Federal Emergency Management Agency
June 12, 2002

Prepared by:

Dewberry & Davis LLC
A Dewberry Company

PASQUOTANK RIVER WATER QUALITY DATA

Lab Code	Date	Time	Station Code	Parameter	Qualifier	Result	Units	Remarks	Comments	Sort Key
	20020409		PAAC01	Dissolved Oxygen		4.5	mg/L			1
	20020409		PAAC01	DO Saturation		44	%			2
	20020409		PAAC01	pH		6.4	SU			3
	20020409		PAAC01	Specific Conductance		759	µS/cm			4
	20020409		PAAC01	Temperature, Water		22.7	^{o}C			5
	20020409		PAAC01	Salinity		0.1	PPT			6
	20020409		PAAC01	Ammonia		0.16	mg/L			7
	20020409		PAAC01	Total Kjeldahl Nitrogen		1.0	mg/L			8
	20020409		PAAC01	NO2+NO3		0.13	mg/L			9
	20020409		PAAC01	Phosphorus, Total		0.20	mg/L			10
	20020409		PAAC01	Nitrogen, Total		1.1	mg/L			11
	20020409		PAAC01	Residue, Suspended		12.0	mg/L			12
	20020409		PAAC01	Residue, Volatile		9.0	mg/L			13
	20020409		PAAC01	Residue, Fixed	<	2.5	mg/L			14
	20020409		PAAC01	Cadmium, Total	<	2	µg/L			15
	20020409		PAAC01	Chromium, Total	<	25	µg/L			16
	20020409		PAAC01	Copper, Total		2.8	µg/L			17
	20020409		PAAC01	Nickel, Total	<	10	µg/L			18
	20020409		PAAC01	Lead, Total	<	10	µg/L			19
	20020409		PAAC01	Zinc, Total		21	µg/L			20
	20020409		PAAC01	Silver, Total	<	5	µg/L			21
	20020409		PAAC01	Aluminum, Total		240	µg/L			22
	20020409		PAAC01	Iron, Total		830	µg/L			23
	20020409		PAAC01	Arsenic, Total	<	10	µg/L			24
	20020409		PAAC01	Mercury, Total	<	0.2	µg/L			25
	20020409		PAAC01	Calcium, Total		16.0	mg/L			26
	20020409		PAAC01	Magnesium, Total		16.0	mg/L			27
	20020409		PAAC01	Hardness, Total		106	mg/L			28
	20020523		PAAC01	Dissolved Oxygen		4.1	mg/L			29
	20020523		PAAC01	DO Saturation		49	%			30
	20020523		PAAC01	pH		6.5	SU			31

20020523	PAAC01	Specific Conductance		5110	µS/cm	32
20020523	PAAC01	Temperature, Water		22.5	°C	33
20020523	PAAC01	Salinity		2.7	PPT	34
20020523	PAAC01	Ammonia		0.48	mg/L	35
20020523	PAAC01	Total Kjeldahl Nitrogen		1.1	mg/L	36
20020523	PAAC01	NO2+NO3		0.07	mg/L	37
20020523	PAAC01	Phosphorus, Total		0.28	mg/L	38
20020523	PAAC01	Nitrogen, Total		1.2	mg/L	39
20020523	PAAC01	Residue, Suspended		4.0	mg/L	40
20020523	PAAC01	Residue, Volatile	<	2.5	mg/L	41
20020523	PAAC01	Residue, Fixed	<	2.5	mg/L	42
20020523	PAAC01	Cadmium, Total	<	2	µg/L	43
20020523	PAAC01	Chromium, Total	<	25	µg/L	44
20020523	PAAC01	Copper, Total		5.2	µg/L	45
20020523	PAAC01	Nickel, Total	<	10	µg/L	46
20020523	PAAC01	Lead, Total	<	10	µg/L	47
20020523	PAAC01	Zinc, Total	<	10	µg/L	48
20020523	PAAC01	Silver, Total	<	5	µg/L	49
20020523	PAAC01	Aluminum, Total		85	µg/L	50
20020523	PAAC01	Iron, Total		580	µg/L	51
20020523	PAAC01	Arsenic, Total	<	10	µg/L	52
20020523	PAAC01	Mercury, Total	<	0.2	µg/L	53
20020523	PAAC01	Calcium, Total		45.0	mg/L	54
20020523	PAAC01	Magnesium, Total		100.0	mg/L	55
20020523	PAAC01	Hardness, Total		524	mg/L	56
20020717	PAAC01	Dissolved Oxygen		4.0	mg/L	57
20020717	PAAC01	DO Saturation		55	%	58
20020717	PAAC01	pH		6.4	SU	59
20020717	PAAC01	Specific Conductance		7870	µS/cm	60
20020717	PAAC01	Temperature, Water		31.0	°C	61
20020717	PAAC01	Salinity		4.3	PPT	62
20020717	PAAC01	Ammonia		0.05	mg/L	63
20020717	PAAC01	Total Kjeldahl Nitrogen		1.2	mg/L	64
20020717	PAAC01	NO2+NO3	<	0.02	mg/L	65
20020717	PAAC01	Phosphorus, Total		0.09	mg/L	66
20020717	PAAC01	Nitrogen, Total		1.2	mg/L	67

20020717	PAAC01	Residue, Suspended		6.0	mg/L	68
20020717	PAAC01	Residue, Volatile		4.0	mg/L	69
20020717	PAAC01	Residue, Fixed	<	2.5	mg/L	70
20020717	PAAC01	Turbidity		5	NTU	71
20020717	PAAC01	Cadmium, Total	<	2	μg/L	72
20020717	PAAC01	Chromium, Total	<	25	μg/L	73
20020717	PAAC01	Copper, Total	<	2.0	μg/L	74
20020717	PAAC01	Nickel, Total	<	10	μg/L	75
20020717	PAAC01	Lead, Total	<	10	μg/L	76
20020717	PAAC01	Zinc, Total		40	μg/L	77
20020717	PAAC01	Silver, Total	<	5	μg/L	78
20020717	PAAC01	Aluminum, Total		80	μg/L	79
20020717	PAAC01	Iron, Total		560	μg/L	80
20020717	PAAC01	Arsenic, Total	<	10	μg/L	81
20020717	PAAC01	Mercury, Total	<	0.2	μg/L	82
20020717	PAAC01	Calcium, Total		51.0	mg/L	83
20020717	PAAC01	Magnesium, Total		160.0	mg/L	84
20020717	PAAC01	Hardness, Total		786	mg/L	85
20021203	PAAC01	Dissolved Oxygen		6.9	mg/L	86
20021203	PAAC01	DO Saturation		59	%	87
20021203	PAAC01	pH		6.5	SU	88
20021203	PAAC01	Specific Conductance		1042	μS/cm	89
20021203	PAAC01	Temperature, Water		6.1	^{o}C	90
20021203	PAAC01	Salinity		0.5	PPT	91
20021203	PAAC01	Ammonia		0.12	mg/L	92
20021203	PAAC01	Total Kjeldahl Nitrogen		0.9	mg/L	93
20021203	PAAC01	NO2+NO3		0.03	mg/L	94
20021203	PAAC01	Phosphorus, Total		0.14	mg/L	95
20021203	PAAC01	Nitrogen, Total		0.9	mg/L	96
20021203	PAAC01	Cadmium, Total	<	2	μg/L	97
20021203	PAAC01	Chromium, Total	<	25	μg/L	98
20021203	PAAC01	Copper, Total		3.1	μg/L	99
20021203	PAAC01	Nickel, Total	<	10	μg/L	100
20021203	PAAC01	Lead, Total	<	10	μg/L	101
20021203	PAAC01	Zinc, Total		35	μg/L	102
20021203	PAAC01	Silver, Total	<	5	μg/L	103

20021203	PAAC01	Aluminum, Total		160	µg/L	104
20021203	PAAC01	Iron, Total		590	µg/L	105
20021203	PAAC01	Arsenic, Total	<	10	µg/L	106
20021203	PAAC01	Mercury, Total	<	0.2	µg/L	107
20021203	PAAC01	Calcium, Total		22.0	mg/L	108
20021203	PAAC01	Magnesium, Total		22.0	mg/L	109
20021203	PAAC01	Hardness, Total		145	mg/L	110
20020409	PACC01	Dissolved Oxygen		4.7	mg/L	111
20020409	PACC01	DO Saturation		53	%	112
20020409	PACC01	pH		6.2	SU	113
20020409	PACC01	Specific Conductance		481	µS/cm	114
20020409	PACC01	Temperature, Water		20.4	^{o}C	115
20020409	PACC01	Salinity		0.2	PPT	116
20020409	PACC01	Ammonia		0.28	mg/L	117
20020409	PACC01	Total Kjeldahl Nitrogen		0.8	mg/L	118
20020409	PACC01	NO2+NO3		0.29	mg/L	119
20020409	PACC01	Phosphorus, Total		0.26	mg/L	120
20020409	PACC01	Nitrogen, Total		1.1	mg/L	121
20020409	PACC01	Residue, Suspended		10.0	mg/L	122
20020409	PACC01	Residue, Volatile		3.0	mg/L	123
20020409	PACC01	Residue, Fixed		8.0	mg/L	124
20020409	PACC01	Cadmium, Total	<	2	µg/L	125
20020409	PACC01	Chromium, Total	<	25	µg/L	126
20020409	PACC01	Copper, Total	<	2.0	µg/L	127
20020409	PACC01	Nickel, Total	<	10	µg/L	128
20020409	PACC01	Lead, Total	<	10	µg/L	129
20020409	PACC01	Zinc, Total		31	µg/L	130
20020409	PACC01	Silver, Total	<	5	µg/L	131
20020409	PACC01	Aluminum, Total		910	µg/L	132
20020409	PACC01	Iron, Total		1500	µg/L	133
20020409	PACC01	Arsenic, Total	<	10	µg/L	134
20020409	PACC01	Mercury, Total	<	0.2	µg/L	135
20020409	PACC01	Calcium, Total		39.0	mg/L	136
20020409	PACC01	Magnesium, Total		16.0	mg/L	137
20020409	PACC01	Hardness, Total		163	mg/L	138
20020523	PACC01	Dissolved Oxygen		4.2	mg/L	139

20020523	PACC01	DO Saturation		44	%	140
20020523	PACC01	pH		7.2	SU	141
20020523	PACC01	Specific Conductance		399	μS/cm	142
20020523	PACC01	Temperature, Water		17.7	°C	143
20020523	PACC01	Salinity		0.2	PPT	144
20020523	PACC01	Ammonia		1.00	mg/L	145
20020523	PACC01	Total Kjeldahl Nitrogen		1.6	mg/L	146
20020523	PACC01	NO2+NO3		0.03	mg/L	147
20020523	PACC01	Phosphorus, Total		0.49	mg/L	148
20020523	PACC01	Nitrogen, Total		1.6	mg/L	149
20020523	PACC01	Residue, Suspended		6.0	mg/L	150
20020523	PACC01	Residue, Volatile	<	5.0	mg/L	151
20020523	PACC01	Residue, Fixed	<	5.0	mg/L	152
20020523	PACC01	Cadmium, Total	<	2	μg/L	153
20020523	PACC01	Chromium, Total	<	25	μg/L	154
20020523	PACC01	Copper, Total		2.5	μg/L	155
20020523	PACC01	Nickel, Total	<	10	μg/L	156
20020523	PACC01	Lead, Total	<	10	μg/L	157
20020523	PACC01	Zinc, Total	<	10	μg/L	158
20020523	PACC01	Silver, Total	<	5	μg/L	159
20020523	PACC01	Aluminum, Total		160	μg/L	160
20020523	PACC01	Iron, Total		780	μg/L	161
20020523	PACC01	Arsenic, Total	<	10	μg/L	162
20020523	PACC01	Mercury, Total	<	0.2	μg/L	163
20020523	PACC01	Calcium, Total		32.0	mg/L	164
20020523	PACC01	Magnesium, Total		13.0	mg/L	165
20020523	PACC01	Hardness, Total		133	mg/L	166
20020717	PACC01	Dissolved Oxygen		2.1	mg/L	167
20020717	PACC01	DO Saturation		26	%	168
20020717	PACC01	pH		6.8	SU	169
20020717	PACC01	Specific Conductance		236	μS/cm	170
20020717	PACC01	Temperature, Water		28.0	°C	171
20020717	PACC01	Salinity		0.1	PPT	172
20020717	PACC01	Ammonia		0.48	mg/L	173
20020717	PACC01	Total Kjeldahl Nitrogen		1.6	mg/L	174
20020717	PACC01	NO2+NO3	<	0.02	mg/L	175

20020717	PACC01	Phosphorus, Total		0.78	mg/L	176
20020717	PACC01	Nitrogen, Total		1.6	mg/L	177
20020717	PACC01	Residue, Suspended		9.0	mg/L	178
20020717	PACC01	Residue, Volatile		3.0	mg/L	179
20020717	PACC01	Residue, Fixed		6.0	mg/L	180
20020717	PACC01	Turbidity		14	NTU	181
20020717	PACC01	Cadmium, Total	<	2	µg/L	182
20020717	PACC01	Chromium, Total	<	25	µg/L	183
20020717	PACC01	Copper, Total		4.0	µg/L	184
20020717	PACC01	Nickel, Total	<	10	µg/L	185
20020717	PACC01	Lead, Total	<	10	µg/L	186
20020717	PACC01	Zinc, Total		25	µg/L	187
20020717	PACC01	Silver, Total	<	5	µg/L	188
20020717	PACC01	Aluminum, Total		860	µg/L	189
20020717	PACC01	Iron, Total		1300	µg/L	190
20020717	PACC01	Arsenic, Total	<	10	µg/L	191
20020717	PACC01	Mercury, Total	<	0.2	µg/L	192
20020717	PACC01	Calcium, Total		16.0	mg/L	193
20020717	PACC01	Magnesium, Total		5.9	mg/L	194
20020717	PACC01	Hardness, Total		64	mg/L	195
20021203	PACC01	Dissolved Oxygen		4.1	mg/L	196
20021203	PACC01	DO Saturation		34	%	197
20021203	PACC01	pH		6.1	SU	198
20021203	PACC01	Specific Conductance		485	µS/cm	199
20021203	PACC01	Temperature, Water		6.2	°C	200
20021203	PACC01	Salinity		0.2	PPT	201
20021203	PACC01	Ammonia		0.21	mg/L	202
20021203	PACC01	Total Kjeldahl Nitrogen		0.8	mg/L	203
20021203	PACC01	NO2+NO3		0.26	mg/L	204
20021203	PACC01	Phosphorus, Total		0.23	mg/L	205
20021203	PACC01	Nitrogen, Total		1.1	mg/L	206
20021203	PACC01	Cadmium, Total	<	2	µg/L	207
20021203	PACC01	Chromium, Total	<	25	µg/L	208
20021203	PACC01	Copper, Total	<	2.0	µg/L	209
20021203	PACC01	Nickel, Total	<	10	µg/L	210
20021203	PACC01	Lead, Total	<	10	µg/L	211

20021203	PACC01	Zinc, Total		50	µg/L	212
20021203	PACC01	Silver, Total	<	5	µg/L	213
20021203	PACC01	Aluminum, Total		190	µg/L	214
20021203	PACC01	Iron, Total		1400	µg/L	215
20021203	PACC01	Arsenic, Total	<	10	µg/L	216
20021203	PACC01	Mercury, Total	<	0.2	µg/L	217
20021203	PACC01	Calcium, Total		44.0	mg/L	218
20021203	PACC01	Magnesium, Total		18.0	mg/L	219
20021203	PACC01	Hardness, Total		184	mg/L	220
20020409	PAGD01	Dissolved Oxygen		7.0	mg/L	221
20020409	PAGD01	DO Saturation		74	%	222
20020409	PAGD01	pH		4.7	SU	223
20020409	PAGD01	Specific Conductance		138	µS/cm	224
20020409	PAGD01	Temperature, Water		18.4	^{o}C	225
20020409	PAGD01	Salinity		0.1	PPT	226
20020409	PAGD01	Ammonia		0.18	mg/L	227
20020409	PAGD01	Total Kjeldahl Nitrogen		2.1	mg/L	228
20020409	PAGD01	NO2+NO3		0.58	mg/L	229
20020409	PAGD01	Phosphorus, Total		0.03	mg/L	230
20020409	PAGD01	Nitrogen, Total		2.7	mg/L	231
20020409	PAGD01	Residue, Suspended		13.0	mg/L	232
20020409	PAGD01	Residue, Volatile		7.0	mg/L	233
20020409	PAGD01	Residue, Fixed		6.0	mg/L	234
20020523	PAGD01	Dissolved Oxygen		6.5	mg/L	235
20020523	PAGD01	DO Saturation		73	%	236
20020523	PAGD01	pH		4.7	SU	237
20020523	PAGD01	Specific Conductance		133	µS/cm	238
20020523	PAGD01	Temperature, Water		21.5	^{o}C	239
20020523	PAGD01	Salinity		0.1	PPT	240
20020523	PAGD01	Ammonia		0.14	mg/L	241
20020523	PAGD01	Total Kjeldahl Nitrogen		1.7	mg/L	242
20020523	PAGD01	NO2+NO3		0.16	mg/L	243
20020523	PAGD01	Phosphorus, Total		0.05	mg/L	244
20020523	PAGD01	Nitrogen, Total		1.9	mg/L	245
20020523	PAGD01	Residue, Suspended		11.0	mg/L	246
20020523	PAGD01	Residue, Volatile		6.0	mg/L	247

20020523	PAGD01	Residue, Fixed	6.0	mg/L	248
20020717	PAGD01	Dissolved Oxygen	5.9	mg/L	249
20020717	PAGD01	DO Saturation	78	%	250
20020717	PAGD01	pH	5.5	SU	251
20020717	PAGD01	Specific Conductance	127	µS/cm	252
20020717	PAGD01	Temperature, Water	29.9	^{o}C	253
20020717	PAGD01	Salinity	0.1	PPT	254
20020717	PAGD01	Ammonia	0.18	mg/L	255
20020717	PAGD01	Total Kjeldahl Nitrogen	2.4	mg/L	256
20020717	PAGD01	NO2+NO3	0.15	mg/L	257
20020717	PAGD01	Phosphorus, Total	0.06	mg/L	258
20020717	PAGD01	Nitrogen, Total	2.6	mg/L	259
20020717	PAGD01	Residue, Suspended	24.0	mg/L	260
20020717	PAGD01	Residue, Volatile	14.0	mg/L	261
20020717	PAGD01	Residue, Fixed	10.0	mg/L	262
20021203	PAGD01	Dissolved Oxygen	7.1	mg/L	263
20021203	PAGD01	DO Saturation	60	%	264
20021203	PAGD01	pH	4.4	SU	265
20021203	PAGD01	Specific Conductance	147	µS/cm	266
20021203	PAGD01	Temperature, Water	8.1	^{o}C	267
20021203	PAGD01	Salinity	0.1	PPT	268
20021203	PAGD01	Ammonia	0.10	mg/L	269
20021203	PAGD01	Total Kjeldahl Nitrogen	1.8	mg/L	270
20021203	PAGD01	NO2+NO3	0.26	mg/L	271
20021203	PAGD01	Phosphorus, Total	0.05	mg/L	272
20021203	PAGD01	Nitrogen, Total	2.1	mg/L	273
20021203	PAGD01	Residue, Suspended	12.0	mg/L	274
20021203	PAGD01	Residue, Volatile	5.0	mg/L	275
20020409	PAGD02	Dissolved Oxygen	5.5	mg/L	276
20020409	PAGD02	DO Saturation	61	%	277
20020409	PAGD02	pH	3.9	SU	278
20020409	PAGD02	Specific Conductance	182	µS/cm	279
20020409	PAGD02	Temperature, Water	18.8	^{o}C	280
20020409	PAGD02	Salinity	0.1	PPT	281
20020409	PAGD02	Ammonia	0.13	mg/L	282
20020409	PAGD02	Total Kjeldahl Nitrogen	0.8	mg/L	283

20020409	PAGD02	NO2+NO3		0.02	mg/L	284
20020409	PAGD02	Phosphorus, Total		0.03	mg/L	285
20020409	PAGD02	Nitrogen, Total		0.8	mg/L	286
20020409	PAGD02	Residue, Suspended	<	2.5	mg/L	287
20020409	PAGD02	Residue, Volatile	<	2.5	mg/L	288
20020409	PAGD02	Residue, Fixed	<	2.5	mg/L	289
20020409	PAGD02	Cadmium, Total	<	2	µg/L	290
20020409	PAGD02	Chromium, Total	<	25	µg/L	291
20020409	PAGD02	Copper, Total	<	2.0	µg/L	292
20020409	PAGD02	Nickel, Total	<	10	µg/L	293
20020409	PAGD02	Lead, Total	<	10	µg/L	294
20020409	PAGD02	Zinc, Total		23	µg/L	295
20020409	PAGD02	Silver, Total	<	5	µg/L	296
20020409	PAGD02	Aluminum, Total		1100	µg/L	297
20020409	PAGD02	Iron, Total		1200	µg/L	298
20020409	PAGD02	Arsenic, Total	<	10	µg/L	299
20020409	PAGD02	Mercury, Total	<	0.2	µg/L	300
20020409	PAGD02	Calcium, Total		10.0	mg/L	301
20020409	PAGD02	Magnesium, Total		3.6	mg/L	302
20020409	PAGD02	Hardness, Total		40	mg/L	303
20020523	PAGD02	Dissolved Oxygen		3.9	mg/L	304
20020523	PAGD02	DO Saturation		39	%	305
20020523	PAGD02	pH		3.9	SU	306
20020523	PAGD02	Specific Conductance		162	µS/cm	307
20020523	PAGD02	Temperature, Water		15.6	^{o}C	308
20020523	PAGD02	Salinity		0.1	PPT	309
20020523	PAGD02	Ammonia		0.55	mg/L	310
20020523	PAGD02	Total Kjeldahl Nitrogen		2.6	mg/L	311
20020523	PAGD02	NO2+NO3		0.02	mg/L	312
20020523	PAGD02	Phosphorus, Total		0.04	mg/L	313
20020523	PAGD02	Nitrogen, Total		2.6	mg/L	314
20020523	PAGD02	Residue, Suspended		3.0	mg/L	315
20020523	PAGD02	Residue, Volatile	<	2.5	mg/L	316
20020523	PAGD02	Residue, Fixed	<	2.5	mg/L	317
20020523	PAGD02	Cadmium, Total	<	2	µg/L	318
20020523	PAGD02	Chromium, Total	<	25	µg/L	319

20020523	PAGD02	Copper, Total	<	2.0	µg/L	320
20020523	PAGD02	Nickel, Total	<	10	µg/L	321
20020523	PAGD02	Lead, Total	<	10	µg/L	322
20020523	PAGD02	Zinc, Total		12	µg/L	323
20020523	PAGD02	Silver, Total	<	5	µg/L	324
20020523	PAGD02	Aluminum, Total		1400	µg/L	325
20020523	PAGD02	Iron, Total		2300	µg/L	326
20020523	PAGD02	Arsenic, Total	<	10	µg/L	327
20020523	PAGD02	Mercury, Total	<	0.2	µg/L	328
20020523	PAGD02	Calcium, Total		7.0	mg/L	329
20020523	PAGD02	Magnesium, Total		2.4	mg/L	330
20020523	PAGD02	Hardness, Total		27	mg/L	331
20020717	PAGD02	Dissolved Oxygen		1.9	mg/L	332
20020717	PAGD02	DO Saturation		24	%	333
20020717	PAGD02	pH		5.0	SU	334
20020717	PAGD02	Specific Conductance		154	µS/cm	335
20020717	PAGD02	Temperature, Water		28.1	^{o}C	336
20020717	PAGD02	Salinity		0.1	PPT	337
20020717	PAGD02	Ammonia		1.80	mg/L	338
20020717	PAGD02	Total Kjeldahl Nitrogen		4.6	mg/L	339
20020717	PAGD02	NO2+NO3	<	0.02	mg/L	340
20020717	PAGD02	Phosphorus, Total		0.32	mg/L	341
20020717	PAGD02	Nitrogen, Total		4.6	mg/L	342
20020717	PAGD02	Residue, Suspended		4.0	mg/L	343
20020717	PAGD02	Residue, Volatile	<	2.5	mg/L	344
20020717	PAGD02	Residue, Fixed	<	2.5	mg/L	345
20020717	PAGD02	Turbidity		11	NTU	346
20020717	PAGD02	Cadmium, Total	<	2	µg/L	347
20020717	PAGD02	Chromium, Total	<	25	µg/L	348
20020717	PAGD02	Copper, Total		2.3	µg/L	349
20020717	PAGD02	Nickel, Total	<	10	µg/L	350
20020717	PAGD02	Lead, Total	<	10	µg/L	351
20020717	PAGD02	Zinc, Total	<	10	µg/L	352
20020717	PAGD02	Silver, Total	<	5	µg/L	353
20020717	PAGD02	Aluminum, Total		1100	µg/L	354
20020717	PAGD02	Iron, Total		3900	µg/L	355

20020717	PAGD02	Arsenic, Total	<	10	µg/L	356
20020717	PAGD02	Mercury, Total	<	0.2	µg/L	357
20020717	PAGD02	Calcium, Total		7.1	mg/L	358
20020717	PAGD02	Magnesium, Total		2.7	mg/L	359
20020717	PAGD02	Hardness, Total		29	mg/L	360
20021203	PAGD02	Dissolved Oxygen		5.1	mg/L	361
20021203	PAGD02	DO Saturation		40	%	362
20021203	PAGD02	pH		4.4	SU	363
20021203	PAGD02	Specific Conductance		208	µS/cm	364
20021203	PAGD02	Temperature, Water		6.5	^{o}C	365
20021203	PAGD02	Salinity		0.1	PPT	366
20021203	PAGD02	Ammonia	<	0.02	mg/L	367
20021203	PAGD02	Total Kjeldahl Nitrogen		1.6	mg/L	368
20021203	PAGD02	NO2+NO3		0.03	mg/L	369
20021203	PAGD02	Phosphorus, Total		0.35	mg/L	370
20021203	PAGD02	Nitrogen, Total		1.6	mg/L	371
20021203	PAGD02	Cadmium, Total	<	2	µg/L	372
20021203	PAGD02	Chromium, Total	<	25	µg/L	373
20021203	PAGD02	Copper, Total		2.7	µg/L	374
20021203	PAGD02	Nickel, Total	<	10	µg/L	375
20021203	PAGD02	Lead, Total	<	10	µg/L	376
20021203	PAGD02	Zinc, Total		37	µg/L	377
20021203	PAGD02	Silver, Total	<	5	µg/L	378
20021203	PAGD02	Aluminum, Total		1100	µg/L	379
20021203	PAGD02	Iron, Total		1200	µg/L	380
20021203	PAGD02	Arsenic, Total	<	10	µg/L	381
20021203	PAGD02	Mercury, Total	<	0.2	µg/L	382
20021203	PAGD02	Calcium, Total		12.0	mg/L	383
20021203	PAGD02	Magnesium, Total		4.3	mg/L	384
20021203	PAGD02	Hardness, Total		48	mg/L	385
20020409	PAHL01	Dissolved Oxygen		6.2	mg/L	386
20020409	PAHL01	DO Saturation		70	%	387
20020409	PAHL01	pH		6.1	SU	388
20020409	PAHL01	Specific Conductance		255	µS/cm	389
20020409	PAHL01	Temperature, Water		19.6	^{o}C	390
20020409	PAHL01	Salinity		0.1	PPT	391

20020409	PAHL01	Ammonia	0.20	mg/L	392
20020409	PAHL01	Total Kjeldahl Nitrogen	1.1	mg/L	393
20020409	PAHL01	NO2+NO3	1.10	mg/L	394
20020409	PAHL01	Phosphorus, Total	0.07	mg/L	395
20020409	PAHL01	Nitrogen, Total	2.2	mg/L	396
20020409	PAHL01	Residue, Suspended	6.0	mg/L	397
20020409	PAHL01	Residue, Volatile	3.0	mg/L	398
20020409	PAHL01	Residue, Fixed	3.0	mg/L	399
20020523	PAHL01	Dissolved Oxygen	4.7	mg/L	400
20020523	PAHL01	DO Saturation	51	%	401
20020523	PAHL01	pH	6.6	SU	402
20020523	PAHL01	Specific Conductance	317	μS/cm	403
20020523	PAHL01	Temperature, Water	19.6	^{o}C	404
20020523	PAHL01	Salinity	0.2	PPT	405
20020523	PAHL01	Ammonia	0.14	mg/L	406
20020523	PAHL01	Total Kjeldahl Nitrogen	1.0	mg/L	407
20020523	PAHL01	NO2+NO3	0.04	mg/L	408
20020523	PAHL01	Phosphorus, Total	0.20	mg/L	409
20020523	PAHL01	Nitrogen, Total	1.0	mg/L	410
20020523	PAHL01	Residue, Suspended	14.0	mg/L	411
20020523	PAHL01	Residue, Volatile	5.0	mg/L	412
20020523	PAHL01	Residue, Fixed	9.0	mg/L	413
20020717	PAHL01	Dissolved Oxygen	5.6	mg/L	414
20020717	PAHL01	DO Saturation	74	%	415
20020717	PAHL01	pH	6.9	SU	416
20020717	PAHL01	Specific Conductance	388	μS/cm	417
20020717	PAHL01	Temperature, Water	31.3	^{o}C	418
20020717	PAHL01	Salinity	0.2	PPT	419
20020717	PAHL01	Ammonia	0.17	mg/L	420
20020717	PAHL01	Total Kjeldahl Nitrogen	2.5	mg/L	421
20020717	PAHL01	NO2+NO3	1.30	mg/L	422
20020717	PAHL01	Phosphorus, Total	0.09	mg/L	423
20020717	PAHL01	Nitrogen, Total	3.8	mg/L	424
20020717	PAHL01	Residue, Suspended	13.0	mg/L	425
20020717	PAHL01	Residue, Volatile	8.0	mg/L	426
20020717	PAHL01	Residue, Fixed	6.0	mg/L	427

20021203	PAHL01	Dissolved Oxygen	7.0	mg/L	428
20021203	PAHL01	DO Saturation	56	%	429
20021203	PAHL01	pH	6.3	SU	430
20021203	PAHL01	Specific Conductance	255	μS/cm	431
20021203	PAHL01	Temperature, Water	6.7	^{o}C	432
20021203	PAHL01	Salinity	0.1	PPT	433
20021203	PAHL01	Ammonia	0.16	mg/L	434
20021203	PAHL01	Total Kjeldahl Nitrogen	1.3	mg/L	435
20021203	PAHL01	NO2+NO3	0.79	mg/L	436
20021203	PAHL01	Phosphorus, Total	0.09	mg/L	437
20021203	PAHL01	Nitrogen, Total	2.1	mg/L	438
20021203	PAHL01	Residue, Suspended	8.0	mg/L	439
20021203	PAHL01	Residue, Volatile	4.0	mg/L	440
20020409	PAJC01	Dissolved Oxygen	6.2	mg/L	441
20020409	PAJC01	DO Saturation	65	%	442
20020409	PAJC01	pH	6.2	SU	443
20020409	PAJC01	Specific Conductance	289	μS/cm	444
20020409	PAJC01	Temperature, Water	17.5	^{o}C	445
20020409	PAJC01	Salinity	0.1	PPT	446
20020409	PAJC01	Ammonia	0.14	mg/L	447
20020409	PAJC01	Total Kjeldahl Nitrogen	2.0	mg/L	448
20020409	PAJC01	NO2+NO3	1.00	mg/L	449
20020409	PAJC01	Phosphorus, Total	0.08	mg/L	450
20020409	PAJC01	Nitrogen, Total	3.0	mg/L	451
20020409	PAJC01	Residue, Suspended	11.0	mg/L	452
20020409	PAJC01	Residue, Volatile	5.0	mg/L	453
20020409	PAJC01	Residue, Fixed	6.0	mg/L	454
20020523	PAJC01	Dissolved Oxygen	8.7	mg/L	455
20020523	PAJC01	DO Saturation	101	%	456
20020523	PAJC01	pH	7.4	SU	457
20020523	PAJC01	Specific Conductance	1789	μS/cm	458
20020523	PAJC01	Temperature, Water	22.1	^{o}C	459
20020523	PAJC01	Salinity	0.9	PPT	460
20020523	PAJC01	Ammonia	0.26	mg/L	461
20020523	PAJC01	Total Kjeldahl Nitrogen	1.4	mg/L	462
20020523	PAJC01	NO2+NO3	0.13	mg/L	463

20020523	PAJC01	Phosphorus, Total	0.16	mg/L		464
20020523	PAJC01	Nitrogen, Total	1.5	mg/L		465
20020523	PAJC01	Residue, Suspended	8.0	mg/L		466
20020523	PAJC01	Residue, Volatile	4.0	mg/L		467
20020523	PAJC01	Residue, Fixed	5.0	mg/L		468
20020717	PAJC01	Dissolved Oxygen	3.7	mg/L		469
20020717	PAJC01	DO Saturation	48	%		470
20020717	PAJC01	pH	7.0	SU		471
20020717	PAJC01	Specific Conductance	490	μS/cm		472
20020717	PAJC01	Temperature, Water	30.2	^{o}C		473
20020717	PAJC01	Salinity	0.2	PPT		474
20020717	PAJC01	Ammonia	0.14	mg/L		475
20020717	PAJC01	Total Kjeldahl Nitrogen	1.7	mg/L		476
20020717	PAJC01	NO2+NO3	1.20	mg/L	Estimated value; sample matrix interfered with determina	477
20020717	PAJC01	Phosphorus, Total	0.16	mg/L		478
20020717	PAJC01	Nitrogen, Total	2.9	mg/L		479
20020717	PAJC01	Residue, Suspended	24.0	mg/L		480
20020717	PAJC01	Residue, Volatile	10.0	mg/L		481
20020717	PAJC01	Residue, Fixed	14.0	mg/L		482
20021203	PAJC01	Dissolved Oxygen	6.2	mg/L		483
20021203	PAJC01	DO Saturation	52	%		484
20021203	PAJC01	pH	6.5	SU		485
20021203	PAJC01	Specific Conductance	944	μS/cm		486
20021203	PAJC01	Temperature, Water	6.1	^{o}C		487
20021203	PAJC01	Salinity	0.5	PPT		488
20021203	PAJC01	Ammonia	0.12	mg/L		489
20021203	PAJC01	Total Kjeldahl Nitrogen	1.2	mg/L		490
20021203	PAJC01	NO2+NO3	0.44	mg/L		491
20021203	PAJC01	Phosphorus, Total	0.10	mg/L		492
20021203	PAJC01	Nitrogen, Total	1.6	mg/L		493
20021203	PAJC01	Residue, Suspended	6.0	mg/L		494
20021203	PAJC01	Residue, Volatile	3.0	mg/L		495
20020409	PAKC01	Dissolved Oxygen	6.1	mg/L		496
20020409	PAKC01	DO Saturation	62	%		497
20020409	PAKC01	pH	5.6	SU		498
20020409	PAKC01	Specific Conductance	313	μS/cm		499

20020409	PAKC01	Temperature, Water		16.5	°C	500
20020409	PAKC01	Salinity		0.1	PPT	501
20020409	PAKC01	Ammonia		0.03	mg/L	502
20020409	PAKC01	Total Kjeldahl Nitrogen	<	0.2	mg/L	503
20020409	PAKC01	NO2+NO3		0.02	mg/L	504
20020409	PAKC01	Phosphorus, Total		0.13	mg/L	505
20020409	PAKC01	Nitrogen, Total		0.0	mg/L	506
20020409	PAKC01	Residue, Suspended		6.0	mg/L	507
20020409	PAKC01	Residue, Volatile		3.0	mg/L	508
20020409	PAKC01	Residue, Fixed		2.5	mg/L	509
20020523	PAKC01	Dissolved Oxygen		4.1	mg/L	510
20020523	PAKC01	DO Saturation		46	%	511
20020523	PAKC01	pH		6.9	SU	512
20020523	PAKC01	Specific Conductance		1070	µS/cm	513
20020523	PAKC01	Temperature, Water		21.8	°C	514
20020523	PAKC01	Salinity		0.5	PPT	515
20020523	PAKC01	Ammonia		0.31	mg/L	516
20020523	PAKC01	Total Kjeldahl Nitrogen		1.2	mg/L	517
20020523	PAKC01	NO2+NO3		0.13	mg/L	518
20020523	PAKC01	Phosphorus, Total		0.24	mg/L	519
20020523	PAKC01	Nitrogen, Total		1.3	mg/L	520
20020523	PAKC01	Residue, Suspended	<	5.0	mg/L	521
20020523	PAKC01	Residue, Volatile	<	5.0	mg/L	522
20020523	PAKC01	Residue, Fixed	<	5.0	mg/L	523
20020717	PAKC01	Dissolved Oxygen		8.8	mg/L	524
20020717	PAKC01	DO Saturation		122	%	525
20020717	PAKC01	pH		7.9	SU	526
20020717	PAKC01	Specific Conductance		4180	µS/cm	527
20020717	PAKC01	Temperature, Water		32.1	°C	528
20020717	PAKC01	Salinity		1.9	PPT	529
20020717	PAKC01	Ammonia		0.02	mg/L	530
20020717	PAKC01	Total Kjeldahl Nitrogen		1.1	mg/L	531
20020717	PAKC01	NO2+NO3		0.03	mg/L	532
20020717	PAKC01	Phosphorus, Total		0.09	mg/L	533
20020717	PAKC01	Nitrogen, Total		1.1	mg/L	534
20020717	PAKC01	Residue, Suspended		7.0	mg/L	535

20020717	PAKC01	Residue, Volatile		4.0	mg/L	536
20020717	PAKC01	Residue, Fixed	<	2.5	mg/L	537
20021203	PAKC01	Dissolved Oxygen		6.5	mg/L	538
20021203	PAKC01	DO Saturation		57	%	539
20021203	PAKC01	pH		6.6	SU	540
20021203	PAKC01	Specific Conductance		657	µS/cm	541
20021203	PAKC01	Temperature, Water		6.8	°C	542
20021203	PAKC01	Salinity		0.3	PPT	543
20021203	PAKC01	Ammonia		0.07	mg/L	544
20021203	PAKC01	Total Kjeldahl Nitrogen		1.0	mg/L	545
20021203	PAKC01	NO2+NO3		0.02	mg/L	546
20021203	PAKC01	Phosphorus, Total		0.15	mg/L	547
20021203	PAKC01	Nitrogen, Total		1.0	mg/L	548
20021203	PAKC01	Residue, Suspended	<	2.5	mg/L	549
20021203	PAKC01	Residue, Volatile	<	2.5	mg/L	550
20021203	PAKC01	Residue, Fixed	<	2.5	mg/L	551
20020409	PANC01	Dissolved Oxygen		5.1	mg/L	552
20020409	PANC01	DO Saturation		54	%	553
20020409	PANC01	pH		6.2	SU	554
20020409	PANC01	Specific Conductance		280	µS/cm	555
20020409	PANC01	Temperature, Water		16.5	°C	556
20020409	PANC01	Salinity		0.3	PPT	557
20020409	PANC01	Ammonia		0.03	mg/L	558
20020409	PANC01	Total Kjeldahl Nitrogen		0.7	mg/L	559
20020409	PANC01	NO2+NO3		0.03	mg/L	560
20020409	PANC01	Phosphorus, Total		0.20	mg/L	561
20020409	PANC01	Nitrogen, Total		0.7	mg/L	562
20020409	PANC01	Residue, Suspended		4.0	mg/L	563
20020409	PANC01	Residue, Volatile	<	2.5	mg/L	564
20020409	PANC01	Residue, Fixed	<	2.5	mg/L	565
20020409	PANC01	Cadmium, Total	<	2	µg/L	566
20020409	PANC01	Chromium, Total	<	25	µg/L	567
20020409	PANC01	Copper, Total	<	2.0	µg/L	568
20020409	PANC01	Nickel, Total	<	10	µg/L	569
20020409	PANC01	Lead, Total	<	10	µg/L	570
20020409	PANC01	Zinc, Total		17	µg/L	571

20020409	PANC01	Silver, Total	<	5	µg/L	572
20020409	PANC01	Aluminum, Total		530	µg/L	573
20020409	PANC01	Iron, Total		490	µg/L	574
20020409	PANC01	Arsenic, Total	<	10	µg/L	575
20020409	PANC01	Mercury, Total	<	0.2	µg/L	576
20020409	PANC01	Calcium, Total		15.0	mg/L	577
20020409	PANC01	Magnesium, Total		7.4	mg/L	578
20020409	PANC01	Hardness, Total		68	mg/L	579
20020523	PANC01	Dissolved Oxygen		6.3	mg/L	580
20020523	PANC01	DO Saturation		76	%	581
20020523	PANC01	pH		6.7	SU	582
20020523	PANC01	Specific Conductance		2945	µS/cm	583
20020523	PANC01	Temperature, Water		24.5	°C	584
20020523	PANC01	Salinity		1.5	PPT	585
20020523	PANC01	Ammonia		0.35	mg/L	586
20020523	PANC01	Total Kjeldahl Nitrogen		1.4	mg/L	587
20020523	PANC01	NO2+NO3		0.08	mg/L	588
20020523	PANC01	Phosphorus, Total		0.50	mg/L	589
20020523	PANC01	Nitrogen, Total		1.5	mg/L	590
20020523	PANC01	Residue, Suspended		4.0	mg/L	591
20020523	PANC01	Residue, Volatile	<	2.5	mg/L	592
20020523	PANC01	Residue, Fixed	<	2.5	mg/L	593
20020523	PANC01	Cadmium, Total	<	2	µg/L	594
20020523	PANC01	Chromium, Total	<	25	µg/L	595
20020523	PANC01	Copper, Total		3.3	µg/L	596
20020523	PANC01	Nickel, Total	<	10	µg/L	597
20020523	PANC01	Lead, Total	<	10	µg/L	598
20020523	PANC01	Zinc, Total	<	10	µg/L	599
20020523	PANC01	Silver, Total	<	5	µg/L	600
20020523	PANC01	Aluminum, Total		75	µg/L	601
20020523	PANC01	Iron, Total		670	µg/L	602
20020523	PANC01	Arsenic, Total	<	10	µg/L	603
20020523	PANC01	Mercury, Total	<	0.2	µg/L	604
20020523	PANC01	Calcium, Total		32.0	mg/L	605
20020523	PANC01	Magnesium, Total		64.0	mg/L	606
20020523	PANC01	Hardness, Total		343	mg/L	607

20020717	PANC01	Dissolved Oxygen		8.2	mg/L	608
20020717	PANC01	DO Saturation		111	%	609
20020717	PANC01	pH		7.4	SU	610
20020717	PANC01	Specific Conductance		8090	µS/cm	611
20020717	PANC01	Temperature, Water		32.2	°C	612
20020717	PANC01	Salinity		4.4	PPT	613
20020717	PANC01	Ammonia	<	0.02	mg/L	614
20020717	PANC01	Total Kjeldahl Nitrogen		0.9	mg/L	615
20020717	PANC01	NO2+NO3	<	0.02	mg/L	616
20020717	PANC01	Phosphorus, Total		0.25	mg/L	617
20020717	PANC01	Nitrogen, Total		0.9	mg/L	618
20020717	PANC01	Residue, Suspended		6.0	mg/L	619
20020717	PANC01	Residue, Volatile		2.0	mg/L	620
20020717	PANC01	Residue, Fixed		3.0	mg/L	621
20020717	PANC01	Turbidity		4	NTU	622
20020717	PANC01	Cadmium, Total	<	2	µg/L	623
20020717	PANC01	Chromium, Total	<	25	µg/L	624
20020717	PANC01	Copper, Total		2.7	µg/L	625
20020717	PANC01	Nickel, Total	<	10	µg/L	626
20020717	PANC01	Lead, Total	<	10	µg/L	627
20020717	PANC01	Zinc, Total		40	µg/L	628
20020717	PANC01	Silver, Total	<	5	µg/L	629
20020717	PANC01	Aluminum, Total		64	µg/L	630
20020717	PANC01	Iron, Total		300	µg/L	631
20020717	PANC01	Arsenic, Total	<	10	µg/L	632
20020717	PANC01	Mercury, Total	<	0.2	µg/L	633
20020717	PANC01	Calcium, Total		57.0	mg/L	634
20020717	PANC01	Magnesium, Total		170.0	mg/L	635
20020717	PANC01	Hardness, Total		842	mg/L	636
20021203	PANC01	Dissolved Oxygen		8.1	mg/L	637
20021203	PANC01	DO Saturation		59	%	638
20021203	PANC01	pH		6.4	SU	639
20021203	PANC01	Specific Conductance		1816	µS/cm	640
20021203	PANC01	Temperature, Water		6.2	°C	641
20021203	PANC01	Salinity		0.9	PPT	642
20021203	PANC01	Ammonia		0.11	mg/L	643

20021203	PANC01	Total Kjeldahl Nitrogen		0.8	mg/L	644
20021203	PANC01	NO2+NO3		0.06	mg/L	645
20021203	PANC01	Phosphorus, Total		0.18	mg/L	646
20021203	PANC01	Nitrogen, Total		0.8	mg/L	647
20021203	PANC01	Cadmium, Total	<	2	µg/L	648
20021203	PANC01	Chromium, Total	<	25	µg/L	649
20021203	PANC01	Copper, Total		3.0	µg/L	650
20021203	PANC01	Nickel, Total	<	10	µg/L	651
20021203	PANC01	Lead, Total	<	10	µg/L	652
20021203	PANC01	Zinc, Total		38	µg/L	653
20021203	PANC01	Silver, Total	<	5	µg/L	654
20021203	PANC01	Aluminum, Total		80	µg/L	655
20021203	PANC01	Iron, Total		360	µg/L	656
20021203	PANC01	Arsenic, Total	<	10	µg/L	657
20021203	PANC01	Mercury, Total	<	0.2	µg/L	658
20021203	PANC01	Calcium, Total		28.0	mg/L	659
20021203	PANC01	Magnesium, Total		40.0	mg/L	660
20021203	PANC01	Hardness, Total		234	mg/L	661
20020409	PAND01	Dissolved Oxygen		8.2	mg/L	662
20020409	PAND01	DO Saturation		88	%	663
20020409	PAND01	pH		5.0	SU	664
20020409	PAND01	Specific Conductance		136	µS/cm	665
20020409	PAND01	Temperature, Water		19.3	^{o}C	666
20020409	PAND01	Salinity		0.1	PPT	667
20020409	PAND01	Ammonia		0.03	mg/L	668
20020409	PAND01	Total Kjeldahl Nitrogen		1.2	mg/L	669
20020409	PAND01	NO2+NO3	<	0.01	mg/L	670
20020409	PAND01	Phosphorus, Total		0.05	mg/L	671
20020409	PAND01	Nitrogen, Total		1.2	mg/L	672
20020409	PAND01	Residue, Suspended		4.0	mg/L	673
20020409	PAND01	Residue, Volatile	<	2.5	mg/L	674
20020409	PAND01	Residue, Fixed	<	2.5	mg/L	675
20020523	PAND01	Dissolved Oxygen		4.7	mg/L	676
20020523	PAND01	DO Saturation		47	%	677
20020523	PAND01	pH		6.6	SU	678
20020523	PAND01	Specific Conductance		252	µS/cm	679

20020523	PAND01	Temperature, Water		16.2	°C		680
20020523	PAND01	Salinity		0.1	PPT		681
20020523	PAND01	Ammonia		0.26	mg/L		682
20020523	PAND01	Total Kjeldahl Nitrogen		2.1	mg/L		683
20020523	PAND01	NO2+NO3		0.22	mg/L	Estimated value; sample matrix interfered wit	684
20020523	PAND01	Phosphorus, Total		0.24	mg/L		685
20020523	PAND01	Nitrogen, Total		2.1	mg/L		686
20020523	PAND01	Residue, Suspended		9.0	mg/L		687
20020523	PAND01	Residue, Volatile		4.0	mg/L		688
20020523	PAND01	Residue, Fixed		5.0	mg/L		689
20020717	PAND01	Dissolved Oxygen		2.4	mg/L		690
20020717	PAND01	DO Saturation		30	%		691
20020717	PAND01	pH		6.7	SU		692
20020717	PAND01	Specific Conductance		391	µS/cm		693
20020717	PAND01	Temperature, Water		27.4	°C		694
20020717	PAND01	Salinity		0.2	PPT		695
20020717	PAND01	Ammonia		1.00	mg/L		696
20020717	PAND01	Total Kjeldahl Nitrogen		2.7	mg/L		697
20020717	PAND01	NO2+NO3		0.05	mg/L		698
20020717	PAND01	Phosphorus, Total		0.60	mg/L		699
20020717	PAND01	Nitrogen, Total		2.8	mg/L		700
20020717	PAND01	Residue, Suspended		5.0	mg/L		701
20020717	PAND01	Residue, Volatile		2.5	mg/L		702
20020717	PAND01	Residue, Fixed	<	2.5	mg/L		703
20021203	PAND01	Dissolved Oxygen		8.2	mg/L		704
20021203	PAND01	DO Saturation		67	%		705
20021203	PAND01	pH		4.2	SU		706
20021203	PAND01	Specific Conductance		191	µS/cm		707
20021203	PAND01	Temperature, Water		6.8	°C		708
20021203	PAND01	Salinity		0.1	PPT		709
20021203	PAND01	Ammonia		0.09	mg/L		710
20021203	PAND01	Total Kjeldahl Nitrogen		1.6	mg/L		711
20021203	PAND01	NO2+NO3		0.13	mg/L		712
20021203	PAND01	Phosphorus, Total		0.05	mg/L		713
20021203	PAND01	Nitrogen, Total		1.7	mg/L		714
20021203	PAND01	Residue, Suspended	<	2.5	mg/L		715

20021203	PAND01	Residue, Volatile	<	2.5	mg/L	716
20021203	PAND01	Residue, Fixed	<	2.5	mg/L	717
20020409	PASC01	Dissolved Oxygen		7.6	mg/L	718
20020409	PASC01	DO Saturation		83	%	719
20020409	PASC01	pH		5.9	SU	720
20020409	PASC01	Specific Conductance		240	μS/cm	721
20020409	PASC01	Temperature, Water		19.9	^{o}C	722
20020409	PASC01	Salinity		0.1	PPT	723
20020409	PASC01	Ammonia		0.04	mg/L	724
20020409	PASC01	Total Kjeldahl Nitrogen		0.7	mg/L	725
20020409	PASC01	NO2+NO3	<	0.01	mg/L	726
20020409	PASC01	Phosphorus, Total		0.03	mg/L	727
20020409	PASC01	Nitrogen, Total		0.7	mg/L	728
20020409	PASC01	Residue, Suspended	<	2.5	mg/L	729
20020409	PASC01	Residue, Volatile	<	2.5	mg/L	730
20020409	PASC01	Residue, Fixed	<	2.5	mg/L	731
20020523	PASC01	Dissolved Oxygen		1.5	mg/L	732
20020523	PASC01	DO Saturation		17	%	733
20020523	PASC01	pH		6.5	SU	734
20020523	PASC01	Specific Conductance		595	μS/cm	735
20020523	PASC01	Temperature, Water		20.2	^{o}C	736
20020523	PASC01	Salinity		0.3	PPT	737
20020523	PASC01	Ammonia		0.69	mg/L	738
20020523	PASC01	Total Kjeldahl Nitrogen		1.8	mg/L	739
20020523	PASC01	NO2+NO3	<	0.01	mg/L	740
20020523	PASC01	Phosphorus, Total		0.42	mg/L	741
20020523	PASC01	Nitrogen, Total		1.8	mg/L	742
20020523	PASC01	Residue, Suspended		3.0	mg/L	743
20020523	PASC01	Residue, Volatile	<	2.5	mg/L	744
20020523	PASC01	Residue, Fixed	<	2.5	mg/L	745
20020717	PASC01	Dissolved Oxygen		5.4	mg/L	746
20020717	PASC01	DO Saturation		70	%	747
20020717	PASC01	pH		6.4	SU	748
20020717	PASC01	Specific Conductance		3228	μS/cm	749
20020717	PASC01	Temperature, Water		28.5	^{o}C	750
20020717	PASC01	Salinity		1.6	PPT	751

	20020717		PASC01	Ammonia	<	0.02	mg/L	752
	20020717		PASC01	Total Kjeldahl Nitrogen		1.1	mg/L	753
	20020717		PASC01	NO2+NO3	<	0.02	mg/L	754
	20020717		PASC01	Phosphorus, Total		0.14	mg/L	755
	20020717		PASC01	Nitrogen, Total		1.1	mg/L	756
	20020717		PASC01	Residue, Suspended		9.0	mg/L	757
	20020717		PASC01	Residue, Volatile		6.0	mg/L	758
	20020717		PASC01	Residue, Fixed	<	3.3	mg/L	759
	20021203		PASC01	Dissolved Oxygen		6.5	mg/L	760
	20021203		PASC01	DO Saturation		55	%	761
	20021203		PASC01	pH		6.4	SU	762
	20021203		PASC01	Specific Conductance		395	μS/cm	763
	20021203		PASC01	Temperature, Water		6.0	^{o}C	764
	20021203		PASC01	Salinity		0.2	PPT	765
	20021203		PASC01	Ammonia		0.08	mg/L	766
	20021203		PASC01	Total Kjeldahl Nitrogen		1.0	mg/L	767
	20021203		PASC01	NO2+NO3	<	0.02	mg/L	768
	20021203		PASC01	Phosphorus, Total		0.15	mg/L	769
	20021203		PASC01	Nitrogen, Total		1.0	mg/L	770
	20021203		PASC01	Residue, Suspended		6.0	mg/L	771
	20021203		PASC01	Residue, Volatile		4.0	mg/L	772
	20021203		PASC01	Residue, Fixed	<	2.5	mg/L	773
	20030326	1645	PAGD01	DO Saturation		50	%	774
	20030326	1645	PAGD01	Dissolved Oxygen		4.9	mg/L	775
	20030326	1645	PAGD01	Specific Conductance		144	μS/cm	776
	20030326	1645	PAGD01	Salinity		0.1	PPT	777
	20030326	1645	PAGD01	Temperature, Water		16.3	^{o}C	778
	20030326	1645	PAGD01	pH		4.0	SU	779
3W1870	20030326	1645	PAGD01	Residue, Suspended		16.0	mg/L	780
3W1870	20030326	1645	PAGD01	Residue, Volatile		6.0	mg/L	781
3W1870	20030326	1645	PAGD01	Residue, Fixed		10.0	mg/L	782
3W1870	20030326	1645	PAGD01	Ammonia		0.24	mg/L	783
3W1870	20030326	1645	PAGD01	Total Kjeldahl Nitrogen		2.3	mg/L	784
3W1870	20030326	1645	PAGD01	NO2+NO3		0.09	mg/L	785
3W1870	20030326	1645	PAGD01	Phosphorus, Total		0.06	mg/L	786
	20030326	1710	PAGD02	DO Saturation		56	%	787

	20030326	1710	PAGD02	Dissolved Oxygen		5.3	mg/L	788
	20030326	1710	PAGD02	Specific Conductance		120	µS/cm	789
	20030326	1710	PAGD02	Salinity		0.1	PPT	790
	20030326	1710	PAGD02	Temperature, Water		17.5	^{o}C	791
	20030326	1710	PAGD02	pH		4.0	SU	792
3W1871	20030326	1710	PAGD02	Residue, Suspended	<	2.5	mg/L	793
3W1871	20030326	1710	PAGD02	Residue, Volatile	<	2.5	mg/L	794
3W1871	20030326	1710	PAGD02	Residue, Fixed	<	2.5	mg/L	795
3W1871	20030326	1710	PAGD02	Turbidity		2	NTU	796
3W1871	20030326	1710	PAGD02	Ammonia		0.02	mg/L	797
3W1871	20030326	1710	PAGD02	Total Kjeldahl Nitrogen		1.9	mg/L	798
3W1871	20030326	1710	PAGD02	NO2+NO3	<	0.02	mg/L	799
3W1871	20030326	1710	PAGD02	Phosphorus, Total		0.02	mg/L	800
3W1871	20030326	1710	PAGD02	Cadmium, Total	<	2	µg/L	801
3W1871	20030326	1710	PAGD02	Chromium, Total	<	25	µg/L	802
3W1871	20030326	1710	PAGD02	Copper, Total		2.9	µg/L	803
3W1871	20030326	1710	PAGD02	Nickel, Total	<	10	µg/L	804
3W1871	20030326	1710	PAGD02	Lead, Total	<	10	µg/L	805
3W1871	20030326	1710	PAGD02	Zinc, Total		13	µg/L	806
3W1871	20030326	1710	PAGD02	Silver, Total	<	5	µg/L	807
3W1871	20030326	1710	PAGD02	Aluminum, Total		1000	µg/L	808
3W1871	20030326	1710	PAGD02	Calcium, Total		8.0	mg/L	809
3W1871	20030326	1710	PAGD02	Iron, Total		860	µg/L	810
3W1871	20030326	1710	PAGD02	Magnesium, Total		2.5	mg/L	811
3W1871	20030326	1710	PAGD02	Manganese, Total		71	µg/L	812
3W1871	20030326	1710	PAGD02	Arsenic, Total	<	10	µg/L	813
3W1871	20030326	1710	PAGD02	Mercury, Total	<	0.2	µg/L	814
	20030326	1730	PAND01	DO Saturation		40	%	815
	20030326	1730	PAND01	Dissolved Oxygen		3.9	mg/L	816
	20030326	1730	PAND01	Specific Conductance		133	µS/cm	817
	20030326	1730	PAND01	Salinity		0.1	PPT	818
	20030326	1730	PAND01	Temperature, Water		16.5	^{o}C	819
	20030326	1730	PAND01	pH		3.8	SU	820
3W1872	20030326	1730	PAND01	Residue, Suspended	<	2.5	mg/L	821
3W1872	20030326	1730	PAND01	Residue, Volatile	<	2.5	mg/L	822
3W1872	20030326	1730	PAND01	Residue, Fixed	<	2.5	mg/L	823

3W1872	20030326	1730	PAND01	Ammonia		0.09	mg/L	824
3W1872	20030326	1730	PAND01	Total Kjeldahl Nitrogen		1.7	mg/L	825
3W1872	20030326	1730	PAND01	NO2+NO3		0.02	mg/L	826
3W1872	20030326	1730	PAND01	Phosphorus, Total		0.04	mg/L	827
	20030326	1800	PAJC01	DO Saturation		47	%	828
	20030326	1800	PAJC01	Dissolved Oxygen		4.5	mg/L	829
	20030326	1800	PAJC01	Specific Conductance		352	µS/cm	830
	20030326	1800	PAJC01	Salinity		0.2	PPT	831
	20030326	1800	PAJC01	Temperature, Water		17.6	°C	832
	20030326	1800	PAJC01	pH		5.8	SU	833
3W1873	20030326	1800	PAJC01	Residue, Suspended		7.0	mg/L	834
3W1873	20030326	1800	PAJC01	Residue, Volatile	<	2.5	mg/L	835
3W1873	20030326	1800	PAJC01	Residue, Fixed		4.0	mg/L	836
3W1873	20030326	1800	PAJC01	Ammonia		0.08	mg/L	837
3W1873	20030326	1800	PAJC01	Total Kjeldahl Nitrogen		1.3	mg/L	838
3W1873	20030326	1800	PAJC01	NO2+NO3		0.26	mg/L	839
3W1873	20030326	1800	PAJC01	Phosphorus, Total		0.10	mg/L	840
	20030326	1830	PAHL01	DO Saturation		50	%	841
	20030326	1830	PAHL01	Dissolved Oxygen		4.8	mg/L	842
	20030326	1830	PAHL01	Specific Conductance		200	µS/cm	843
	20030326	1830	PAHL01	Salinity		0.1	PPT	844
	20030326	1830	PAHL01	Temperature, Water		16.6	°C	845
	20030326	1830	PAHL01	pH		5.9	SU	846
3W1874	20030326	1830	PAHL01	Residue, Suspended		10.0	mg/L	847
3W1874	20030326	1830	PAHL01	Residue, Volatile		5.0	mg/L	848
3W1874	20030326	1830	PAHL01	Residue, Fixed		5.0	mg/L	849
3W1874	20030326	1830	PAHL01	Ammonia		0.20	mg/L	850
3W1874	20030326	1830	PAHL01	Total Kjeldahl Nitrogen		1.4	mg/L	851
3W1874	20030326	1830	PAHL01	NO2+NO3		0.60	mg/L	852
3W1874	20030326	1830	PAHL01	Phosphorus, Total		0.09	mg/L	853
	20030326	1850	PASC02	DO Saturation		54	%	854
	20030326	1850	PASC02	Dissolved Oxygen		5.2	mg/L	855
	20030326	1850	PASC02	Specific Conductance		210	µS/cm	856
	20030326	1850	PASC02	Salinity		0.1	PPT	857
	20030326	1850	PASC02	Temperature, Water		17.3	°C	858
	20030326	1850	PASC02	pH		6.2	SU	859

3W1875	20030326	1850	PASC01	Residue, Suspended	<	2.5	mg/L	860
3W1875	20030326	1850	PASC01	Residue, Volatile	<	2.5	mg/L	861
3W1875	20030326	1850	PASC01	Residue, Fixed	<	2.5	mg/L	862
3W1875	20030326	1850	PASC01	Ammonia	<	0.02	mg/L	863
3W1875	20030326	1850	PASC01	Total Kjeldahl Nitrogen		0.7	mg/L	864
3W1875	20030326	1850	PASC01	NO2+NO3	<	0.02	mg/L	865
3W1875	20030326	1850	PASC01	Phosphorus, Total		0.04	mg/L	866
3W1876	20030326	1915	PAPC01	Residue, Suspended		7.0	mg/L	867
3W1876	20030326	1915	PAPC01	Residue, Volatile	<	2.5	mg/L	868
3W1876	20030326	1915	PAPC01	Residue, Fixed		5.0	mg/L	869
3W1876	20030326	1915	PAPC01	Turbidity		14	NTU	870
3W1876	20030326	1915	PAPC01	Ammonia		0.13	mg/L	871
3W1876	20030326	1915	PAPC01	Total Kjeldahl Nitrogen		0.9	mg/L	872
3W1876	20030326	1915	PAPC01	NO2+NO3		0.13	mg/L	873
3W1876	20030326	1915	PAPC01	Phosphorus, Total		0.48	mg/L	874
3W1876	20030326	1915	PAPC01	Cadmium, Total	<	2	µg/L	875
3W1876	20030326	1915	PAPC01	Chromium, Total	<	25	µg/L	876
3W1876	20030326	1915	PAPC01	Copper, Total		3.2	µg/L	877
3W1876	20030326	1915	PAPC01	Nickel, Total	<	10	µg/L	878
3W1876	20030326	1915	PAPC01	Lead, Total	<	10	µg/L	879
3W1876	20030326	1915	PAPC01	Zinc, Total		16	µg/L	880
3W1876	20030326	1915	PAPC01	Silver, Total	<	5	µg/L	881
3W1876	20030326	1915	PAPC01	Aluminum, Total		750	µg/L	882
3W1876	20030326	1915	PAPC01	Calcium, Total		14.0	mg/L	883
3W1876	20030326	1915	PAPC01	Iron, Total		2900	µg/L	884
3W1876	20030326	1915	PAPC01	Magnesium, Total		8.2	mg/L	885
3W1876	20030326	1915	PAPC01	Manganese, Total		190	µg/L	886
3W1876	20030326	1915	PAPC01	Arsenic, Total	<	10	µg/L	887
3W1876	20030326	1915	PAPC01	Mercury, Total	<	0.2	µg/L	888
	20030326	1930	PAAC01	DO Saturation		40	%	889
	20030326	1930	PAAC01	Dissolved Oxygen		3.7	mg/L	890
	20030326	1930	PAAC01	Specific Conductance		363	µS/cm	891
	20030326	1930	PAAC01	Salinity		0.2	PPT	892
	20030326	1930	PAAC01	Temperature, Water		17.5	^{o}C	893
	20030326	1930	PAAC01	pH		6.1	SU	894
3W1877	20030326	1930	PAAC01	Residue, Suspended		6.0	mg/L	895

3W1877	20030326	1930	PAAC01	Residue, Volatile	<	2.5	mg/L	896
3W1877	20030326	1930	PAAC01	Residue, Fixed		4.0	mg/L	897
3W1877	20030326	1930	PAAC01	Turbidity		7	NTU	898
3W1877	20030326	1930	PAAC01	Ammonia		0.08	mg/L	899
3W1877	20030326	1930	PAAC01	Total Kjeldahl Nitrogen		1.0	mg/L	900
3W1877	20030326	1930	PAAC01	NO2+NO3		0.17	mg/L	901
3W1877	20030326	1930	PAAC01	Phosphorus, Total		0.31	mg/L	902
3W1877	20030326	1930	PAAC01	Cadmium, Total	<	2	µg/L	903
3W1877	20030326	1930	PAAC01	Chromium, Total	<	25	µg/L	904
3W1877	20030326	1930	PAAC01	Copper, Total		3.7	µg/L	905
3W1877	20030326	1930	PAAC01	Nickel, Total	<	10	µg/L	906
3W1877	20030326	1930	PAAC01	Lead, Total	<	10	µg/L	907
3W1877	20030326	1930	PAAC01	Zinc, Total	<	10	µg/L	908
3W1877	20030326	1930	PAAC01	Silver, Total	<	5	µg/L	909
3W1877	20030326	1930	PAAC01	Aluminum, Total		480	µg/L	910
3W1877	20030326	1930	PAAC01	Calcium, Total		12.0	mg/L	911
3W1877	20030326	1930	PAAC01	Iron, Total		1500	µg/L	912
3W1877	20030326	1930	PAAC01	Magnesium, Total		8.4	mg/L	913
3W1877	20030326	1930	PAAC01	Manganese, Total		93	µg/L	914
3W1877	20030326	1930	PAAC01	Arsenic, Total	<	10	µg/L	915
3W1877	20030326	1930	PAAC01	Mercury, Total	<	0.2	µg/L	916
	20030326	1950	PAMC01	DO Saturation		30	%	917
	20030326	1950	PAMC01	Dissolved Oxygen		2.9	mg/L	918
	20030326	1950	PAMC01	Specific Conductance		354	µS/cm	919
	20030326	1950	PAMC01	Salinity		0.2	PPT	920
	20030326	1950	PAMC01	Temperature, Water		17.4	^{o}C	921
	20030326	1950	PAMC01	pH		6.2	SU	922
3W1878	20030326	1950	PAMC01	Residue, Suspended		8.0	mg/L	923
3W1878	20030326	1950	PAMC01	Residue, Volatile		3.0	mg/L	924
3W1878	20030326	1950	PAMC01	Residue, Fixed		5.0	mg/L	925
3W1878	20030326	1950	PAMC01	Turbidity		12	NTU	926
3W1878	20030326	1950	PAMC01	Ammonia		0.10	mg/L	927
3W1878	20030326	1950	PAMC01	Total Kjeldahl Nitrogen		1.4	mg/L	928
3W1878	20030326	1950	PAMC01	NO2+NO3		0.07	mg/L	929
3W1878	20030326	1950	PAMC01	Phosphorus, Total		0.35	mg/L	930
3W1878	20030326	1950	PAMC01	Cadmium, Total	<	2	µg/L	931

3W1878	20030326	1950	PAMC01	Chromium, Total	<	25	µg/L	932
3W1878	20030326	1950	PAMC01	Copper, Total		4.1	µg/L	933
3W1878	20030326	1950	PAMC01	Nickel, Total	<	10	µg/L	934
3W1878	20030326	1950	PAMC01	Lead, Total	<	10	µg/L	935
3W1878	20030326	1950	PAMC01	Zinc, Total		28	µg/L	936
3W1878	20030326	1950	PAMC01	Silver, Total	<	5	µg/L	937
3W1878	20030326	1950	PAMC01	Aluminum, Total		910	µg/L	938
3W1878	20030326	1950	PAMC01	Calcium, Total		9.6	mg/L	939
3W1878	20030326	1950	PAMC01	Iron, Total		1700	µg/L	940
3W1878	20030326	1950	PAMC01	Magnesium, Total		8.2	mg/L	941
3W1878	20030326	1950	PAMC01	Manganese, Total		110	µg/L	942
3W1878	20030326	1950	PAMC01	Arsenic, Total	<	10	µg/L	943
3W1878	20030326	1950	PAMC01	Mercury, Total	<	0.2	µg/L	944
	20030326	2015	PANC01	DO Saturation		60	%	945
	20030326	2015	PANC01	Dissolved Oxygen		6.2	mg/L	946
	20030326	2015	PANC01	Specific Conductance		224	µS/cm	947
	20030326	2015	PANC01	Salinity		0.1	PPT	948
	20030326	2015	PANC01	Temperature, Water		16.8	°C	949
	20030326	2015	PANC01	pH		6.5	SU	950
3W1879	20030326	2015	PANC01	Residue, Suspended		6.0	mg/L	951
3W1879	20030326	2015	PANC01	Residue, Volatile		3.0	mg/L	952
3W1879	20030326	2015	PANC01	Residue, Fixed		3.0	mg/L	953
3W1879	20030326	2015	PANC01	Turbidity		7	NTU	954
3W1879	20030326	2015	PANC01	Ammonia		0.26	mg/L	955
3W1879	20030326	2015	PANC01	Total Kjeldahl Nitrogen		1.1	mg/L	956
3W1879	20030326	2015	PANC01	NO2+NO3		0.15	mg/L	957
3W1879	20030326	2015	PANC01	Phosphorus, Total		0.31	mg/L	958
3W1879	20030326	2015	PANC01	Cadmium, Total	<	2	µg/L	959
3W1879	20030326	2015	PANC01	Chromium, Total	<	25	µg/L	960
3W1879	20030326	2015	PANC01	Copper, Total		3.2	µg/L	961
3W1879	20030326	2015	PANC01	Nickel, Total	<	10	µg/L	962
3W1879	20030326	2015	PANC01	Lead, Total	<	10	µg/L	963
3W1879	20030326	2015	PANC01	Zinc, Total	<	10	µg/L	964
3W1879	20030326	2015	PANC01	Silver, Total	<	5	µg/L	965
3W1879	20030326	2015	PANC01	Aluminum, Total		350	µg/L	966
3W1879	20030326	2015	PANC01	Calcium, Total		16.0	mg/L	967

3W1879	20030326	2015	PANC01	Iron, Total		530	µg/L		968
3W1879	20030326	2015	PANC01	Magnesium, Total		7.0	mg/L		969
3W1879	20030326	2015	PANC01	Manganese, Total		45	µg/L		970
3W1879	20030326	2015	PANC01	Arsenic, Total	<	10	µg/L		971
3W1879	20030326	2015	PANC01	Mercury, Total	<	0.2	µg/L		972
3W1880	20030326	2015	PACC01	Residue, Suspended		10.0	mg/L		973
3W1880	20030326	2015	PACC01	Residue, Volatile		3.0	mg/L		974
3W1880	20030326	2015	PACC01	Residue, Fixed		7.0	mg/L		975
3W1880	20030326	2015	PACC01	Turbidity		17	NTU		976
3W1880	20030326	2015	PACC01	Ammonia		0.27	mg/L		977
3W1880	20030326	2015	PACC01	Total Kjeldahl Nitrogen		0.9	mg/L		978
3W1880	20030326	2015	PACC01	NO2+NO3		0.26	mg/L		979
3W1880	20030326	2015	PACC01	Phosphorus, Total		0.32	mg/L		980
3W1880	20030326	2015	PACC01	Cadmium, Total	<	2	µg/L		981
3W1880	20030326	2015	PACC01	Chromium, Total	<	25	µg/L		982
3W1880	20030326	2015	PACC01	Copper, Total		2.6	µg/L		983
3W1880	20030326	2015	PACC01	Nickel, Total	<	10	µg/L		984
3W1880	20030326	2015	PACC01	Lead, Total	<	10	µg/L		985
3W1880	20030326	2015	PACC01	Zinc, Total		13	µg/L		986
3W1880	20030326	2015	PACC01	Silver, Total	<	5	µg/L		987
3W1880	20030326	2015	PACC01	Aluminum, Total		360	µg/L		988
3W1880	20030326	2015	PACC01	Calcium, Total		42.0	mg/L		989
3W1880	20030326	2015	PACC01	Iron, Total		2700	µg/L		990
3W1880	20030326	2015	PACC01	Magnesium, Total		17.0	mg/L		991
3W1880	20030326	2015	PACC01	Manganese, Total		300	µg/L		992
3W1880	20030326	2015	PACC01	Arsenic, Total	<	10	µg/L		993
3W1880	20030326	2015	PACC01	Mercury, Total	<	0.2	µg/L		994
	20030407	1410	PAGD02	DO Saturation		36	%	S	995
	20030407	1410	PAGD02	Dissolved Oxygen		3.8	mg/L	S	996
	20030407	1410	PAGD02	Specific Conductance		116	µS/cm	S	997
	20030407	1410	PAGD02	Salinity		0.1	PPT	S	998
	20030407	1410	PAGD02	Temperature, Water		13.1	°C	S	999
	20030407	1410	PAGD02	pH		3.9	SU	S	1000
3W2101	20030407	1430	PAGD02	Residue, Suspended		4.0	mg/L	S	1001
3W2101	20030407	1430	PAGD02	Residue, Volatile		3.0	mg/L	S	1002
3W2101	20030407	1430	PAGD02	Residue, Fixed	<	2.5	mg/L	S	1003

3W2101	20030407	1430	PAGD02	Turbidity		2	NTU	S	1004
3W2101	20030407	1430	PAGD02	Ammonia		0.02	mg/L	S	1005
3W2101	20030407	1430	PAGD02	Total Kjeldahl Nitrogen		1.8	mg/L	S	1006
3W2101	20030407	1430	PAGD02	NO2+NO3	<	0.02	mg/L	S	1007
3W2101	20030407	1430	PAGD02	Phosphorus, Total		0.04	mg/L	S	1008
3W2101	20030407	1430	PAGD02	Cadmium, Total	<	2	µg/L	S	1009
3W2101	20030407	1430	PAGD02	Chromium, Total	<	25	µg/L	S	1010
3W2101	20030407	1430	PAGD02	Copper, Total		4.0	µg/L	S	1011
3W2101	20030407	1430	PAGD02	Nickel, Total	<	10	µg/L	S	1012
3W2101	20030407	1430	PAGD02	Lead, Total	<	10	µg/L	S	1013
3W2101	20030407	1430	PAGD02	Zinc, Total		12	µg/L	S	1014
3W2101	20030407	1430	PAGD02	Silver, Total	<	5	µg/L	S	1015
3W2101	20030407	1430	PAGD02	Aluminum, Total		1100	µg/L	S	1016
3W2101	20030407	1430	PAGD02	Calcium, Total		7.6	mg/L	S	1017
3W2101	20030407	1430	PAGD02	Iron, Total		1400	µg/L	S	1018
3W2101	20030407	1430	PAGD02	Magnesium, Total		2.4	mg/L	S	1019
3W2101	20030407	1430	PAGD02	Manganese, Total		82	µg/L	S	1020
3W2101	20030407	1430	PAGD02	Arsenic, Total	<	10	µg/L	S	1021
3W2101	20030407	1430	PAGD02	Mercury, Total	<	0.2	µg/L	S	1022
	20030407	1445	PAND01	DO Saturation		52	%	S	1023
	20030407	1445	PAND01	Dissolved Oxygen		5.6	mg/L	S	1024
	20030407	1445	PAND01	Specific Conductance		116	µS/cm	S	1025
	20030407	1445	PAND01	Salinity		0.1	PPT	S	1026
	20030407	1445	PAND01	Temperature, Water		11.9	°C	S	1027
	20030407	1445	PAND01	pH		5.3	SU	S	1028
3W2102	20030407	1445	PAND01	Residue, Suspended		93.0	mg/L	S	1029
3W2102	20030407	1445	PAND01	Residue, Volatile		18.0	mg/L	S	1030
3W2102	20030407	1445	PAND01	Residue, Fixed		74.0	mg/L	S	1031
3W2102	20030407	1445	PAND01	Turbidity		40	NTU	S	1032
3W2102	20030407	1445	PAND01	Ammonia		0.13	mg/L	S	1033
3W2102	20030407	1445	PAND01	Total Kjeldahl Nitrogen		1.6	mg/L	S	1034
3W2102	20030407	1445	PAND01	NO2+NO3		0.07	mg/L	S	1035
3W2102	20030407	1445	PAND01	Phosphorus, Total		0.27	mg/L	S	1036
3W2102	20030407	1445	PAND01	Cadmium, Total	<	2	µg/L	S	1037
3W2102	20030407	1445	PAND01	Chromium, Total	<	25	µg/L	S	1038
3W2102	20030407	1445	PAND01	Copper, Total		4.2	µg/L	S	1039

3W2102	20030407	1445	PAND01	Nickel, Total	<	10	µg/L	S	1040
3W2102	20030407	1445	PAND01	Lead, Total	<	10	µg/L	S	1041
3W2102	20030407	1445	PAND01	Zinc, Total		21	µg/L	S	1042
3W2102	20030407	1445	PAND01	Silver, Total	<	5	µg/L	S	1043
3W2102	20030407	1445	PAND01	Aluminum, Total		3400	µg/L	S	1044
3W2102	20030407	1445	PAND01	Calcium, Total		7.8	mg/L	S	1045
3W2102	20030407	1445	PAND01	Iron, Total		3000	µg/L	S	1046
3W2102	20030407	1445	PAND01	Magnesium, Total		3.1	mg/L	S	1047
3W2102	20030407	1445	PAND01	Manganese, Total		95	µg/L	S	1048
3W2102	20030407	1445	PAND01	Arsenic, Total	<	10	µg/L	S	1049
3W2102	20030407	1445	PAND01	Mercury, Total	<	0.2	µg/L	S	1050
	20030407	1500	PAKC02	DO Saturation		38	%	S	1051
	20030407	1500	PAKC02	Dissolved Oxygen		4.2	mg/L	S	1052
	20030407	1500	PAKC02	Specific Conductance		248	µS/cm	S	1053
	20030407	1500	PAKC02	Salinity		0.1	PPT	S	1054
	20030407	1500	PAKC02	Temperature, Water		11.0	^{o}C	S	1055
	20030407	1500	PAKC02	pH		6.0	SU	S	1056
3W2103	20030407	1500	PAKC02	Residue, Suspended		6.0	mg/L	S	1057
3W2103	20030407	1500	PAKC02	Residue, Volatile		6.0	mg/L	S	1058
3W2103	20030407	1500	PAKC02	Residue, Fixed	<	2.5	mg/L	S	1059
3W2103	20030407	1500	PAKC02	Ammonia		0.04	mg/L	S	1060
3W2103	20030407	1500	PAKC02	Total Kjeldahl Nitrogen		1.2	mg/L	S	1061
3W2103	20030407	1500	PAKC02	NO2+NO3		0.06	mg/L	S	1062
3W2103	20030407	1500	PAKC02	Phosphorus, Total		0.17	mg/L	S	1063
	20030407	1530	PACC01	DO Saturation		48	%	S	1064
	20030407	1530	PACC01	Dissolved Oxygen		5.0	mg/L	S	1065
	20030407	1530	PACC01	Specific Conductance		220	µS/cm	S	1066
	20030407	1530	PACC01	Salinity		0.1	PPT	S	1067
	20030407	1530	PACC01	Temperature, Water		12.5	^{o}C	S	1068
	20030407	1530	PACC01	pH		6.3	SU	S	1069
3W2104	20030407	1530	PACC01	Residue, Suspended		41.0	mg/L	S	1070
3W2104	20030407	1530	PACC01	Residue, Volatile		9.0	mg/L	S	1071
3W2104	20030407	1530	PACC01	Residue, Fixed		32.0	mg/L	S	1072
3W2104	20030407	1530	PACC01	Turbidity		29	NTU	S	1073
3W2104	20030407	1530	PACC01	Ammonia		0.17	mg/L	S	1074
3W2104	20030407	1530	PACC01	Total Kjeldahl Nitrogen		1.0	mg/L	S	1075

3W2104	20030407	1530	PACC01	NO2+NO3		0.11	mg/L	S	1076
3W2104	20030407	1530	PACC01	Phosphorus, Total		0.32	mg/L	S	1077
3W2104	20030407	1530	PACC01	Cadmium, Total	<	2	µg/L	S	1078
3W2104	20030407	1530	PACC01	Chromium, Total	<	25	µg/L	S	1079
3W2104	20030407	1530	PACC01	Copper, Total		5.4	µg/L	S	1080
3W2104	20030407	1530	PACC01	Nickel, Total	<	10	µg/L	S	1081
3W2104	20030407	1530	PACC01	Lead, Total	<	10	µg/L	S	1082
3W2104	20030407	1530	PACC01	Zinc, Total		22	µg/L	S	1083
3W2104	20030407	1530	PACC01	Silver, Total	<	5	µg/L	S	1084
3W2104	20030407	1530	PACC01	Aluminum, Total		1300	µg/L	S	1085
3W2104	20030407	1530	PACC01	Calcium, Total		19.0	mg/L	S	1086
3W2104	20030407	1530	PACC01	Iron, Total		2600	µg/L	S	1087
3W2104	20030407	1530	PACC01	Magnesium, Total		6.6	mg/L	S	1088
3W2104	20030407	1530	PACC01	Manganese, Total		190	µg/L	S	1089
3W2104	20030407	1530	PACC01	Arsenic, Total	<	10	µg/L	S	1090
3W2104	20030407	1530	PACC01	Mercury, Total	<	0.2	µg/L	S	1091
	20030407	1550	PAPC01	DO Saturation		58	%	S	1092
	20030407	1550	PAPC01	Dissolved Oxygen		6.3	mg/L	S	1093
	20030407	1550	PAPC01	Specific Conductance		99	µS/cm	S	1094
	20030407	1550	PAPC01	Salinity		0.0	PPT	S	1095
	20030407	1550	PAPC01	Temperature, Water		12.1	^{o}C	S	1096
	20030407	1550	PAPC01	pH		6.4	SU	S	1097
3W2105	20030407	1545	PAPC01	Residue, Suspended		50.0	mg/L	S	1098
3W2105	20030407	1545	PAPC01	Residue, Volatile		9.0	mg/L	S	1099
3W2105	20030407	1545	PAPC01	Residue, Fixed		41.0	mg/L	S	1100
3W2105	20030407	1545	PAPC01	Turbidity		60	NTU	S	1101
3W2105	20030407	1545	PAPC01	Ammonia		0.70	mg/L	S	1102
3W2105	20030407	1545	PAPC01	Total Kjeldahl Nitrogen		1.6	mg/L	S	1103
3W2105	20030407	1545	PAPC01	NO2+NO3		0.20	mg/L	S	1104
3W2105	20030407	1545	PAPC01	Phosphorus, Total		1.20	mg/L	S	1105
3W2105	20030407	1545	PAPC01	Cadmium, Total	<	2	µg/L	S	1106
3W2105	20030407	1545	PAPC01	Chromium, Total	<	25	µg/L	S	1107
3W2105	20030407	1545	PAPC01	Copper, Total		5.7	µg/L	S	1108
3W2105	20030407	1545	PAPC01	Nickel, Total	<	10	µg/L	S	1109
3W2105	20030407	1545	PAPC01	Lead, Total	<	10	µg/L	S	1110
3W2105	20030407	1545	PAPC01	Zinc, Total		17	µg/L	S	1111

3W2105	20030407	1545	PAPC01	Silver, Total	<	5	µg/L	S	1112
3W2105	20030407	1545	PAPC01	Aluminum, Total		4900	µg/L	S	1113
3W2105	20030407	1545	PAPC01	Calcium, Total		4.5	mg/L	S	1114
3W2105	20030407	1545	PAPC01	Iron, Total		2000	µg/L	S	1115
3W2105	20030407	1545	PAPC01	Magnesium, Total		2.6	mg/L	S	1116
3W2105	20030407	1545	PAPC01	Manganese, Total		76	µg/L	S	1117
3W2105	20030407	1545	PAPC01	Arsenic, Total	<	10	µg/L	S	1118
3W2105	20030407	1545	PAPC01	Mercury, Total	<	0.2	µg/L	S	1119
	20030407	1615	PAAC01	DO Saturation		64	%	S	1120
	20030407	1615	PAAC01	Dissolved Oxygen		6.9	mg/L	S	1122
	20030407	1615	PAAC01	Specific Conductance		272	µS/cm	S	1123
	20030407	1615	PAAC01	Salinity		0.1	PPT	S	1124
	20030407	1615	PAAC01	Temperature, Water		11.6	°C	S	1125
	20030407	1615	PAAC01	pH		6.4	SU	S	1126
3W2106	20030407	1615	PAAC01	Residue, Suspended		9.0	mg/L	S	1127
3W2106	20030407	1615	PAAC01	Residue, Volatile		3.0	mg/L	S	1128
3W2106	20030407	1615	PAAC01	Residue, Fixed		6.0	mg/L	S	1129
3W2106	20030407	1615	PAAC01	Turbidity		13	NTU	S	1130
3W2106	20030407	1615	PAAC01	Ammonia		0.65	mg/L	S	1131
3W2106	20030407	1615	PAAC01	Total Kjeldahl Nitrogen		1.4	mg/L	S	1132
3W2106	20030407	1615	PAAC01	NO2+NO3		0.45	mg/L	S	1133
3W2106	20030407	1615	PAAC01	Phosphorus, Total		1.60	mg/L	S	1134
3W2106	20030407	1615	PAAC01	Cadmium, Total	<	2	µg/L	S	1135
3W2106	20030407	1615	PAAC01	Chromium, Total	<	25	µg/L	S	1136
3W2106	20030407	1615	PAAC01	Copper, Total		3.2	µg/L	S	1137
3W2106	20030407	1615	PAAC01	Nickel, Total	<	10	µg/L	S	1138
3W2106	20030407	1615	PAAC01	Lead, Total	<	10	µg/L	S	1139
3W2106	20030407	1615	PAAC01	Zinc, Total	<	10	µg/L	S	1140
3W2106	20030407	1615	PAAC01	Silver, Total	<	5	µg/L	S	1141
3W2106	20030407	1615	PAAC01	Aluminum, Total		680	µg/L	S	1142
3W2106	20030407	1615	PAAC01	Calcium, Total		7.9	mg/L	S	1143
3W2106	20030407	1615	PAAC01	Iron, Total		1100	µg/L	S	1144
3W2106	20030407	1615	PAAC01	Magnesium, Total		6.0	mg/L	S	1145
3W2106	20030407	1615	PAAC01	Manganese, Total		90	µg/L	S	1146
3W2106	20030407	1615	PAAC01	Arsenic, Total	<	10	µg/L	S	1147
3W2106	20030407	1615	PAAC01	Mercury, Total	<	0.2	µg/L	S	1148

	20030407	1630	PAMC01	DO Saturation		46	%	S	1149
	20030407	1630	PAMC01	Dissolved Oxygen		5.0	mg/L	S	1150
	20030407	1630	PAMC01	Specific Conductance		543	µS/cm	S	1151
	20030407	1630	PAMC01	Salinity		0.3	PPT	S	1152
	20030407	1630	PAMC01	Temperature, Water		11.8	°C	S	1153
	20030407	1630	PAMC01	pH		6.4	SU	S	1154
3W2107	20030407	1630	PAMC01	Residue, Suspended		5.0	mg/L	S	1155
3W2107	20030407	1630	PAMC01	Residue, Volatile		3.0	mg/L	S	1156
3W2107	20030407	1630	PAMC01	Residue, Fixed	<	2.5	mg/L	S	1157
3W2107	20030407	1630	PAMC01	Turbidity		6	NTU	S	1158
3W2107	20030407	1630	PAMC01	Ammonia		0.12	mg/L	S	1159
3W2107	20030407	1630	PAMC01	Total Kjeldahl Nitrogen		1.1	mg/L	S	1160
3W2107	20030407	1630	PAMC01	NO2+NO3		0.06	mg/L	S	1161
3W2107	20030407	1630	PAMC01	Phosphorus, Total		0.32	mg/L	S	1162
3W2107	20030407	1630	PAMC01	Cadmium, Total	<	2	µg/L	S	1163
3W2107	20030407	1630	PAMC01	Chromium, Total	<	25	µg/L	S	1164
3W2107	20030407	1630	PAMC01	Copper, Total		3.4	µg/L	S	1165
3W2107	20030407	1630	PAMC01	Nickel, Total	<	10	µg/L	S	1166
3W2107	20030407	1630	PAMC01	Lead, Total	<	10	µg/L	S	1167
3W2107	20030407	1630	PAMC01	Zinc, Total		22	µg/L	S	1168
3W2107	20030407	1630	PAMC01	Silver, Total	<	5	µg/L	S	1169
3W2107	20030407	1630	PAMC01	Aluminum, Total		240	µg/L	S	1170
3W2107	20030407	1630	PAMC01	Calcium, Total		14.0	mg/L	S	1171
3W2107	20030407	1630	PAMC01	Iron, Total		1900	µg/L	S	1172
3W2107	20030407	1630	PAMC01	Magnesium, Total		11.0	mg/L	S	1173
3W2107	20030407	1630	PAMC01	Manganese, Total		190	µg/L	S	1174
3W2107	20030407	1630	PAMC01	Arsenic, Total	<	10	µg/L	S	1175
3W2107	20030407	1630	PAMC01	Mercury, Total	<	0.2	µg/L	S	1176
	20030407	1700	PANC01	DO Saturation		40	%	S	1178
	20030407	1700	PANC01	Dissolved Oxygen		4.1	mg/L	S	1179
	20030407	1700	PANC01	Specific Conductance		318	µS/cm	S	1180
	20030407	1700	PANC01	Salinity		0.2	PPT	S	1181
	20030407	1700	PANC01	Temperature, Water		13.9	°C	S	1182
	20030407	1700	PANC01	pH		6.4	SU	S	1183
3W2108	20030407	1700	PANC01	Residue, Suspended		6.0	mg/L	S	1184
3W2108	20030407	1700	PANC01	Residue, Volatile		3.0	mg/L	S	1185

3W2108	20030407	1700	PANC01	Residue, Fixed		3.0	mg/L	S	1186
3W2108	20030407	1700	PANC01	Turbidity		7	NTU	S	1187
3W2108	20030407	1700	PANC01	Ammonia		0.06	mg/L	S	1188
3W2108	20030407	1700	PANC01	Total Kjeldahl Nitrogen		0.9	mg/L	S	1189
3W2108	20030407	1700	PANC01	NO2+NO3		0.03	mg/L	S	1190
3W2108	20030407	1700	PANC01	Phosphorus, Total		0.50	mg/L	S	1191
3W2108	20030407	1700	PANC01	Cadmium, Total	<	2	μg/L	S	1192
3W2108	20030407	1700	PANC01	Chromium, Total	<	25	μg/L	S	1193
3W2108	20030407	1700	PANC01	Copper, Total		2.8	μg/L	S	1194
3W2108	20030407	1700	PANC01	Nickel, Total	<	10	μg/L	S	1195
3W2108	20030407	1700	PANC01	Lead, Total	<	10	μg/L	S	1196
3W2108	20030407	1700	PANC01	Zinc, Total	<	10	μg/L	S	1197
3W2108	20030407	1700	PANC01	Silver, Total	<	5	μg/L	S	1198
3W2108	20030407	1700	PANC01	Aluminum, Total		260	μg/L	S	1199
3W2108	20030407	1700	PANC01	Calcium, Total		16.0	mg/L	S	1200
3W2108	20030407	1700	PANC01	Iron, Total		860	μg/L	S	1201
3W2108	20030407	1700	PANC01	Magnesium, Total		8.8	mg/L	S	1202
3W2108	20030407	1700	PANC01	Manganese, Total		150	μg/L	S	1203
3W2108	20030407	1700	PANC01	Arsenic, Total	<	10	μg/L	S	1204
3W2108	20030407	1700	PANC01	Mercury, Total	<	0.2	μg/L	S	1205
	20030430	1415	PAGD02	DO Saturation		39	%		1206
	20030430	1415	PAGD02	Dissolved Oxygen		3.5	mg/L		1207
	20030430	1415	PAGD02	Specific Conductance		105	μS/cm		1208
	20030430	1415	PAGD02	Salinity		0.1	PPT		1209
	20030430	1415	PAGD02	Temperature, Water		20.9	°C		1210
	20030430	1415	PAGD02	pH		4.1	SU		1211
3W2553	20030430	1415	PAGD02	Residue, Suspended	<	5.0	mg/L		1212
3W2553	20030430	1415	PAGD02	Residue, Volatile	<	5.0	mg/L		1213
3W2553	20030430	1415	PAGD02	Residue, Fixed	<	5.0	mg/L		1214
3W2553	20030430	1415	PAGD02	Turbidity		1	NTU		1215
3W2553	20030430	1415	PAGD02	Ammonia		0.05	mg/L		1216
3W2553	20030430	1415	PAGD02	Total Kjeldahl Nitrogen		2.0	mg/L		1217
3W2553	20030430	1415	PAGD02	NO2+NO3	<	0.02	mg/L		1218
3W2553	20030430	1415	PAGD02	Phosphorus, Total		0.04	mg/L		1219
3W2553	20030430	1415	PAGD02	Cadmium, Total	<	2	μg/L		1220
3W2553	20030430	1415	PAGD02	Chromium, Total	<	25	μg/L		1221

3W2553	20030430	1415	PAGD02	Copper, Total		3.7	µg/L	1222
3W2553	20030430	1415	PAGD02	Nickel, Total	<	10	µg/L	1223
3W2553	20030430	1415	PAGD02	Lead, Total	<	10	µg/L	1224
3W2553	20030430	1415	PAGD02	Zinc, Total		13	µg/L	1225
3W2553	20030430	1415	PAGD02	Silver, Total	<	5	µg/L	1226
3W2553	20030430	1415	PAGD02	Aluminum, Total		1100	µg/L	1227
3W2553	20030430	1415	PAGD02	Calcium, Total		6.5	mg/L	1228
3W2553	20030430	1415	PAGD02	Iron, Total		1500	µg/L	1229
3W2553	20030430	1415	PAGD02	Magnesium, Total		1.9	mg/L	1230
3W2553	20030430	1415	PAGD02	Manganese, Total		69	µg/L	1231
3W2553	20030430	1415	PAGD02	Arsenic, Total	<	10	µg/L	1232
3W2553	20030430	1415	PAGD02	Mercury, Total	<	0.2	µg/L	1233
	20030430	1430	PAND01	DO Saturation		34	%	1234
	20030430	1430	PAND01	Dissolved Oxygen		3.1	mg/L	1235
	20030430	1430	PAND01	Specific Conductance		109	µS/cm	1236
	20030430	1430	PAND01	Salinity		0.1	PPT	1237
	20030430	1430	PAND01	Temperature, Water		20.0	°C	1238
	20030430	1430	PAND01	pH		3.9	SU	1239
3W2554	20030430	1430	PAND01	Residue, Suspended		4.0	mg/L	1240
3W2554	20030430	1430	PAND01	Residue, Volatile	<	2.5	mg/L	1241
3W2554	20030430	1430	PAND01	Residue, Fixed	<	2.5	mg/L	1242
3W2554	20030430	1430	PAND01	Turbidity		3	NTU	1243
3W2554	20030430	1430	PAND01	Ammonia		0.19	mg/L	1244
3W2554	20030430	1430	PAND01	Total Kjeldahl Nitrogen		2.1	mg/L	1245
3W2554	20030430	1430	PAND01	NO2+NO3	<	0.02	mg/L	1246
3W2554	20030430	1430	PAND01	Phosphorus, Total		0.06	mg/L	1247
3W2554	20030430	1430	PAND01	Cadmium, Total	<	2	µg/L	1248
3W2554	20030430	1430	PAND01	Chromium, Total	<	25	µg/L	1249
3W2554	20030430	1430	PAND01	Copper, Total		2.6	µg/L	1250
3W2554	20030430	1430	PAND01	Nickel, Total	<	10	µg/L	1251
3W2554	20030430	1430	PAND01	Lead, Total	<	10	µg/L	1252
3W2554	20030430	1430	PAND01	Zinc, Total		12	µg/L	1253
3W2554	20030430	1430	PAND01	Silver, Total	<	5	µg/L	1254
3W2554	20030430	1430	PAND01	Aluminum, Total		1000	µg/L	1255
3W2554	20030430	1430	PAND01	Calcium, Total		4.8	mg/L	1256
3W2554	20030430	1430	PAND01	Iron, Total		3200	µg/L	1257

3W2554	20030430	1430	PAND01	Magnesium, Total		1.8	mg/L	1258
3W2554	20030430	1430	PAND01	Manganese, Total		71	µg/L	1259
3W2554	20030430	1430	PAND01	Arsenic, Total	<	10	µg/L	1260
3W2554	20030430	1430	PAND01	Mercury, Total	<	0.2	µg/L	1261
	20030430	1500	PAGD01	DO Saturation		52	%	1262
	20030430	1500	PAGD01	Dissolved Oxygen		4.6	mg/L	1263
	20030430	1500	PAGD01	Specific Conductance		133	µS/cm	1264
	20030430	1500	PAGD01	Salinity		0.1	PPT	1265
	20030430	1500	PAGD01	Temperature, Water		21.6	^{o}C	1266
	20030430	1500	PAGD01	pH		3.8	SU	1267
3W2555	20030430	1500	PAGD01	Residue, Suspended		12.0	mg/L	1268
3W2555	20030430	1500	PAGD01	Residue, Volatile		6.0	mg/L	1269
3W2555	20030430	1500	PAGD01	Residue, Fixed		6.0	mg/L	1270
3W2555	20030430	1500	PAGD01	Ammonia		0.23	mg/L	1271
3W2555	20030430	1500	PAGD01	Total Kjeldahl Nitrogen		2.3	mg/L	1272
3W2555	20030430	1500	PAGD01	NO2+NO3		0.02	mg/L	1273
3W2555	20030430	1500	PAGD01	Phosphorus, Total		0.06	mg/L	1274
	20030430	1530	PAJC01	DO Saturation		40	%	1275
	20030430	1530	PAJC01	Dissolved Oxygen		3.4	mg/L	1276
	20030430	1530	PAJC01	Specific Conductance		230	µS/cm	1277
	20030430	1530	PAJC01	Salinity		0.1	PPT	1278
	20030430	1530	PAJC01	Temperature, Water		22.5	^{o}C	1279
	20030430	1530	PAJC01	pH		5.8	SU	1280
3W2556	20030430	1530	PAJC01	Residue, Suspended		12.0	mg/L	1281
3W2556	20030430	1530	PAJC01	Residue, Volatile		4.0	mg/L	1282
3W2556	20030430	1530	PAJC01	Residue, Fixed		7.0	mg/L	1283
3W2556	20030430	1530	PAJC01	Ammonia		0.30	mg/L	1284
3W2556	20030430	1530	PAJC01	Total Kjeldahl Nitrogen		1.5	mg/L	1285
3W2556	20030430	1530	PAJC01	NO2+NO3		0.30	mg/L	1286
3W2556	20030430	1530	PAJC01	Phosphorus, Total		0.14	mg/L	1287
	20030430	1600	PAHL01	DO Saturation		51	%	1288
	20030430	1600	PAHL01	Dissolved Oxygen		4.2	mg/L	1289
	20030430	1600	PAHL01	Specific Conductance		156	µS/cm	1290
	20030430	1600	PAHL01	Salinity		0.1	PPT	1291
	20030430	1600	PAHL01	Temperature, Water		24.7	^{o}C	1292
	20030430	1600	PAHL01	pH		6.0	SU	1293

3W2557	20030430	1600	PAHL01	Residue, Suspended		17.0	mg/L	1294
3W2557	20030430	1600	PAHL01	Residue, Volatile		6.0	mg/L	1295
3W2557	20030430	1600	PAHL01	Residue, Fixed		11.0	mg/L	1296
3W2557	20030430	1600	PAHL01	Ammonia		0.21	mg/L	1297
3W2557	20030430	1600	PAHL01	Total Kjeldahl Nitrogen		1.4	mg/L	1298
3W2557	20030430	1600	PAHL01	NO2+NO3		0.54	mg/L	1299
3W2557	20030430	1600	PAHL01	Phosphorus, Total		0.12	mg/L	1300
	20030430	1620	PASC02	DO Saturation		45	%	1301
	20030430	1620	PASC02	Dissolved Oxygen		4.1	mg/L	1302
	20030430	1620	PASC02	Specific Conductance		227	µS/cm	1303
	20030430	1620	PASC02	Salinity		0.1	PPT	1304
	20030430	1620	PASC02	Temperature, Water		20.8	^{o}C	1305
	20030430	1620	PASC02	pH		6.4	SU	1306
3W2558	20030430	1620	PASC02	Residue, Suspended		3.0	mg/L	1307
3W2558	20030430	1620	PASC02	Residue, Volatile	<	2.5	mg/L	1308
3W2558	20030430	1620	PASC02	Residue, Fixed	<	2.5	mg/L	1309
3W2558	20030430	1620	PASC02	Ammonia		0.51	mg/L	1310
3W2558	20030430	1620	PASC02	Total Kjeldahl Nitrogen		1.5	mg/L	1311
3W2558	20030430	1620	PASC02	NO2+NO3		0.05	mg/L	1312
3W2558	20030430	1620	PASC02	Phosphorus, Total		0.17	mg/L	1313
	20030430	1645	PAMC01	DO Saturation		41	%	1314
	20030430	1645	PAMC01	Dissolved Oxygen		3.5	mg/L	1315
	20030430	1645	PAMC01	Specific Conductance		265	µS/cm	1316
	20030430	1645	PAMC01	Salinity		0.1	PPT	1317
	20030430	1645	PAMC01	Temperature, Water		22.7	^{o}C	1318
	20030430	1645	PAMC01	pH		6.3	SU	1319
3W2559	20030430	1645	PAMC01	Residue, Suspended		6.0	mg/L	1320
3W2559	20030430	1645	PAMC01	Residue, Volatile		3.0	mg/L	1321
3W2559	20030430	1645	PAMC01	Residue, Fixed		3.0	mg/L	1322
3W2559	20030430	1645	PAMC01	Turbidity		6	NTU	1323
3W2559	20030430	1645	PAMC01	Ammonia		0.54	mg/L	1324
3W2559	20030430	1645	PAMC01	Total Kjeldahl Nitrogen		1.7	mg/L	1325
3W2559	20030430	1645	PAMC01	NO2+NO3	<	0.02	mg/L	1326
3W2559	20030430	1645	PAMC01	Phosphorus, Total		0.56	mg/L	1327
3W2559	20030430	1645	PAMC01	Cadmium, Total	<	2	µg/L	1328
3W2559	20030430	1645	PAMC01	Chromium, Total	<	25	µg/L	1329

3W2559	20030430	1645	PAMC01	Copper, Total	<	2.0	µg/L	1330
3W2559	20030430	1645	PAMC01	Nickel, Total	<	10	µg/L	1331
3W2559	20030430	1645	PAMC01	Lead, Total	<	10	µg/L	1332
3W2559	20030430	1645	PAMC01	Zinc, Total	<	10	µg/L	1333
3W2559	20030430	1645	PAMC01	Silver, Total	<	5	µg/L	1334
3W2559	20030430	1645	PAMC01	Aluminum, Total		390	µg/L	1335
3W2559	20030430	1645	PAMC01	Calcium, Total		11.0	mg/L	1336
3W2559	20030430	1645	PAMC01	Iron, Total		1900	µg/L	1337
3W2559	20030430	1645	PAMC01	Magnesium, Total		6.6	mg/L	1338
3W2559	20030430	1645	PAMC01	Manganese, Total		260	µg/L	1339
3W2559	20030430	1645	PAMC01	Arsenic, Total	<	10	µg/L	1340
3W2559	20030430	1645	PAMC01	Mercury, Total	<	0.2	µg/L	1341
	20030430	1700	PAAC01	DO Saturation		54	%	1342
	20030430	1700	PAAC01	Dissolved Oxygen		4.7	mg/L	1343
	20030430	1700	PAAC01	Specific Conductance		165	µS/cm	1344
	20030430	1700	PAAC01	Salinity		0.1	PPT	1345
	20030430	1700	PAAC01	Temperature, Water		23.0	°C	1346
	20030430	1700	PAAC01	pH		6.4	SU	1347
3W2560	20030430	1700	PAAC01	Residue, Suspended		4.0	mg/L	1348
3W2560	20030430	1700	PAAC01	Residue, Volatile	<	2.5	mg/L	1349
3W2560	20030430	1700	PAAC01	Residue, Fixed	<	2.5	mg/L	1350
3W2560	20030430	1700	PAAC01	Turbidity		4	NTU	1351
3W2560	20030430	1700	PAAC01	Ammonia		0.27	mg/L	1352
3W2560	20030430	1700	PAAC01	Total Kjeldahl Nitrogen		1.2	mg/L	1353
3W2560	20030430	1700	PAAC01	NO2+NO3		0.03	mg/L	1354
3W2560	20030430	1700	PAAC01	Phosphorus, Total		0.52	mg/L	1355
3W2560	20030430	1700	PAAC01	Cadmium, Total	<	2	µg/L	1356
3W2560	20030430	1700	PAAC01	Chromium, Total	<	25	µg/L	1357
3W2560	20030430	1700	PAAC01	Copper, Total	<	2.0	µg/L	1358
3W2560	20030430	1700	PAAC01	Nickel, Total	<	10	µg/L	1359
3W2560	20030430	1700	PAAC01	Lead, Total	<	10	µg/L	1360
3W2560	20030430	1700	PAAC01	Zinc, Total	<	10	µg/L	1361
3W2560	20030430	1700	PAAC01	Silver, Total	<	5	µg/L	1362
3W2560	20030430	1700	PAAC01	Aluminum, Total		220	µg/L	1363
3W2560	20030430	1700	PAAC01	Calcium, Total		10.0	mg/L	1364
3W2560	20030430	1700	PAAC01	Iron, Total		1500	µg/L	1365

3W2560	20030430	1700	PAAC01	Magnesium, Total		6.4	mg/L	1366
3W2560	20030430	1700	PAAC01	Manganese, Total		120	µg/L	1367
3W2560	20030430	1700	PAAC01	Arsenic, Total	<	10	µg/L	1368
3W2560	20030430	1700	PAAC01	Mercury, Total	<	0.2	µg/L	1369
	20030430	1730	PAPC01	DO Saturation		27	%	1370
	20030430	1730	PAPC01	Dissolved Oxygen		2.4	mg/L	1371
	20030430	1730	PAPC01	Specific Conductance		213	µS/cm	1372
	20030430	1730	PAPC01	Salinity		0.1	PPT	1373
	20030430	1730	PAPC01	Temperature, Water		21.8	°C	1374
	20030430	1730	PAPC01	pH		6.3	SU	1375
3W2561	20030430	1730	PAPC01	Residue, Suspended		10.0	mg/L	1376
3W2561	20030430	1730	PAPC01	Residue, Volatile		10.0	mg/L	1377
3W2561	20030430	1730	PAPC01	Residue, Fixed	<	2.5	mg/L	1378
3W2561	20030430	1730	PAPC01	Turbidity		13	NTU	1379
3W2561	20030430	1730	PAPC01	Ammonia		0.65	mg/L	1380
3W2561	20030430	1730	PAPC01	Total Kjeldahl Nitrogen		1.6	mg/L	1381
3W2561	20030430	1730	PAPC01	NO2+NO3		0.12	mg/L	1382
3W2561	20030430	1730	PAPC01	Phosphorus, Total		1.00	mg/L	1383
3W2561	20030430	1730	PAPC01	Cadmium, Total	<	2	µg/L	1384
3W2561	20030430	1730	PAPC01	Chromium, Total	<	25	µg/L	1385
3W2561	20030430	1730	PAPC01	Copper, Total		2.4	µg/L	1386
3W2561	20030430	1730	PAPC01	Nickel, Total	<	10	µg/L	1387
3W2561	20030430	1730	PAPC01	Lead, Total	<	10	µg/L	1388
3W2561	20030430	1730	PAPC01	Zinc, Total	<	10	µg/L	1389
3W2561	20030430	1730	PAPC01	Silver, Total	<	5	µg/L	1390
3W2561	20030430	1730	PAPC01	Aluminum, Total		830	µg/L	1391
3W2561	20030430	1730	PAPC01	Calcium, Total		13.0	mg/L	1392
3W2561	20030430	1730	PAPC01	Iron, Total		3300	µg/L	1393
3W2561	20030430	1730	PAPC01	Magnesium, Total		7.9	mg/L	1394
3W2561	20030430	1730	PAPC01	Manganese, Total		300	µg/L	1395
3W2561	20030430	1730	PAPC01	Arsenic, Total	<	10	µg/L	1396
3W2561	20030430	1730	PAPC01	Mercury, Total	<	0.2	µg/L	1397
	20030430	1800	PAKC02	DO Saturation		24	%	1398
	20030430	1800	PAKC02	Dissolved Oxygen		2.1	mg/L	1399
	20030430	1800	PAKC02	Specific Conductance		207	µS/cm	1400
	20030430	1800	PAKC02	Salinity		0.1	PPT	1401

	20030430	1800	PAKC02	Temperature, Water		20.6	°C	1402
	20030430	1800	PAKC02	pH		6.0	SU	1403
3W2562	20020430	1800	PAKC02	Residue, Suspended		4.0	mg/L	1404
3W2562	20020430	1800	PAKC02	Residue, Volatile	<	2.5	mg/L	1405
3W2562	20020430	1800	PAKC02	Residue, Fixed		3.0	mg/L	1406
3W2562	20020430	1800	PAKC02	Ammonia		0.27	mg/L	1407
3W2562	20020430	1800	PAKC02	Total Kjeldahl Nitrogen		1.6	mg/L	1408
3W2562	20020430	1800	PAKC02	NO2+NO3	<	0.02	mg/L	1409
3W2562	20020430	1800	PAKC02	Phosphorus, Total		0.49	mg/L	1410
	20030430	1815	PACC01	DO Saturation		28	%	1411
	20030430	1815	PACC01	Dissolved Oxygen		2.6	mg/L	1412
	20030430	1815	PACC01	Specific Conductance		295	µS/cm	1413
	20030430	1815	PACC01	Salinity		0.1	PPT	1414
	20030430	1815	PACC01	Temperature, Water		20.4	°C	1415
	20030430	1815	PACC01	pH		6.0	SU	1416
3W2563	20030430	1815	PACC01	Residue, Suspended		100.0	mg/L	1417
3W2563	20030430	1815	PACC01	Residue, Volatile		64.0	mg/L	1418
3W2563	20030430	1815	PACC01	Residue, Fixed		36.0	mg/L	1419
3W2563	20030430	1815	PACC01	Turbidity		330	NTU	1420
3W2563	20030430	1815	PACC01	Ammonia		2.10	mg/L	1421
3W2563	20030430	1815	PACC01	Total Kjeldahl Nitrogen		3.5	mg/L	1422
3W2563	20030430	1815	PACC01	NO2+NO3		5.10	mg/L	1423
3W2563	20030430	1815	PACC01	Phosphorus, Total		0.97	mg/L	1424
3W2563	20030430	1815	PACC01	Cadmium, Total	<	2	µg/L	1425
3W2563	20030430	1815	PACC01	Chromium, Total	<	25	µg/L	1426
3W2563	20030430	1815	PACC01	Copper, Total		7.8	µg/L	1427
3W2563	20030430	1815	PACC01	Nickel, Total	<	10	µg/L	1428
3W2563	20030430	1815	PACC01	Lead, Total		10	µg/L	1429
3W2563	20030430	1815	PACC01	Zinc, Total		32	µg/L	1430
3W2563	20030430	1815	PACC01	Silver, Total	<	5	µg/L	1431
3W2563	20030430	1815	PACC01	Aluminum, Total		13000	µg/L	1432
3W2563	20030430	1815	PACC01	Calcium, Total		23.0	mg/L	1433
3W2563	20030430	1815	PACC01	Iron, Total		4300	µg/L	1434
3W2563	20030430	1815	PACC01	Magnesium, Total		10.0	mg/L	1435
3W2563	20030430	1815	PACC01	Manganese, Total		190	µg/L	1436
3W2563	20030430	1815	PACC01	Arsenic, Total	<	10	µg/L	1437

3W2563	20030430	1815	PACC01	Mercury, Total	<	0.2	µg/L	1438
	20030430	1830	PANC01	DO Saturation		36	%	1439
	20030430	1830	PANC01	Dissolved Oxygen		3.2	mg/L	1440
	20030430	1830	PANC01	Specific Conductance		203	µS/cm	1441
	20030430	1830	PANC01	Salinity		0.1	PPT	1442
	20030430	1830	PANC01	Temperature, Water		22.3	^{o}C	1443
	20030430	1830	PANC01	pH		6.4	SU	1444
3W2564	20030430	1830	PANC01	Residue, Suspended		20.0	mg/L	1445
3W2564	20030430	1830	PANC01	Residue, Volatile		9.0	mg/L	1446
3W2564	20030430	1830	PANC01	Residue, Fixed		10.0	mg/L	1447
3W2564	20030430	1830	PANC01	Turbidity		32	NTU	1448
3W2564	20030430	1830	PANC01	Ammonia		1.00	mg/L	1449
3W2564	20030430	1830	PANC01	Total Kjeldahl Nitrogen		2.1	mg/L	1450
3W2564	20030430	1830	PANC01	NO2+NO3		0.20	mg/L	1451
3W2564	20030430	1830	PANC01	Phosphorus, Total		0.86	mg/L	1452
3W2564	20030430	1830	PANC01	Cadmium, Total	<	2	µg/L	1453
3W2564	20030430	1830	PANC01	Chromium, Total	<	25	µg/L	1454
3W2564	20030430	1830	PANC01	Copper, Total		2.0	µg/L	1455
3W2564	20030430	1830	PANC01	Nickel, Total	<	10	µg/L	1456
3W2564	20030430	1830	PANC01	Lead, Total	<	10	µg/L	1457
3W2564	20030430	1830	PANC01	Zinc, Total	<	10	µg/L	1458
3W2564	20030430	1830	PANC01	Silver, Total	<	5	µg/L	1459
3W2564	20030430	1830	PANC01	Aluminum, Total		1800	µg/L	1460
3W2564	20030430	1830	PANC01	Calcium, Total		13.0	mg/L	1461
3W2564	20030430	1830	PANC01	Iron, Total		1300	µg/L	1462
3W2564	20030430	1830	PANC01	Magnesium, Total		6.0	mg/L	1463
3W2564	20030430	1830	PANC01	Manganese, Total		400	µg/L	1464
3W2564	20030430	1830	PANC01	Arsenic, Total	<	10	µg/L	1465
3W2564	20030430	1830	PANC01	Mercury, Total	<	0.2	µg/L	1466
	20030505	1610	PAGD02	Specific Conductance		103	µS/cm	1467
	20030505	1610	PAGD02	Salinity		0.1	PPT	1468
	20030505	1610	PAGD02	Temperature, Water		15.0	^{o}C	1469
	20030505	1610	PAGD02	pH		4.0	SU	1470
3W2627	20030505	1610	PAGD02	Residue, Suspended	<	2.5	mg/L	1471
3W2627	20030505	1610	PAGD02	Residue, Volatile	<	2.5	mg/L	1472
3W2627	20030505	1610	PAGD02	Residue, Fixed	<	2.5	mg/L	1473

3W2627	20030505	1610	PAGD02	Turbidity		1	NTU	1474
3W2627	20030505	1610	PAGD02	Ammonia		0.07	mg/L	1475
3W2627	20030505	1610	PAGD02	Total Kjeldahl Nitrogen		2.2	mg/L	1476
3W2627	20030505	1610	PAGD02	NO2+NO3	<	0.02	mg/L	1477
3W2627	20030505	1610	PAGD02	Phosphorus, Total		0.05	mg/L	1478
3W2627	20030505	1610	PAGD02	Cadmium, Total	<	2	µg/L	1479
3W2627	20030505	1610	PAGD02	Chromium, Total	<	25	µg/L	1480
3W2627	20030505	1610	PAGD02	Copper, Total		2.0	µg/L	1481
3W2627	20030505	1610	PAGD02	Nickel, Total	<	10	µg/L	1482
3W2627	20030505	1610	PAGD02	Lead, Total	<	10	µg/L	1483
3W2627	20030505	1610	PAGD02	Zinc, Total		16	µg/L	1484
3W2627	20030505	1610	PAGD02	Silver, Total	<	5	µg/L	1485
3W2627	20030505	1610	PAGD02	Aluminum, Total		1200	µg/L	1486
3W2627	20030505	1610	PAGD02	Calcium, Total		6.3	mg/L	1487
3W2627	20030505	1610	PAGD02	Iron, Total		2100	µg/L	1488
3W2627	20030505	1610	PAGD02	Magnesium, Total		1.9	mg/L	1489
3W2627	20030505	1610	PAGD02	Manganese, Total		81	µg/L	1490
3W2627	20030505	1610	PAGD02	Arsenic, Total	<	10	µg/L	1491
3W2627	20030505	1610	PAGD02	Mercury, Total	<	0.2	µg/L	1492
	20030505	1630	PAND01	Specific Conductance		119	µS/cm	1493
	20030505	1630	PAND01	Salinity		0.1	PPT	1494
	20030505	1630	PAND01	Temperature, Water		15.4	^{o}C	1495
	20030505	1630	PAND01	pH		3.9	SU	1496
3W2628	20030505	1630	PAND01	Residue, Suspended	<	2.5	mg/L	1497
3W2628	20030505	1630	PAND01	Residue, Volatile	<	2.5	mg/L	1498
3W2628	20030505	1630	PAND01	Residue, Fixed	<	2.5	mg/L	1499
3W2628	20030505	1630	PAND01	Ammonia		0.25	mg/L	1500
3W2628	20030505	1630	PAND01	Total Kjeldahl Nitrogen		2.2	mg/L	1501
3W2628	20030505	1630	PAND01	NO2+NO3	<	0.02	mg/L	1502
3W2628	20030505	1630	PAND01	Phosphorus, Total		0.06	mg/L	1503
	20030505	1650	PAKC02	DO Saturation		54	%	1504
	20030505	1650	PAKC02	Dissolved Oxygen		5.2	mg/L	1505
	20030505	1650	PAKC02	Specific Conductance		172	µS/cm	1506
	20030505	1650	PAKC02	Salinity		0.1	PPT	1507
	20030505	1650	PAKC02	Temperature, Water		12.5	^{o}C	1508
	20030505	1650	PAKC02	pH		6.1	SU	1509

3W2629	20030505	1650	PAKC02	Residue, Suspended	<	2.5	mg/L	1510
3W2629	20030505	1650	PAKC02	Residue, Volatile	<	2.5	mg/L	1511
3W2629	20030505	1650	PAKC02	Residue, Fixed	<	2.5	mg/L	1512
3W2629	20030505	1650	PAKC02	Ammonia		0.98	mg/L	1513
3W2629	20030505	1650	PAKC02	Total Kjeldahl Nitrogen		2.3	mg/L	1514
3W2629	20030505	1650	PAKC02	NO2+NO3		0.02	mg/L	1515
3W2629	20030505	1650	PAKC02	Phosphorus, Total		0.50	mg/L	1516
	20030505	1715	PACC01	Specific Conductance		390	µS/cm	1517
	20030505	1715	PACC01	Salinity		0.2	PPT	1518
	20030505	1715	PACC01	Temperature, Water		14.3	^{o}C	1519
	20030505	1715	PACC01	pH		6.1	SU	1520
3W2630	20030505	1715	PACC01	Residue, Suspended		44.0	mg/L	1521
3W2630	20030505	1715	PACC01	Residue, Volatile		10.0	mg/L	1522
3W2630	20030505	1715	PACC01	Residue, Fixed		34.0	mg/L	1523
3W2630	20030505	1715	PACC01	Turbidity		65	NTU	1524
3W2630	20030505	1715	PACC01	Ammonia		0.56	mg/L	1525
3W2630	20030505	1715	PACC01	Total Kjeldahl Nitrogen		1.5	mg/L	1526
3W2630	20030505	1715	PACC01	NO2+NO3		1.20	mg/L	1527
3W2630	20030505	1715	PACC01	Phosphorus, Total		0.39	mg/L	1528
3W2630	20030505	1715	PACC01	Cadmium, Total	<	2	µg/L	1529
3W2630	20030505	1715	PACC01	Chromium, Total	<	25	µg/L	1530
3W2630	20030505	1715	PACC01	Copper, Total		5.7	µg/L	1531
3W2630	20030505	1715	PACC01	Nickel, Total	<	10	µg/L	1532
3W2630	20030505	1715	PACC01	Lead, Total	<	10	µg/L	1533
3W2630	20030505	1715	PACC01	Zinc, Total		28	µg/L	1534
3W2630	20030505	1715	PACC01	Silver, Total	<	5	µg/L	1535
3W2630	20030505	1715	PACC01	Aluminum, Total		3100	µg/L	1536
3W2630	20030505	1715	PACC01	Calcium, Total		34.0	mg/L	1537
3W2630	20030505	1715	PACC01	Iron, Total		3300	µg/L	1538
3W2630	20030505	1715	PACC01	Magnesium, Total		13.0	mg/L	1539
3W2630	20030505	1715	PACC01	Manganese, Total		220	µg/L	1540
3W2630	20030505	1715	PACC01	Arsenic, Total	<	10	µg/L	1541
3W2630	20030505	1715	PACC01	Mercury, Total	<	0.2	µg/L	1542
	20030505	1745	PAPC01	Specific Conductance		228	µS/cm	1543
	20030505	1745	PAPC01	Salinity		0.1	PPT	1544
	20030505	1745	PAPC01	Temperature, Water		14.7	^{o}C	1545

	20030505	1745	PAPC01	pH		6.2	SU	1546
3W2631	20030505	1745	PAPC01	Residue, Suspended		6.0	mg/L	1547
3W2631	20030505	1745	PAPC01	Residue, Volatile		2.5	mg/L	1548
3W2631	20030505	1745	PAPC01	Residue, Fixed		4.0	mg/L	1549
3W2631	20030505	1745	PAPC01	Turbidity		20	NTU	1550
3W2631	20030505	1745	PAPC01	Ammonia		0.95	mg/L	1551
3W2631	20030505	1745	PAPC01	Total Kjeldahl Nitrogen		1.9	mg/L	1552
3W2631	20030505	1745	PAPC01	NO2+NO3		0.55	mg/L	1553
3W2631	20030505	1745	PAPC01	Phosphorus, Total		0.68	mg/L	1554
3W2631	20030505	1745	PAPC01	Cadmium, Total	<	2	µg/L	1555
3W2631	20030505	1745	PAPC01	Chromium, Total	<	25	µg/L	1556
3W2631	20030505	1745	PAPC01	Copper, Total		3.8	µg/L	1557
3W2631	20030505	1745	PAPC01	Nickel, Total	<	10	µg/L	1558
3W2631	20030505	1745	PAPC01	Lead, Total	<	10	µg/L	1559
3W2631	20030505	1745	PAPC01	Zinc, Total	<	10	µg/L	1560
3W2631	20030505	1745	PAPC01	Silver, Total	<	5	µg/L	1561
3W2631	20030505	1745	PAPC01	Aluminum, Total		1600	µg/L	1562
3W2631	20030505	1745	PAPC01	Calcium, Total		11.0	mg/L	1563
3W2631	20030505	1745	PAPC01	Iron, Total		2600	µg/L	1564
3W2631	20030505	1745	PAPC01	Magnesium, Total		6.6	mg/L	1565
3W2631	20030505	1745	PAPC01	Manganese, Total		130	µg/L	1566
3W2631	20030505	1745	PAPC01	Arsenic, Total	<	10	µg/L	1567
3W2631	20030505	1745	PAPC01	Mercury, Total	<	0.2	µg/L	1568
	20030505	1815	PAAC01	Specific Conductance		208	µS/cm	1569
	20030505	1815	PAAC01	Salinity		0.1	PPT	1570
	20030505	1815	PAAC01	Temperature, Water		14.7	^{o}C	1571
	20030505	1815	PAAC01	pH		6.4	SU	1572
3W2632	20030505	1815	PAAC01	Residue, Suspended		2.5	mg/L	1573
3W2632	20030505	1815	PAAC01	Residue, Volatile		2.5	mg/L	1574
3W2632	20030505	1815	PAAC01	Residue, Fixed	<	2.5	mg/L	1575
3W2632	20030505	1815	PAAC01	Turbidity		6	NTU	1576
3W2632	20030505	1815	PAAC01	Ammonia		0.40	mg/L	1577
3W2632	20030505	1815	PAAC01	Total Kjeldahl Nitrogen		1.5	mg/L	1578
3W2632	20030505	1815	PAAC01	NO2+NO3		0.11	mg/L	1579
3W2632	20030505	1815	PAAC01	Phosphorus, Total		0.44	mg/L	1580
3W2632	20030505	1815	PAAC01	Cadmium, Total	<	2	µg/L	1581

3W2632	20030505	1815	PAAC01	Chromium, Total	<	25	µg/L	1582
3W2632	20030505	1815	PAAC01	Copper, Total		3.9	µg/L	1583
3W2632	20030505	1815	PAAC01	Nickel, Total	<	10	µg/L	1584
3W2632	20030505	1815	PAAC01	Lead, Total	<	10	µg/L	1585
3W2632	20030505	1815	PAAC01	Zinc, Total	<	10	µg/L	1586
3W2632	20030505	1815	PAAC01	Silver, Total	<	5	µg/L	1587
3W2632	20030505	1815	PAAC01	Aluminum, Total		440	µg/L	1588
3W2632	20030505	1815	PAAC01	Calcium, Total		9.7	mg/L	1589
3W2632	20030505	1815	PAAC01	Iron, Total		1800	µg/L	1590
3W2632	20030505	1815	PAAC01	Magnesium, Total		5.3	mg/L	1591
3W2632	20030505	1815	PAAC01	Manganese, Total		45	µg/L	1592
3W2632	20030505	1815	PAAC01	Arsenic, Total	<	10	µg/L	1593
3W2632	20030505	1815	PAAC01	Mercury, Total	<	0.2	µg/L	1594
	20030505	1845	PAMC01	DO Saturation		53	%	1595
	20030505	1845	PAMC01	Dissolved Oxygen		5.6	mg/L	1596
	20030505	1845	PAMC01	Specific Conductance		297	µS/cm	1597
	20030505	1845	PAMC01	Salinity		0.1	PPT	1598
	20030505	1845	PAMC01	Temperature, Water		13.6	^{o}C	1599
	20030505	1845	PAMC01	pH		6.4	SU	1600
3W2633	20030505	1845	PAMC01	Residue, Suspended		3.0	mg/L	1601
3W2633	20030505	1845	PAMC01	Residue, Volatile	<	2.5	mg/L	1602
3W2633	20030505	1845	PAMC01	Residue, Fixed	<	2.5	mg/L	1603
3W2633	20030505	1845	PAMC01	Turbidity		6	NTU	1604
3W2633	20030505	1845	PAMC01	Ammonia		0.73	mg/L	1605
3W2633	20030505	1845	PAMC01	Total Kjeldahl Nitrogen		1.7	mg/L	1606
3W2633	20030505	1845	PAMC01	NO2+NO3		0.07	mg/L	1607
3W2633	20030505	1845	PAMC01	Phosphorus, Total		0.64	mg/L	1608
3W2633	20030505	1845	PAMC01	Cadmium, Total	<	2	µg/L	1609
3W2633	20030505	1845	PAMC01	Chromium, Total	<	25	µg/L	1610
3W2633	20030505	1845	PAMC01	Copper, Total	<	2.0	µg/L	1611
3W2633	20030505	1845	PAMC01	Nickel, Total	<	10	µg/L	1612
3W2633	20030505	1845	PAMC01	Lead, Total	<	10	µg/L	1613
3W2633	20030505	1845	PAMC01	Zinc, Total	<	10	µg/L	1614
3W2633	20030505	1845	PAMC01	Silver, Total	<	5	µg/L	1615
3W2633	20030505	1845	PAMC01	Aluminum, Total		440	µg/L	1616
3W2633	20030505	1845	PAMC01	Calcium, Total		11.0	mg/L	1617

3W2633	20030505	1845	PAMC01	Iron, Total		3000	µg/L		1618
3W2633	20030505	1845	PAMC01	Magnesium, Total		6.8	mg/L		1619
3W2633	20030505	1845	PAMC01	Manganese, Total		150	µg/L		1620
3W2633	20030505	1845	PAMC01	Arsenic, Total	<	10	µg/L		1621
3W2633	20030505	1845	PAMC01	Mercury, Total	<	0.2	µg/L		1622
	20030505	1915	PANC01	DO Saturation		59	%		1623
	20030505	1915	PANC01	Dissolved Oxygen		6.1	mg/L		1624
	20030505	1915	PANC01	Specific Conductance		202	µS/cm		1625
	20030505	1915	PANC01	Salinity		0.1	PPT		1626
	20030505	1915	PANC01	Temperature, Water		13.8	°C		1627
	20030505	1915	PANC01	pH		6.6	SU		1628
3W2634	20030505	1915	PANC01	Residue, Suspended		7.0	mg/L		1629
3W2634	20030505	1915	PANC01	Residue, Volatile		2.5	mg/L		1630
3W2634	20030505	1915	PANC01	Residue, Fixed		5.0	mg/L		1631
3W2634	20030505	1915	PANC01	Turbidity		13	NTU		1632
3W2634	20030505	1915	PANC01	Ammonia		1.30	mg/L		1633
3W2634	20030505	1915	PANC01	Total Kjeldahl Nitrogen		2.2	mg/L		1634
3W2634	20030505	1915	PANC01	NO2+NO3		0.08	mg/L		1635
3W2634	20030505	1915	PANC01	Phosphorus, Total		0.57	mg/L		1636
3W2634	20030505	1915	PANC01	Cadmium, Total	<	2	µg/L		1637
3W2634	20030505	1915	PANC01	Chromium, Total	<	25	µg/L		1638
3W2634	20030505	1915	PANC01	Copper, Total		2.7	µg/L		1639
3W2634	20030505	1915	PANC01	Nickel, Total	<	10	µg/L		1640
3W2634	20030505	1915	PANC01	Lead, Total	<	10	µg/L		1641
3W2634	20030505	1915	PANC01	Zinc, Total	<	10	µg/L		1642
3W2634	20030505	1915	PANC01	Silver, Total	<	5	µg/L		1643
3W2634	20030505	1915	PANC01	Aluminum, Total		740	µg/L		1644
3W2634	20030505	1915	PANC01	Calcium, Total		13.0	mg/L		1645
3W2634	20030505	1915	PANC01	Iron, Total		860	µg/L		1646
3W2634	20030505	1915	PANC01	Magnesium, Total		5.8	mg/L		1647
3W2634	20030505	1915	PANC01	Manganese, Total		200	µg/L		1648
3W2634	20030505	1915	PANC01	Arsenic, Total	<	10	µg/L		1649
3W2634	20030505	1915	PANC01	Mercury, Total	<	0.2	µg/L		1650
	20030522	1330	PAGD02	DO Saturation		33	%	S	1651
	20030522	1330	PAGD02	Dissolved Oxygen		3.1	mg/L	S	1652
	20030522	1330	PAGD02	Specific Conductance		107	µS/cm	S	1653

	20030522	1330	PAGD02	Salinity		0.1	PPT	S	1654
	20030522	1330	PAGD02	Temperature, Water		18.5	^{o}C	S	1655
	20030522	1330	PAGD02	pH		4.4	SU	S	1656
3W3005	20030522	1330	PAGD02	Residue, Suspended		60.0	mg/L	S	1657
3W3005	20030522	1330	PAGD02	Residue, Volatile		46.0	mg/L	S	1658
3W3005	20030522	1330	PAGD02	Residue, Fixed		14.0	mg/L	S	1659
3W3005	20030522	1330	PAGD02	Turbidity		1	NTU	S	1660
3W3005	20030522	1330	PAGD02	Ammonia		0.16	mg/L	S	1661
3W3005	20030522	1330	PAGD02	Total Kjeldahl Nitrogen		2.4	mg/L	S	1662
3W3005	20030522	1330	PAGD02	NO2+NO3	<	0.02	mg/L	S	1663
3W3005	20030522	1330	PAGD02	Phosphorus, Total		0.05	mg/L	S	1664
3W3005	20030522	1330	PAGD02	Cadmium, Total	<	2	µg/L	S	1665
3W3005	20030522	1330	PAGD02	Chromium, Total	<	25	µg/L	S	1666
3W3005	20030522	1330	PAGD02	Copper, Total		11.0	µg/L	S	1667
3W3005	20030522	1330	PAGD02	Nickel, Total	<	10	µg/L	S	1668
3W3005	20030522	1330	PAGD02	Lead, Total	<	10	µg/L	S	1669
3W3005	20030522	1330	PAGD02	Zinc, Total		14	µg/L	S	1670
3W3005	20030522	1330	PAGD02	Silver, Total	<	5	µg/L	S	1671
3W3005	20030522	1330	PAGD02	Aluminum, Total		1300	µg/L	S	1672
3W3005	20030522	1330	PAGD02	Calcium, Total		6.0	mg/L	S	1673
3W3005	20030522	1330	PAGD02	Iron, Total		2500	µg/L	S	1674
3W3005	20030522	1330	PAGD02	Magnesium, Total		1.8	mg/L	S	1675
3W3005	20030522	1330	PAGD02	Manganese, Total		54	µg/L	S	1676
3W3005	20030522	1330	PAGD02	Arsenic, Total	<	10	µg/L	S	1677
3W3005	20030522	1330	PAGD02	Mercury, Total	<	0.2	µg/L	S	1678
	20030522	1345	PAND01	DO Saturation		51	%	S	1679
	20030522	1345	PAND01	Dissolved Oxygen		4.7	mg/L	S	1680
	20030522	1345	PAND01	Specific Conductance		123	µS/cm	S	1681
	20030522	1345	PAND01	Salinity		0.1	PPT	S	1682
	20030522	1345	PAND01	Temperature, Water		18.9	^{o}C	S	1683
	20030522	1345	PAND01	pH		5.4	SU	S	1684
3W3006	20030522	1345	PAND01	Residue, Suspended		17.0	mg/L	S	1685
3W3006	20030522	1345	PAND01	Residue, Volatile		6.0	mg/L	S	1686
3W3006	20030522	1345	PAND01	Residue, Fixed		12.0	mg/L	S	1687
3W3006	20030522	1345	PAND01	Ammonia		0.25	mg/L	S	1688
3W3006	20030522	1345	PAND01	Total Kjeldahl Nitrogen	<	2.0	mg/L	S	1689

3W3006	20030522	1345	PAND01	NO2+NO3		0.11	mg/L	S	1690
3W3006	20030522	1345	PAND01	Phosphorus, Total		0.17	mg/L	S	1691
3W3006	20030522	1345	PAND01	Cadmium, Total	<	2	µg/L	S	1692
3W3006	20030522	1345	PAND01	Chromium, Total	<	25	µg/L	S	1693
3W3006	20030522	1345	PAND01	Copper, Total		4.5	µg/L	S	1694
3W3006	20030522	1345	PAND01	Nickel, Total	<	10	µg/L	S	1695
3W3006	20030522	1345	PAND01	Lead, Total	<	10	µg/L	S	1696
3W3006	20030522	1345	PAND01	Zinc, Total		12	µg/L	S	1697
3W3006	20030522	1345	PAND01	Silver, Total	<	5	µg/L	S	1698
3W3006	20030522	1345	PAND01	Aluminum, Total		1600	µg/L	S	1699
3W3006	20030522	1345	PAND01	Calcium, Total		7.5	mg/L	S	1700
3W3006	20030522	1345	PAND01	Iron, Total		2500	µg/L	S	1701
3W3006	20030522	1345	PAND01	Magnesium, Total		2.9	mg/L	S	1702
3W3006	20030522	1345	PAND01	Manganese, Total		66	µg/L	S	1703
3W3006	20030522	1345	PAND01	Arsenic, Total	<	10	µg/L	S	1704
3W3006	20030522	1345	PAND01	Mercury, Total	<	0.2	µg/L	S	1705
	20030522	1400	PAKC02	DO Saturation		24	%	S	1706
	20030522	1400	PAKC02	Dissolved Oxygen		2.3	mg/L	S	1707
	20030522	1400	PAKC02	Specific Conductance		216	µS/cm	S	1708
	20030522	1400	PAKC02	Salinity		0.1	PPT	S	1709
	20030522	1400	PAKC02	Temperature, Water		18.2	^{o}C	S	1710
	20030522	1400	PAKC02	pH		6.5	SU	S	1711
3W3007	20030522	1400	PAKC02	Residue, Suspended		7.0	mg/L	S	1712
3W3007	20030522	1400	PAKC02	Residue, Volatile		3.0	mg/L	S	1713
3W3007	20030522	1400	PAKC02	Residue, Fixed		4.0	mg/L	S	1714
3W3007	20030522	1400	PAKC02	Ammonia		1.50	mg/L	S	1715
3W3007	20030522	1400	PAKC02	Total Kjeldahl Nitrogen		2.8	mg/L	S	1716
3W3007	20030522	1400	PAKC02	NO2+NO3		0.05	mg/L	S	1717
3W3007	20030522	1400	PAKC02	Phosphorus, Total		0.56	mg/L	S	1718
	20030522	1430	PACC01	DO Saturation		36	%	S	1719
	20030522	1430	PACC01	Dissolved Oxygen		3.3	mg/L	S	1720
	20030522	1430	PACC01	Specific Conductance		326	µS/cm	S	1721
	20030522	1430	PACC01	Salinity		0.2	PPT	S	1722
	20030522	1430	PACC01	Temperature, Water		19.6	^{o}C	S	1723
	20030522	1430	PACC01	pH		6.5	SU	S	1724
3W3008	20030522	1430	PACC01	Residue, Suspended		32.0	mg/L	S	1725

3W3008	20030522	1430	PACC01	Residue, Volatile		10.0	mg/L	S	1726
3W3008	20030522	1430	PACC01	Residue, Fixed		23.0	mg/L	S	1727
3W3008	20030522	1430	PACC01	Turbidity		37	NTU	S	1728
3W3008	20030522	1430	PACC01	Ammonia		0.70	mg/L	S	1729
3W3008	20030522	1430	PACC01	Total Kjeldahl Nitrogen		1.7	mg/L	S	1730
3W3008	20030522	1430	PACC01	NO2+NO3		0.45	mg/L	S	1731
3W3008	20030522	1430	PACC01	Phosphorus, Total		0.28	mg/L	S	1732
3W3008	20030522	1430	PACC01	Cadmium, Total	<	2	µg/L	S	1733
3W3008	20030522	1430	PACC01	Chromium, Total	<	25	µg/L	S	1734
3W3008	20030522	1430	PACC01	Copper, Total		27.0	µg/L	S	1735
3W3008	20030522	1430	PACC01	Nickel, Total	<	10	µg/L	S	1736
3W3008	20030522	1430	PACC01	Lead, Total	<	10	µg/L	S	1737
3W3008	20030522	1430	PACC01	Zinc, Total		32	µg/L	S	1738
3W3008	20030522	1430	PACC01	Silver, Total	<	5	µg/L	S	1739
3W3008	20030522	1430	PACC01	Aluminum, Total		1100	µg/L	S	1740
3W3008	20030522	1430	PACC01	Calcium, Total		28.0	mg/L	S	1741
3W3008	20030522	1430	PACC01	Iron, Total		2600	µg/L	S	1742
3W3008	20030522	1430	PACC01	Magnesium, Total		10.0	mg/L	S	1743
3W3008	20030522	1430	PACC01	Manganese, Total		190	µg/L	S	1744
3W3008	20030522	1430	PACC01	Arsenic, Total	<	10	µg/L	S	1745
3W3008	20030522	1430	PACC01	Mercury, Total	<	0.2	µg/L	S	1746
	20030522	1500	PAPC01	DO Saturation		20	%	S	1747
	20030522	1500	PAPC01	Dissolved Oxygen		1.9	mg/L	S	1748
	20030522	1500	PAPC01	Specific Conductance		365	µS/cm	S	1749
	20030522	1500	PAPC01	Salinity		0.2	PPT	S	1750
	20030522	1500	PAPC01	Temperature, Water		19.5	^{o}C	S	1751
	20030522	1500	PAPC01	pH		6.8	SU	S	1752
3W3009	20030522	1500	PAPC01	Residue, Suspended		6.0	mg/L	S	1753
3W3009	20030522	1500	PAPC01	Residue, Volatile	<	5.0	mg/L	S	1754
3W3009	20030522	1500	PAPC01	Residue, Fixed		5.0	mg/L	S	1755
3W3009	20030522	1500	PAPC01	Turbidity		8	NTU	S	1756
3W3009	20030522	1500	PAPC01	Ammonia		2.10	mg/L	S	1757
3W3009	20030522	1500	PAPC01	Total Kjeldahl Nitrogen		3.1	mg/L	S	1758
3W3009	20030522	1500	PAPC01	NO2+NO3		0.22	mg/L	S	1759
3W3009	20030522	1500	PAPC01	Phosphorus, Total		0.62	mg/L	S	1760
3W3009	20030522	1500	PAPC01	Cadmium, Total	<	2	µg/L	S	1761

3W3009	20030522	1500	PAPC01	Chromium, Total	<	25	µg/L	S	1762
3W3009	20030522	1500	PAPC01	Copper, Total		7.0	µg/L	S	1763
3W3009	20030522	1500	PAPC01	Nickel, Total	<	10	µg/L	S	1764
3W3009	20030522	1500	PAPC01	Lead, Total	<	10	µg/L	S	1765
3W3009	20030522	1500	PAPC01	Zinc, Total	<	10	µg/L	S	1766
3W3009	20030522	1500	PAPC01	Silver, Total	<	5	µg/L	S	1767
3W3009	20030522	1500	PAPC01	Aluminum, Total		320	µg/L	S	1768
3W3009	20030522	1500	PAPC01	Calcium, Total		17.0	mg/L	S	1769
3W3009	20030522	1500	PAPC01	Iron, Total		2600	µg/L	S	1770
3W3009	20030522	1500	PAPC01	Magnesium, Total		9.4	mg/L	S	1771
3W3009	20030522	1500	PAPC01	Manganese, Total		250	µg/L	S	1772
3W3009	20030522	1500	PAPC01	Arsenic, Total	<	10	µg/L	S	1773
3W3009	20030522	1500	PAPC01	Mercury, Total	<	0.2	µg/L	S	1774
	20030522	1520	PAAC01	DO Saturation		27	%	S	1775
	20030522	1520	PAAC01	Dissolved Oxygen		2.4	mg/L	S	1776
	20030522	1520	PAAC01	Specific Conductance		304	µS/cm	S	1777
	20030522	1520	PAAC01	Salinity		0.1	PPT	S	1778
	20030522	1520	PAAC01	Temperature, Water		19.6	^{o}C	S	1779
	20030522	1520	PAAC01	pH		6.8	SU	S	1780
3W3010	20030522	1520	PAAC01	Residue, Suspended		6.0	mg/L	S	1781
3W3010	20030522	1520	PAAC01	Residue, Volatile		3.0	mg/L	S	1782
3W3010	20030522	1520	PAAC01	Residue, Fixed		3.0	mg/L	S	1783
3W3010	20030522	1520	PAAC01	Turbidity		6	NTU	S	1784
3W3010	20030522	1520	PAAC01	Ammonia		0.88	mg/L	S	1785
3W3010	20030522	1520	PAAC01	Total Kjeldahl Nitrogen		1.9	mg/L	S	1786
3W3010	20030522	1520	PAAC01	NO2+NO3		0.08	mg/L	S	1787
3W3010	20030522	1520	PAAC01	Phosphorus, Total		0.57	mg/L	S	1788
3W3010	20030522	1520	PAAC01	Cadmium, Total	<	2	µg/L	S	1789
3W3010	20030522	1520	PAAC01	Chromium, Total	<	25	µg/L	S	1790
3W3010	20030522	1520	PAAC01	Copper, Total		4.6	µg/L	S	1791
3W3010	20030522	1520	PAAC01	Nickel, Total	<	10	µg/L	S	1792
3W3010	20030522	1520	PAAC01	Lead, Total	<	10	µg/L	S	1793
3W3010	20030522	1520	PAAC01	Zinc, Total	<	10	µg/L	S	1794
3W3010	20030522	1520	PAAC01	Silver, Total	<	5	µg/L	S	1795
3W3010	20030522	1520	PAAC01	Aluminum, Total		150	µg/L	S	1796
3W3010	20030522	1520	PAAC01	Calcium, Total		13.0	mg/L	S	1797

3W3010	20030522	1520	PAAC01	Iron, Total		1500	µg/L	S	1798
3W3010	20030522	1520	PAAC01	Magnesium, Total		7.9	mg/L	S	1799
3W3010	20030522	1520	PAAC01	Manganese, Total		280	µg/L	S	1800
3W3010	20030522	1520	PAAC01	Arsenic, Total	<	10	µg/L	S	1801
3W3010	20030522	1520	PAAC01	Mercury, Total	<	0.2	µg/L	S	1802
	20030522	1545	PAMC01	DO Saturation		22	%	S	1803
	20030522	1545	PAMC01	Dissolved Oxygen		2.0	mg/L	S	1804
	20030522	1545	PAMC01	Specific Conductance		413	µS/cm	S	1805
	20030522	1545	PAMC01	Salinity		0.2	PPT	S	1806
	20030522	1545	PAMC01	Temperature, Water		19.6	^{o}C	S	1807
	20030522	1545	PAMC01	pH		6.7	SU	S	1808
3W3011	20030522	1545	PAMC01	Residue, Suspended		4.0	mg/L	S	1809
3W3011	20030522	1545	PAMC01	Residue, Volatile	<	2.5	mg/L	S	1810
3W3011	20030522	1545	PAMC01	Residue, Fixed	<	2.5	mg/L	S	1811
3W3011	20030522	1545	PAMC01	Turbidity		4	NTU	S	1812
3W3011	20030522	1545	PAMC01	Ammonia		1.00	mg/L	S	1813
3W3011	20030522	1545	PAMC01	Total Kjeldahl Nitrogen		2.2	mg/L	S	1814
3W3011	20030522	1545	PAMC01	NO2+NO3		0.02	mg/L	S	1815
3W3011	20030522	1545	PAMC01	Phosphorus, Total		0.62	mg/L	S	1816
3W3011	20030522	1545	PAMC01	Cadmium, Total	<	2	µg/L	S	1817
3W3011	20030522	1545	PAMC01	Chromium, Total	<	25	µg/L	S	1818
3W3011	20030522	1545	PAMC01	Copper, Total		11.0	µg/L	S	1819
3W3011	20030522	1545	PAMC01	Nickel, Total	<	10	µg/L	S	1820
3W3011	20030522	1545	PAMC01	Lead, Total	<	10	µg/L	S	1821
3W3011	20030522	1545	PAMC01	Zinc, Total	<	10	µg/L	S	1822
3W3011	20030522	1545	PAMC01	Silver, Total	<	5	µg/L	S	1823
3W3011	20030522	1545	PAMC01	Aluminum, Total		160	µg/L	S	1824
3W3011	20030522	1545	PAMC01	Calcium, Total		12.0	mg/L	S	1825
3W3011	20030522	1545	PAMC01	Iron, Total		2200	µg/L	S	1826
3W3011	20030522	1545	PAMC01	Magnesium, Total		8.7	mg/L	S	1827
3W3011	20030522	1545	PAMC01	Manganese, Total		360	µg/L	S	1828
3W3011	20030522	1545	PAMC01	Arsenic, Total	<	10	µg/L	S	1829
3W3011	20030522	1545	PAMC01	Mercury, Total	<	0.2	µg/L	S	1830
	20030522	1600	PANC01	DO Saturation		15	%	S	1831
	20030522	1600	PANC01	Dissolved Oxygen		1.4	mg/L	S	1832
	20030522	1600	PANC01	Specific Conductance		314	µS/cm	S	1833

	20030522	1600	PANC01	Salinity		0.2	PPT	S	1834
	20030522	1600	PANC01	Temperature, Water		19.0	^{o}C	S	1835
	20030522	1600	PANC01	pH		6.8	SU	S	1836
3W3012	20030522	1600	PANC01	Residue, Suspended		4.0	mg/L	S	1837
3W3012	20030522	1600	PANC01	Residue, Volatile		2.5	mg/L	S	1838
3W3012	20030522	1600	PANC01	Residue, Fixed	<	2.5	mg/L	S	1839
3W3012	20030522	1600	PANC01	Turbidity		3	NTU	S	1840
3W3012	20030522	1600	PANC01	Ammonia		2.30	mg/L	S	1841
3W3012	20030522	1600	PANC01	Total Kjeldahl Nitrogen		3.1	mg/L	S	1842
3W3012	20030522	1600	PANC01	NO2+NO3		0.06	mg/L	S	1843
3W3012	20030522	1600	PANC01	Phosphorus, Total		0.85	mg/L	S	1844
3W3012	20030522	1600	PANC01	Cadmium, Total	<	2	µg/L	S	1845
3W3012	20030522	1600	PANC01	Chromium, Total	<	25	µg/L	S	1846
3W3012	20030522	1600	PANC01	Copper, Total		11.0	µg/L	S	1847
3W3012	20030522	1600	PANC01	Nickel, Total	<	10	µg/L	S	1848
3W3012	20030522	1600	PANC01	Lead, Total	<	10	µg/L	S	1849
3W3012	20030522	1600	PANC01	Zinc, Total	<	10	µg/L	S	1850
3W3012	20030522	1600	PANC01	Silver, Total	<	5	µg/L	S	1851
3W3012	20030522	1600	PANC01	Aluminum, Total		120	µg/L	S	1852
3W3012	20030522	1600	PANC01	Calcium, Total		15.0	mg/L	S	1853
3W3012	20030522	1600	PANC01	Iron, Total		930	µg/L	S	1854
3W3012	20030522	1600	PANC01	Magnesium, Total		7.9	mg/L	S	1855
3W3012	20030522	1600	PANC01	Manganese, Total		410	µg/L	S	1856
3W3012	20030522	1600	PANC01	Arsenic, Total	<	10	µg/L	S	1857
3W3012	20030522	1600	PANC01	Mercury, Total	<	0.2	µg/L	S	1858
	20030604	1330	PACC01	DO Saturation		31	%	S	1859
	20030604	1330	PACC01	Dissolved Oxygen		2.7	mg/L	S	1860
	20030604	1330	PACC01	Specific Conductance		162	µS/cm	S	1861
	20030604	1330	PACC01	Salinity		0.1	PPT	S	1862
	20030604	1330	PACC01	Temperature, Water		21.2	^{o}C	S	1863
	20030604	1330	PACC01	pH		6.6	SU	S	1864
3W3281	20030604	1330	PACC01	Residue, Suspended		32.0	mg/L	S	1865
3W3281	20030604	1330	PACC01	Residue, Volatile		12.0	mg/L	S	1866
3W3281	20030604	1330	PACC01	Residue, Fixed		20.0	mg/L	S	1867
3W3281	20030604	1330	PACC01	Turbidity		26	NTU	S	1868
3W3281	20030604	1330	PACC01	Ammonia		0.19	mg/L	S	1869

3W3281	20030604	1330	PACC01	Total Kjeldahl Nitrogen		1.3	mg/L	S	1870
3W3281	20030604	1330	PACC01	NO2+NO3		0.09	mg/L	S	1871
3W3281	20030604	1330	PACC01	Phosphorus, Total		0.37	mg/L	S	1872
3W3281	20030604	1330	PACC01	Cadmium, Total	<	2	µg/L	S	1873
3W3281	20030604	1330	PACC01	Chromium, Total	<	25	µg/L	S	1874
3W3281	20030604	1330	PACC01	Copper, Total		4.5	µg/L	S	1875
3W3281	20030604	1330	PACC01	Nickel, Total	<	10	µg/L	S	1876
3W3281	20030604	1330	PACC01	Lead, Total	<	10	µg/L	S	1877
3W3281	20030604	1330	PACC01	Zinc, Total		23	µg/L	S	1878
3W3281	20030604	1330	PACC01	Silver, Total	<	5	µg/L	S	1879
3W3281	20030604	1330	PACC01	Aluminum, Total		870	µg/L	S	1880
3W3281	20030604	1330	PACC01	Calcium, Total		37.0	mg/L	S	1881
3W3281	20030604	1330	PACC01	Iron, Total		3000	µg/L	S	1882
3W3281	20030604	1330	PACC01	Magnesium, Total		14.0	mg/L	S	1883
3W3281	20030604	1330	PACC01	Manganese, Total		230	µg/L	S	1884
3W3281	20030604	1330	PACC01	Arsenic, Total	<	10	µg/L	S	1885
3W3281	20030604	1330	PACC01	Mercury, Total	<	0.2	µg/L	S	1886
	20030604	1400	PAPC01	DO Saturation		18	%	S	1887
	20030604	1400	PAPC01	Dissolved Oxygen		1.6	mg/L	S	1888
	20030604	1400	PAPC01	Specific Conductance		300	µS/cm	S	1889
	20030604	1400	PAPC01	Salinity		0.1	PPT	S	1890
	20030604	1400	PAPC01	Temperature, Water		21.2	^{o}C	S	1891
	20030604	1400	PAPC01	pH		6.7	SU	S	1892
3W3282	20030604	1400	PAPC01	Residue, Suspended		14.0	mg/L	S	1893
3W3282	20030604	1400	PAPC01	Residue, Volatile		8.0	mg/L	S	1894
3W3282	20030604	1400	PAPC01	Residue, Fixed		7.0	mg/L	S	1895
3W3282	20030604	1400	PAPC01	Ammonia		1.40	mg/L	S	1896
3W3282	20030604	1400	PAPC01	Total Kjeldahl Nitrogen		2.6	mg/L	S	1897
3W3282	20030604	1400	PAPC01	NO2+NO3		0.95	mg/L	S	1898
3W3282	20030604	1400	PAPC01	Phosphorus, Total		0.83	mg/L	S	1899
3W3282	20030604	1400	PAPC01	Cadmium, Total	<	2	µg/L	S	1900
3W3282	20030604	1400	PAPC01	Chromium, Total	<	25	µg/L	S	1901
3W3282	20030604	1400	PAPC01	Copper, Total		2.7	µg/L	S	1902
3W3282	20030604	1400	PAPC01	Nickel, Total	<	10	µg/L	S	1903
3W3282	20030604	1400	PAPC01	Lead, Total	<	10	µg/L	S	1904
3W3282	20030604	1400	PAPC01	Zinc, Total	<	10	µg/L	S	1905

3W3282	20030604	1400	PAPC01	Silver, Total	<	5	µg/L	S	1906
3W3282	20030604	1400	PAPC01	Aluminum, Total		640	µg/L	S	1907
3W3282	20030604	1400	PAPC01	Calcium, Total		13.0	mg/L	S	1908
3W3282	20030604	1400	PAPC01	Iron, Total		2600	µg/L	S	1909
3W3282	20030604	1400	PAPC01	Magnesium, Total		8.7	mg/L	S	1910
3W3282	20030604	1400	PAPC01	Manganese, Total		220	µg/L	S	1911
3W3282	20030604	1400	PAPC01	Arsenic, Total	<	10	µg/L	S	1912
3W3282	20030604	1400	PAPC01	Mercury, Total	<	0.2	µg/L	S	1913
	20030604	1420	PAAC01	DO Saturation		32	%	S	1914
	20030604	1420	PAAC01	Dissolved Oxygen		2.8	mg/L	S	1915
	20030604	1420	PAAC01	Specific Conductance		246	µS/cm	S	1916
	20030604	1420	PAAC01	Salinity		0.1	PPT	S	1917
	20030604	1420	PAAC01	Temperature, Water		21.2	^{o}C	S	1918
	20030604	1420	PAAC01	pH		6.6	SU	S	1919
3W3283	20030604	1420	PAAC01	Residue, Suspended		5.0	mg/L	S	1920
3W3283	20030604	1420	PAAC01	Residue, Volatile		4.0	mg/L	S	1921
3W3283	20030604	1420	PAAC01	Residue, Fixed	<	2.5	mg/L	S	1922
3W3283	20030604	1420	PAAC01	Turbidity		34	NTU	S	1923
3W3283	20030604	1420	PAAC01	Ammonia		0.62	mg/L	S	1924
3W3283	20030604	1420	PAAC01	Total Kjeldahl Nitrogen		1.8	mg/L	S	1925
3W3283	20030604	1420	PAAC01	NO2+NO3		0.32	mg/L	S	1926
3W3283	20030604	1420	PAAC01	Phosphorus, Total		0.60	mg/L	S	1927
3W3283	20030604	1420	PAAC01	Cadmium, Total	<	2	µg/L	S	1928
3W3283	20030604	1420	PAAC01	Chromium, Total	<	25	µg/L	S	1929
3W3283	20030604	1420	PAAC01	Copper, Total		2.5	µg/L	S	1930
3W3283	20030604	1420	PAAC01	Nickel, Total	<	10	µg/L	S	1931
3W3283	20030604	1420	PAAC01	Lead, Total	<	10	µg/L	S	1932
3W3283	20030604	1420	PAAC01	Zinc, Total	<	10	µg/L	S	1933
3W3283	20030604	1420	PAAC01	Silver, Total	<	5	µg/L	S	1934
3W3283	20030604	1420	PAAC01	Aluminum, Total		160	µg/L	S	1935
3W3283	20030604	1420	PAAC01	Calcium, Total		9.5	mg/L	S	1936
3W3283	20030604	1420	PAAC01	Iron, Total		1200	µg/L	S	1937
3W3283	20030604	1420	PAAC01	Magnesium, Total		6.5	mg/L	S	1938
3W3283	20030604	1420	PAAC01	Manganese, Total		110	µg/L	S	1939
3W3283	20030604	1420	PAAC01	Arsenic, Total	<	10	µg/L	S	1940
3W3283	20030604	1420	PAAC01	Mercury, Total	<	0.2	µg/L	S	1941

	20030604	1445	PAMC01	DO Saturation		17	%	S	1942
	20030604	1445	PAMC01	Dissolved Oxygen		1.5	mg/L	S	1943
	20030604	1445	PAMC01	Specific Conductance		145	μS/cm	S	1944
	20030604	1445	PAMC01	Salinity		0.1	PPT	S	1945
	20030604	1445	PAMC01	Temperature, Water		21.6	^{o}C	S	1946
	20030604	1445	PAMC01	pH		6.5	SU	S	1947
3W3284	20030604	1445	PAMC01	Residue, Suspended		4.0	mg/L	S	1948
3W3284	20030604	1445	PAMC01	Residue, Volatile		2.5	mg/L	S	1949
3W3284	20030604	1445	PAMC01	Residue, Fixed	<	2.5	mg/L	S	1950
3W3284	20030604	1445	PAMC01	Ammonia		0.67	mg/L	S	1951
3W3284	20030604	1445	PAMC01	Total Kjeldahl Nitrogen		1.7	mg/L	S	1952
3W3284	20030604	1445	PAMC01	NO2+NO3		0.22	mg/L	S	1953
3W3284	20030604	1445	PAMC01	Phosphorus, Total		0.50	mg/L	S	1954
3W3284	20030604	1445	PAMC01	Cadmium, Total	<	2	μg/L	S	1955
3W3284	20030604	1445	PAMC01	Chromium, Total	<	25	μg/L	S	1956
3W3284	20030604	1445	PAMC01	Copper, Total		3.8	μg/L	S	1957
3W3284	20030604	1445	PAMC01	Nickel, Total	<	10	μg/L	S	1958
3W3284	20030604	1445	PAMC01	Lead, Total	<	10	μg/L	S	1959
3W3284	20030604	1445	PAMC01	Zinc, Total	<	10	μg/L	S	1960
3W3284	20030604	1445	PAMC01	Silver, Total	<	5	μg/L	S	1961
3W3284	20030604	1445	PAMC01	Aluminum, Total		180	μg/L	S	1962
3W3284	20030604	1445	PAMC01	Calcium, Total		9.4	mg/L	S	1963
3W3284	20030604	1445	PAMC01	Iron, Total		1400	μg/L	S	1964
3W3284	20030604	1445	PAMC01	Magnesium, Total		7.4	mg/L	S	1965
3W3284	20030604	1445	PAMC01	Manganese, Total		150	μg/L	S	1966
3W3284	20030604	1445	PAMC01	Arsenic, Total	<	10	μg/L	S	1967
3W3284	20030604	1445	PAMC01	Mercury, Total	<	0.2	μg/L	S	1968
	20030604	1530	PANC01	DO Saturation		31	%	S	1969
	20030604	1530	PANC01	Dissolved Oxygen		2.7	mg/L	S	1970
	20030604	1530	PANC01	Specific Conductance		162	μS/cm	S	1971
	20030604	1530	PANC01	Salinity		0.1	PPT	S	1972
	20030604	1530	PANC01	Temperature, Water		21.2	^{o}C	S	1973
	20030604	1530	PANC01	pH		6.7	SU	S	1974
3W3285	20030604	1530	PANC01	Residue, Suspended		5.0	mg/L	S	1975
3W3285	20030604	1530	PANC01	Residue, Volatile		3.0	mg/L	S	1976
3W3285	20030604	1530	PANC01	Residue, Fixed	<	2.5	mg/L	S	1977

3W3285	20030604	1530	PANC01	Turbidity		3	NTU	S	1978
3W3285	20030604	1530	PANC01	Ammonia		0.83	mg/L	S	1979
3W3285	20030604	1530	PANC01	Total Kjeldahl Nitrogen		1.8	mg/L	S	1980
3W3285	20030604	1530	PANC01	NO2+NO3		0.27	mg/L	S	1981
3W3285	20030604	1530	PANC01	Phosphorus, Total		0.66	mg/L	S	1982
3W3285	20030604	1530	PANC01	Cadmium, Total	<	2	µg/L	S	1983
3W3285	20030604	1530	PANC01	Chromium, Total	<	25	µg/L	S	1984
3W3285	20030604	1530	PANC01	Copper, Total		7.7	µg/L	S	1985
3W3285	20030604	1530	PANC01	Nickel, Total	<	10	µg/L	S	1986
3W3285	20030604	1530	PANC01	Lead, Total	<	10	µg/L	S	1987
3W3285	20030604	1530	PANC01	Zinc, Total	<	10	µg/L	S	1988
3W3285	20030604	1530	PANC01	Silver, Total	<	5	µg/L	S	1989
3W3285	20030604	1530	PANC01	Aluminum, Total		130	µg/L	S	1990
3W3285	20030604	1530	PANC01	Calcium, Total		15.0	mg/L	S	1991
3W3285	20030604	1530	PANC01	Iron, Total		670	µg/L	S	1992
3W3285	20030604	1530	PANC01	Magnesium, Total		8.0	mg/L	S	1993
3W3285	20030604	1530	PANC01	Manganese, Total		130	µg/L	S	1994
3W3285	20030604	1530	PANC01	Arsenic, Total	<	10	µg/L	S	1995
3W3285	20030604	1530	PANC01	Mercury, Total	<	0.2	µg/L	S	1996

APPENDIX I

Pasquotank River Basin Data Summary

PREPARED FOR: North Carolina Wetlands Restoration Program (NCWRP)

PREPARED BY: CH2MHILL

DATE: January 27, 2003

This Technical Memorandum (TM) provides a summary of water quality and hydrology data available within the Pasquotank River Basin. The TM also identifies potential monitoring locations that would provide data to better calibrate the AVGWLF watershed model that is being developed as part of this study.

Introduction

The North Carolina Wetlands Restoration Program (NCWRP) is a statewide program established by the North Carolina General Assembly to promote the enhancement, creation and preservation of wetlands, streams and riparian areas throughout North Carolina. NCWRP is leading the development of Local Watershed Plans for each of North Carolina's seventeen major river basins. The Plans identify projects which have the highest potential to improve and protect water quality, flood control, wildlife and fisheries habitat, and recreational opportunities. The Plans also guide NCWRP restoration expenditures to ensure that restoration goals are achieved and measurable results are obtained.

CH2M HILL is working with Decision Support Professionals (DSPro) to develop a Local Watershed Plan for the Pasquotank River Basin. The Pasquotank River Basin is contained within cataloging unit 03010205; the project area encompasses the 14 digit hydrologic units 03010205010020, 03010205050010, and 03010205040010. CH2M HILL is responsible for summarizing the available water quality and hydrologic data within the study area and developing a watershed planning model of the study area. This TM summarizes the available water quality and hydrologic data.

Purpose

The purpose of this TM is to summarize the available hydrologic and water quality data available within the study area. These data will be used to develop a watershed model that will be applied to describe existing water quality conditions and to predict water quality changes that may occur as the land use changes with and without best management practices (BMPs). The objectives of this TM are:

- Summarize existing water quality and hydrologic data available within the study area

- Recommend changes within the monitoring program to support the WRP's Local Watershed Plan
- Aid in development of performance measures for total nitrogen (TN), total phosphorus (TP) and sediment.

Hydrology

The Pasquotank River Basin is located within the northeast corner of the North Carolina Coastal Plain. The US Geological Survey (USGS) has maintained a gaging station on the Pasquotank River at the US Highway 17 bridge since October 1995 (Figure 1). This site is influenced by tides, and daily flows at the site are often negative due to flow reversals. Based on data available on January 20, 2003, the mean flow at the site is 150 cfs (USGS, website). Most of the streams located in the study area are likely tidally influenced. The watershed hydrology is complicated by the flat topography and extent of controlled drainage for irrigation throughout the basin.

Water Quality

Division of Water Quality Chemical Data

Ambient Data

The North Carolina Division of Water Quality (DWQ) maintains one ambient monitoring station within the study area on the Pasquotank River at Elizabeth City (Figure 1). The river at the sampling location is classified as SB, meaning that it is saltwater and is used for primary recreation. Data for field parameters, solids, chloride, turbidity, nutrients, and metals are collected monthly. The state reviews the data and considers the water impaired for any parameters that have greater than 10 percent violations.

Data collected between September 26, 1995 and August 29, 2000 (basin plan study period) indicate that pH is often below the minimum allowed by state water quality standards (6.8 S.U.). Out of 45 samples available during the sampling period analyzed, 21 samples were below 6.8. This is likely attributable to the extent of swamp waters located within the watershed, which maintain a naturally low pH. The other parameter that could potentially be indicating water quality problems is nickel. Forty-five samples were collected during the basin plan study period, and each of these samples was reported as less than the laboratory reporting level. However, the reporting level is higher than the state standard of 8.3 ug/l for salt waters.

Special Study Data

DWQ performed water quality sampling on several creeks within the study area to provide information for the Local Watershed Plan (Table 1 and Figure 1). The data are included in Appendix H of the Pasquotank River Local Watershed Characterization Report.

TABLE 1
Summary of Sampling Stations by DWQ

Site No.	Location Description	Stream Classification	Parameters[1]
NC-1	Newbegun Creek at Sawmill Park (NC 34)	C-SW	Field parameters, Nutrients, Residue, Metals, Ions, Hardness
CC-1	Charles Creek at Halstead Boulevard	C-SW	Field parameters, Nutrients, Residue, Metals, Ions, Hardness
AC-1	Areneuse Creek at NC 343	C-SW and SB (upstream of NC 343, the creek is classified as C-SW; downstream of NC 343, the creek is classified as SB).	Field parameters, Nutrients, Residue, Metals, Ions, Hardness
SC-1	Sawyers Creek at Sawyers Creek Road (SR 1152)	C-SW	Field parameters, Nutrients, Residue
HL-1	Tributary draining Hales Lake at Burnt Mills (NC 343)	C-SW	Field parameters, Nutrients, Residue
JC-1	Joyce Creek at NC 343	C-SW	Field parameters, Nutrients, Residue
GD-1	Intracoastal Waterway at the NC/VA border (US 17)	C-SW	Field parameters, Nutrients, Residue
ND-1	Newland Drainage Canal at School House Road (SR 1363)	C-SW	Field parameters, Nutrients, Residue
GD-2	Pasquotank River at Stafford Road (SR 1361)	WS-V SW	Field parameters, Nutrients, Residue, Metals, Ions, Hardness
KC-1	Knobbs Creek at US 17	C-Sw	Field parameters, Nutrients, Residue

[1]The following parameters were included in the sampling:

- Field Parameters include dissolved oxygen (DO), temperature, pH, conductivity and salinity
- Nutrients include ammonia, total Kjeldahl nitrogen (TKN), nitrate-nitrite, total phosphorus (TP), and total nitrogen (TN)
- Residue includes total suspended solids (TSS), volatile solids, and fixed solids
- Metals include cadmium, chromium, copper, nickel, lead, zinc, silver, aluminum, iron, arsenic, and mercury
- Ions include calcium and magnesium

Data are available from each of these sites for April 9, 2002, May 23, 2002, and July 17, 2002. The data are indicative of swamp waters, and show several low DO and pH values. The state standards indicate that DO can be less than 5 mg/l in waters classified as swamp waters if the low DO values are due to natural conditions. The state standards also note that pH can be as low as 4.3 in swamp waters if due to natural conditions. All DO values for Charles Creek and Areneuse Creek were below 5 mg/l. The DO values on Charles Creek ranged from 2.06 mg/l to 4.73 mg/l while the values on Areneuse Creek ranged from 3.95 mg/l to 4.51 mg/l. The Pasquotank River site had the lowest recorded DO value of 1.88 mg/l recorded on July 17, 2002. Other creeks that exhibited DO values below 5 mg/l on one or two occasions were: Sawyers Creek, tributary draining Hales Lake, Joyce Creek, Newland Drainage Canal, and Knobbs Creek. Several of the stations exhibited high nutrient levels. There are no state surface water standards for phosphorus and nitrogen, but DWQ considers 0.05 mg/l as a potential target for TP concentrations. Most of the creeks showed TP values that exceeded 0.05 mg/l on at least one occasion, and the data collected in June and July generally showed higher concentrations of TP than the data collected in April. Charles Creek consistently exhibited one of the highest TP concentrations, and values at that station ranged from 0.26 mg/l to 0.78 mg/l. Newbegun Creek also showed fairly high values consistently, and they ranged from 0.20 mg/l to 0.50 mg/l. Newland Drainage Canal showed one value of 0.60 mg/l TP, and Areneuse Creek showed values of 0.20 and 0.28 mg/l in April and June respectively. DWQ staff located in the Washington Regional Office have indicated that there have been numerous algal blooms in the vicinity of the canals in Areneuse Creek (DWQ, May 2002).

DWQ does not include a target value for total nitrogen in its reports on the Pasquotank River Basin, but literature often supports a value in the range of 0.5 to 1 mg/l to protect against the effects of eutrophication. Each of the sites sampled had a least one TN value which exceeded 1 mg/l. The highest TN value of 4.6 mg/l was reported on the Pasquotank River, and a value of 3.8 mg/l was reported on the tributary draining Hales Lake.

Algal Bloom Data

DWQ investigated an algal bloom report in Areneuse Creek and Newbegun Creek in July 2000. Samples indicated blue green algae. Staff also noted that strong winds may have broken up the algal bloom, and blooms may also have occurred in the mainstem of the river and neighboring canals (DWQ, January 2002).

US Geological Survey

The USGS has performed surface water quality and groundwater quality sampling within the study, and in areas in proximity to the study area (Figure 1). Much of the sampling data is related to one or two sampling events. The sampling data for nitrogen and phosphorus were obtained from the USGS online database, and the results are included in Appendix J of the Pasquotank River Local Watershed Characterization Report.

Environmental Protection Agency

As part of EPA's Environmental Monitoring and Assessment Program (EMAP), sediment samples were taken from the Pasquotank River near Elizabeth City. A sample from 1996 showed elevated levels of PCBs, DDT, and metals (DWQ, January 2002).

Elizabeth City Stormwater Sampling Data

Elizabeth City performed stormwater sampling between 1997 and 1999. Ambient water quality data was collected from eight points within Elizabeth City (Figure 1). Four sampling points were located in the main stem of the Pasquotank River, two were located on Charles

Creek, and two were located at storm water pump stations near the Pasquotank River. The data are summarized in Appendix K of the Pasquotank River Local Watershed Characterization Report. The data were not gathered using methodologies approved by the DWQ, and thus the data should be interpreted carefully.

Overall, there was no trend between the location of sampling sites and the parameters measured. A review of this data does reveal, however, elevated fecal coliform, total nitrogen, and total phosphorus values in the Pasquotank River, Charles Creek, and at both pump stations.

Data from the two pump stations showed elevated fecal coliform values as high as 2,100,000 cfu/100ml. Dissolved oxygen values were as low as 0.52 mg/l. This water is known to be stagnant frequently and would not be expected to have typical dissolved oxygen values. This data indicates that sources of fecal coliform exist within Elizabeth City and are being discharged into the Pasquotank River by means of these pump stations. Such conditions are typical of suburban and urban areas. The highest concentrations of TN (9.81 mg/l) and TP (5.01 mg/l) were also observed at the two pump stations.

The greatest frequency of elevated fecal coliform values within the Pasquotank River are found at the two stations immediately downstream of the pump stations. The highest fecal coliform value was 3,348 cfu/100ml. Dissolved oxygen and pH tends to be low at all sampling locations along the Pasquotank, with the exception of the most downstream station where mixing with the waters of the Albemarle sound is greatest. Total phosphorus and total nitrogen were elevated at each location with average TP ranging from 0.11 mg/l to 0.8 mg/l and average TN ranging from 1.51 mg/l to 2.22 mg/l.

The two sampling stations on Charles Creek have reported fecal coliform values as high as 5,150 cfu/100ml (Station 7), dissolved oxygen as low as 1.4 mg/l, and pH as low as 5.2 S.U.. This data indicates that Charles Creek could be a source of fecal coliform into the basin and that the low DO and pH conditions within the Pasquotank River also exist in Charles Creek. Likewise, Charles Creek also exhibits elevated nutrient levels with average TP values of approximately 0.5 mg/l and average TN values greater than 2 mg/l.

Overall the sampling data reviewed show that the Pasquotank River has elevated fecal coliform, nitrogen, and phosphorus levels upstream and downstream of Elizabeth City. Charles Creek, and the two pump stations are sources of fecal coliform, nitrogen, phosphorus, and water with low concentrations of dissolved oxygen. (Landmark and CH2M HILL, 2002).

East Carolina University

East Carolina University (ECU) collected nitrate and phosphate data from 10 sites on the Pasquotank River and Dismal Swamp Canal from November 1998 to May 1999, and the online report indicates that sampling was supposed to continue through January 2000 (ECU website). During this sampling period, the highest monthly average concentration of nitrate was 1.2 mg/l in January and April, and the lowest monthly average concentration of nitrate was 0.3 mg/l in May. The individual data points ranged from a low of 0.2 mg/l to a high of 2.8 mg/l.

The highest monthly concentration of phosphate was 0.49 mg/l in November, and the lowest monthly average concentration was 0.12 mg/l in May. The individual data points ranged from 0.06 mg/l to 1.70 mg/l.

Recommended Monitoring Locations and Parameters

Because of the limited hydrologic and water quality data in the basin, the current modeling analyses are conducted based on evaluations completed in similar watersheds. Additional monitoring is recommended in order to calibrate and validate the watershed model, AVGWLF for the Pasquotank Basin. In order to improve the accuracy of the model predictions, both physical and water quality are required to quantify nutrient and sediment loading from uplands.

It is recommended that a minimum of two representative sites be selected for collection of hydrologic and water quality data for model calibration and validation. The characteristics of the 16 watersheds within the study area were reviewed to determine which watersheds may be considered representative of the study area as a whole.

Based on a review of the hydrography and subbasin characterics, it is recommended that Joyce Creek watershed be monitored at or near Highway 343. Additionally, it is recommended that one of the following creeks be targeted for hydrologic and water quality data collection: Milldam Creek, Areneuse Creek and Portohonto Creek. These creeks are in close proximity to the mouth of the Pasquotank River; hydrologic data would need to be corrected for tidal influence.

It is recommended that monitoring be conducted to characterize loading during both base flow and storm flow conditions. Temporary stream gages may be installed for a period of 6 months. Water quality sampling is recommended weekly during base flow conditions. During storm flow conditions water quality sampling is recommended at a frequency of 2-4 hours during hydrograph rise and every 6 to 8 hours in days following peak flow.

The following parameters are recommended for sampling from all sites:

Field Parameters

Temperature
Dissolved oxygen
Specific Conductance
PH

Water Quality Parameters

Total Suspended Solids
Total Phosphorus

Dissolved P
Ortho-Phosphate
Total Nitrogen
Total Kjeldahl Nitrogen (TKN)
Nitrate+Nitrite
Ammonia

References

Caldwell, Scott. 2003. Personal communication January 17, 2003.

DWQ, January 2002. *Basinwide Assessment Report: Chowan and Pasquotank River Basins*.

DWQ, May 2002. *Pasquotank River Basinwide Water Quality Plan*.

East Carolina University. http://www.ecsu.edu/ECSU/AcadDept/Geology/prwqp.htm

Landmark. 2002. Memorandum to Bonnie Duncan, North Carolina Wetlands Restoration Unit dated February 27, 2002.

Landmark and CH2M HILL. 2002. *Pasquotank River: Local Watershed Characterization*. July 2002.

USGS. http://nc.waterdata.usgs.gov/nwis/current/?type=flow

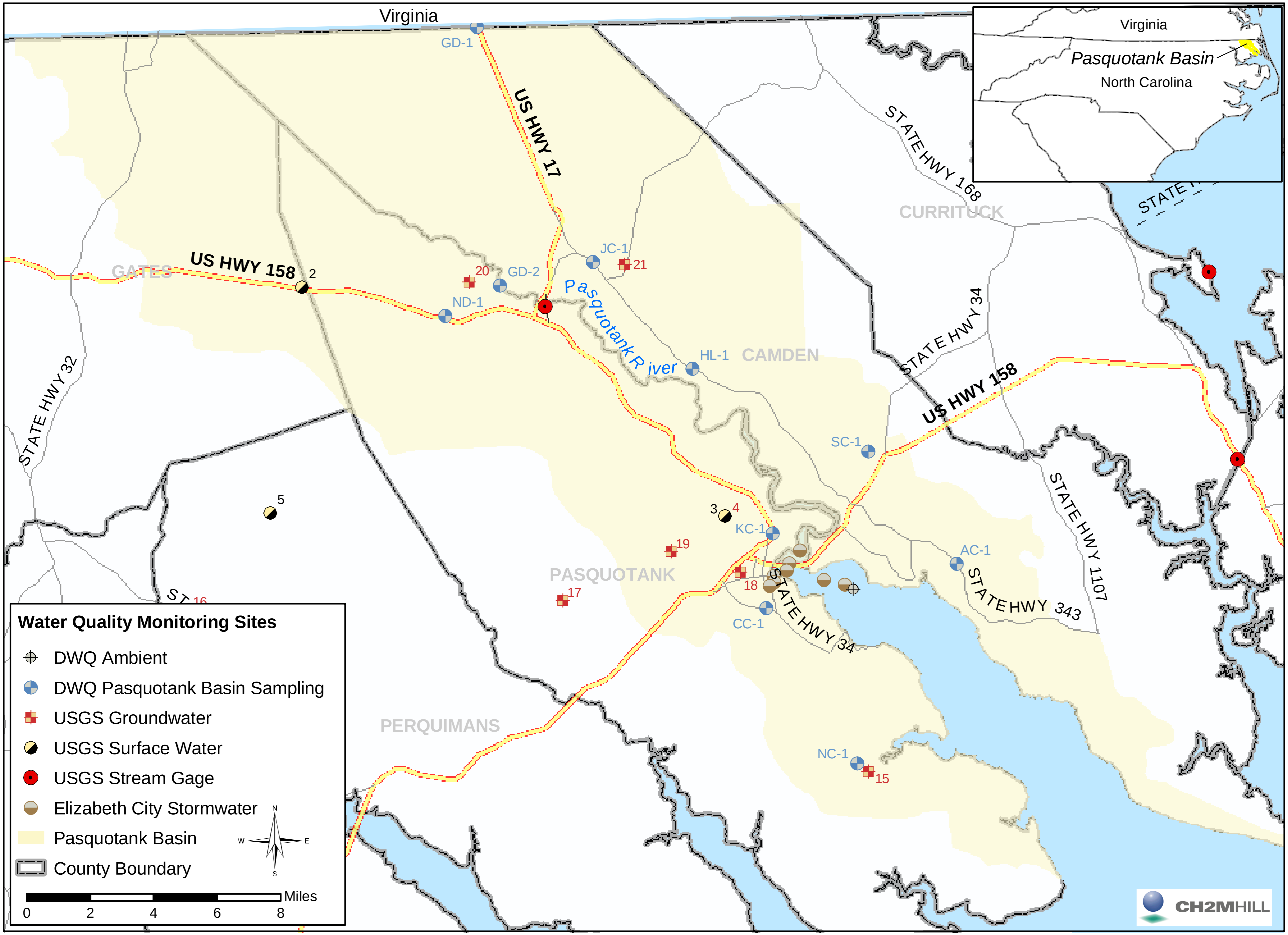


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Figure 1. Location of Physical and Water Quality Monitoring Sites in the Pasquotank Basin

Appendix B: USGS Sampling Data

Station ID	Description	Type	County	Date | Time	Nitrogen, Ammonia Dissolved *(mg/l as N)*	Nitrogen, Nitrite Dissolved *(mg/l as N)*	Nitrogen, Ammonia + Organic Dis. *(mg/l as N)*	Nitrogen, Ammonia + Organic Total *(mg/l as N)*	Nirtrogen, N02+NO3 Dissolved *(mg/l as N)*	Total Nitrogen (mg/l as N)	Phosphours Total *(mg/l as P)*	Phosphorus Dissolved *(mg/l as P)*	Phosphorus Ortho, Dissolved *(mg/l as P)*
2	USGS 0204378000 NEWLAND CANAL NEAR ACORN HILL, NC	surface	Gates County, North Carolina	01/27/95 | 1100hrs	0.05	<.01	1	0.09	0.63		0.04		
3	USGS 02043814 NEWLAND CANAL NR LYNCHS CORNER, NC	surface	Pasquotank County, North Carolina	01/27/95 | 0900hrs 06/07/95 | 1000hrs 09/25/95 | 1800hrs	0.08 1.8 -	<.01 0.1 -	1.4 3.8 -	1.5 3.8 -	0.45 0.57 -				
4	USGS0204386000 KNOBBS CR AT SR1332 NR ELIZABERTH CITY, NC	surface	Pasquotank County, North Carolina	01/26/95 | 1330hrs 04/06/95 | 0730hrs 06/05/95 | 1630hrs 09/12/95 | 1130hrs	0.02 0.03 0.66 0.09	<.01 <.01 <.01 <.01	0.8 1 0.1 <.01	0.8 1 1.6 0.9	<.05 <.05 <.05 <.05		0.02 0.07 .02 0.11		
15	USGS 361218076100401 PK-210 F10-K4	groundwater	Pasquotank County, North Carolina	08/31/94 | 1930hrs	2.8	<.01	3.1		<.05			0.4	0.32
17*	USGS 361717076201301 PK-209 LU-04	groundwater	Pasquotank County, North Carolina	05/17/94 | 0930hrs	0.31	0.03	1.1		<.05			1.4	1.4
18	USGS 361752076141201 PK-208 E.C. BUS GARAGE	groundwater	Pasquotank County, North Carolina	05/11/95 | 1030hrs	0.03	0.02	0.03	0.3	0.07			0.03	<.01
19	USGS 36182907616320 PK-141 (NC-195) NR ELIZABETH CITY (SURFICIAL)	groundwater	Pasquotank County, North Carolina	09/01/94 | 1300hrs	0.14	<.01	0.02		<.05			0.05	0.04
20	USGS362601076230702 PK-190 (NC-203) MORGANS CORNER RS C12w2	groundwater	Pasquotank County, North Carolina	09/01/94 | 1700hrs	0.2	<.01	0.3		<.05			0.22	<.01
21	USGS 362623076175001 CA-008 SUPPLY 03	groundwater	Pasquotank County, North Carolina	05/18/94 | 1030hrs	0.042	0.02	0.5		<.05			0.11	0.11

de of study area

Stormwater Management Analysis
Elizabeth City Department of Public Works
Local Watershed Restoration Plan For the Pasquotank River Basin

Notes: Sampling locations 2-6 and 8 are found on a designated section of the Pasquotank River from the Norfolk-Southern Railroad bridge to a line across the River from Hospital Point to Cobb Point (30-3-(7)). (Stream Classification: SC)

Sampling locations 1 and 7 are found on Charles Creek (30-3-11). (Stream Classification: C;Sw)

Parameter	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class C Streams	< 200 30 day GM, not > 400 20% of samples			< 20	> 5.0 daily, > 4.0 instantaneous			6.0-9.0, > 4.3 Sw	< 2.8 °C above normal			
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug, < 2.2 °C above normal other months; < 32 °C always			
1/17/1997												
1	143	50	71	5	2.3	50	883	7.8	29			
2	6	2	75	3	5.2	100	1022	6.7	29			
3	2,100,000	40	116	11	0.52	100	1135	6.8	28			
4	13	2	90	1	4.4	0	929	6.4	29			
5	1980	40	25	3	2.6	100	1178	7.7	26			
6	2	2	107	2	4.1	50	836	6.4	29			
7/23/1997												
1	>1640	3.5	71	14	2.6	50	915	7.3	27			
2	3	2	25	3	5.9	50	1161	6.6	29			
3	27273	5	114	19	2.8	50	1374	7.4	26			
4	128	2	75	1	5	50	1022	6.7	29			
5	>77,000	6	56	17	0.4	0	196	6.8	26			
6	1	2	126	5	4.5	50	836	6.3	29			
7/30/1997												
1	410	1.5	29	6	1.4	0	919	6.7	27			
2	27	1	44	3	5.3	50	1040	6.3	28			
3	310,000	4	10	16	0.9	75	1374	6.9	26			
4	74	1	37	7	4.7	50	899	6.3	28			
5	>18000	1	46	13	0.9	50	1200	7.2	25			
6	238	0.8	66	3	3.8	50	836	5.8	28			
8/6/1997												
1	470	4	0	8	2.7	50	900	6.5	25			
2	32	4	44	6	5.5	150	1108	6.6	27			
3	45455	4	3	16	0.4	0	887	6.4	26			
4	28	3	73	6	5.2	50	1108	6.6	27			
5	>60,000	3	63	17	0.5	0	500	6.5	25			
6	55	3	32	8	4.5	50	722	6.6	27			
8/13/1997												
1	450	6.7	162	5	2.1	50	1022	6	29			
2	5	4.1	153	6	7.5	100	1301	6.4	29			
3	<10,000	3.4	49	6	0.4	100	1178	6.6	26			
4	407	4	141	6	7.3	100	1394	7	29			
5	>909	3.2	61	141	7.5	50	1200	7.3	25			
6	8	2.8	162	5	6.4	50	1088	6.3	28			
8/20/1997												
1	150	5.4	68	18	5	50	1000	6.4	28			
2	2	2.7	56	8	6.2	100	1650	6.6	29			
3	<909	2.9	6.3	10	0.7	0	1000	6.5	26			
4	9	3.8	81	12	7.3	100	1600	7	29			
5	1545	2.2	51	11	6.5	0	1150	6.8	25			
6	22	2.6	9.7	8	5.9	100	1100	7.1	29			
9/17/1997												
1	84	4.2	68	11	5.2	100	1150	7	25			
2	21	3.6	34	8	6.9	150	2000	7	26			
3	<100	2	0	5	1.5	100	1000	7.2	26			
4	24	2.6	46	3	5.8	150	1750	5.8	25			
5	7000	2.5	8	3	1.5	50	1000	7.2	24			
6	13	1.8	10	4	5	1500	1400	6.5	26			
10/8/1997												
1	860	2.4	13	13	2.5	100	1400	11.1	23			
2	13	1.7	116	8	10.2	250	2200	5.7	24			
3	21	1.3	7	7	1.1	100	1500	11.2	19			
4	40	2.2	49	6	10	23	1900	5.6	24			
5	21	1.3	9	4	1	100	1100	11.1	22			
6	15	1.5	85	10	7.4	100	1300	10.3	23			
10/31/1997												
1	24	2.3	12	10	7.2	200	1900	8.2	25			
2	51	1.6	93	6	9.6	400	3500	7.3	23			
3	21	2	10	22	4.6	100	600	7.8	21			
4	30	2.4	38	5	10	500	3700	7.2	23			
5	800	2.2	15	14	2.9	0	400	8.4	23			
6	29	1.6	78	8	7.6	300	2200	7.9	24			
11/24/1997												
1	3	4	4	12	6.2	200	24650	6.9	13			
2												
3	7,273	3	7	38	1	400	494	6.7	15	0.25	2.35	3.5
4												
5	909	4	9	18	2.3	600	778	6.9	13	0.33	2.54	3
6												
7	145	6	8	19	8.6	200	3139	7.2	11	0.43	2.18	2.2
8	37	2	3	16	8	200	3373	6.9	13	0.16	1.81	3.1
12/10/1997												
1	18	2	6	10	4	1.5	790	6.9	14	0.69	2.59	3.9
2												
3	200	7	20	31	6.3	1	508	6.8	2	0.16	2.74	2.4
4												
5	800	5	10	12	4.6	0.5	331	7	13	0.29	2.98	3.8
6												
7	3	3	5	13	7.5	2.5	1465	7	13	0.39	3.42	2.2
8	1	2	6	9	9.5	2.5	1428	6.8	12	0.1	2.13	1.6
1/27/1998												
1	96	2	5	8	8.6	400	216	7	12	0.26	5.87	2.3
2												
3	0	2	12	4	7.9	100	330	6.8	12	0.14	2.75	1.8
4												
5	6700	2	8	34	5.4	50	378	6.5	13	0.29	3.67	1.4
6												
7	53	2	15	6	7.2	0	196	6.8	8	0.29	6.41	1.1
8	31	3	5	6	9.5	75	521	6.4	9	0.1	8.95	2.2
2/26/1998												
1	46	1	12	4	7	0	246	7.4	10	0.31	1.2	3
2												
3	200	2	33	7	7.5	5	320	7	13	0.08	2.79	3.3
4												
5	0	3	18	11	4.2	30	339	7	13	0.19	2.23	2.6
6												
7	155	2	6	6	8.6	0	203	7	12	0.25	1.03	3
8	14	2	22	8	8.4	0	68	5.2	12	0.1	1.6	3.7
3/24/1998												
1	1	0.8	9	4	6.2	0	227	7	11	0.31	1.59	3.5
2												
3	7200	1.5	21	4	8	50	284	7.1	14	0.1	2.3	2.58
4												
5	11900	2.7	45	2	4.2	50	301	6.9	13	0.15	2.88	5.2
6												
7	3	0.9	30	5	7.9	0	193	7	13	0.31	2.14	4.8
8	26	0.9	9	6	8.3	0	146	5.6	13	0.09	1.8	2
4/28/1998												
1	230	1.6	27	4	2.8	0	435	6.7	16	0.57	1.67	4.4
2												
3	0	1.8	49	3	6.5	0	553	6.9	20	0.21	2.39	8.4
4												
5	636	2.4	42	12	1	10	352	6.7	17	1.38	2.17	5.7
6												
7	461	1.8	355	4	6.7	10	256	5.2	19	0.26	2.12	4.3
8	22	1.2	186	2	7.1	0	195	2.8	20	0.1	1.82	3.3
5/20/1998												
1	650	1.8	98	5	3.9	10	612	6.7	24	0.46	1.9	15
2												
3	90	2	38	9	5.9	10	707	6.3	22	0.12	1.89	<1.0
4												
5	4300	1.6	39	9	1.8	70	566	6.6	22	0.2	1.6	1.9
6												
7	241	1.8	157	4	5.9	40	308	6.4	23	0.24	1.32	2
8	52	0.5	109	5	6.2	10	360	3.7	21	0.1	1.4	<1.0
6/17/1998												
1	220	4	90	4	4.9	0	634	7	28	0.45	1.2	5.3
2	30	3	119	2	6.5	0	612	6.2	26	0.06	1.02	3.4
3	21	<1	167	2	5.7	0	405	5.9	27	0.09	1.14	4.1
4	132	2	90	5	4.8	0	634	6.8	28	0.26	1.32	3.7
5	53	<1	99	5	5.8	0	600	6.2	25	<0.04	1.29	6.3
6	2300	2	59	3	4.3	0	700	6.9	25	0.17	1.71	4.8
7	35	<1	36	4	6.1	0	600	6.1	25	0.08	1.15	5.1
8	2000	>2	97	8	1.3	0	623	6.7	27	0.21	1.22	4.1
6/23/1998												
1	106	4	72	6	7.2	0	673	6.5	31	0.51	1.24	5.3
2	13	2	114	6	8.7	100	743	6.2	29	0.11	1.48	5.4
3	1500	6	20	2	4.8	100	981	6.4	26	0.39	1.87	5.5
4	11	6	65	3	8.2	100	650	5.8	29	0.2	1.03	3.2
5	6900	2	55	10	1.1	70	662	6.2	28	0.39	1.73	6.4
6	82	2	112	3	4.4	0	340	5.8	28	0.17	1.84	4.9
7	173	4	95	5	9.5	0	628	6.4	31	0.27	1.68	5.1
8	49	7	87	12	7.2	100	662	5.7	28	0.19	1.46	4.6
7/15/1998												
1	66	3	73	6	6.6	0	730	6.9	30	0.3	2.93	4.3
2	1	1	59	3	6.6	0	697	6.1	29	0.04	3.74	5.7
3	0	2	32	7	3.6	0	1135	6.6	28	0.21	9.81	3.5
4	7	2	44	3	6	0	650	6	29	0.06	7.02	5.7
5	100	3	40	6	3	0	1060	6.6	27	0.2	7.85	4
6	4	0.5	95	2	5.6	0	557	6.4	29	0.09	7.26	5.1
7	87	2	70	6	6.7	0	1161	6.6	29	0.09	6.77	4.9
8	24	2	51	7	5.8	0	650	6	29	0.05	6.92	5.1
7/28/1998												
1	350	5	27	10	8.8	0	334	6.6	29	0.37	2.09	10
2	26	1	54	4	4.5	0	3.81	5.9	29	0.12	1.22	6
3	1500	2	4	7	7.4	0	578	6.7	27	0.19	2.34	7.9
4	55	2	58	2	4.7	0	427	5.8	29	0.17	2.28	3.2
5	29000	2	3	6	2.2	0	662	6.5	28	0.18	2.19	8.7
6	56	0.8	39	2	4.5	0	232	6.7	29	0.17	2.24	3
7	60	2	87	4	7.5	0	319	6.1	30	0.21	2.22	4.7
8	82	4	85	6	4.3	0	372	6	29	0.13	2.44	6.4
8/11/1998												
1	850	2	58	7	4.2	0	804	7.1	28	0.77	1.27	4.2
2	1	2	79	8	5.5	0	697	6.5	29	0.45	0.52	4.4
3	133000	>100	105	21	2.4	0	674	6.6	27	0.61	1.13	5.5
4	83	2	85	8	5.2	50	604	6.4	29	0.51	0.55	5.9
5	147,000	3	45	10	7.8	0	1011	7	27	0.32	1.1	7.1
6	20	0.8	107	7	4.9	0	348	6.2	29	0.48	0.86	5.7
7	545	2	73	10	4.5	0	548	7	30	0.58	1.03	4.9
8	619	2	77	6	4.3	0	627	6.3	29	0.4	0.68	3.2
8/25/1998												
1	66	4	62	7	3	0	771	7.2	27	0.66	1.46	2.4
2	7	0.8	64	3	5.6	0	709	6.4	28	0.08	0.89	1.7
3	300	3	41	6	2	100	1300	6.9	27	0.29	2.59	2.1
4	6	0.2	69	2	5.4	0	615	6.4	28	0.11	1.14	1.5
5	17,300	3	33	4	2.7	100	1079	6.7	26	0.4	3.48	2.4
6	7	1	112	3	5	0	473	6.3	28	0.15	1.16	2.9
7	86	5	95	5	4.3	0	639	7	30	0.34	1.11	1.6
8	62	0.3	67	5	5.9	0	662	6.3	28	0.1	0.92	3.9
9/9/1998												
1	890	>2	57	12	1.8	0	758	6.7	21	1.21	2.93	3.1
2	45	1	80	18	4	300	4000	6.2	25	0.07	2.31	1.8
3	10,300	4	40	6	3.9	0	510	3.9	24	0.14	2.88	4.4
4	41	1	191	5	3	250	37000	6.1	25	0.25	2.06	1.7
5	56,000	2	39	6	1.4	0	499	6.5	23	0.25	2.33	2.3
6	32	1	92	2	2.6	400	2200	5.9	25	0.13	2.43	2.3
7	175	3	60	12	2.9	100	1664	6.6	23	1.02	2.44	1.5
8	171	1	85	8	2.8	200	3000	6.1	25	0.15	2.26	2.8
9/23/1998												
1	264	>4	31	15	3	0	1000	7.7	25	1.01	2.47	2.57
2	22	0.7	74	16	4.3	500	5000	6.5	25	0.04	2.16	3.7
3	68000	1	69	8	2.5	0	380	7.4	25	0.26	2.62	4.1
4	22	0.7	83	6	3.5	400	3827	6.3	26	0.8	2.98	3.6
5	6600	2	35	10	1.5	100	918	7.5	24	0.44	3.14	4.3
6	19	0.8	100	7	3.6	300	2312	6.2	27	0.07	2.43	3
7	89	4.6	74	15	4.7	300	2400	7.9	25	0.59	2.08	2.3
8	398	1	89	12	3.7	300	3179	6.4	27	0.07	2.29	2.4
10/7/1998												
1	270	3	38	8	4.1	100	955	7.8	22	0.88	1.54	1.7
2	19	2	60	3	6.7	400	4986	6.8	22	0.04	0.86	2
3	300	2	20	7	3.8	0	714	7.6	24	0.1	1.51	1.8
4	70	2	75	3	6.4	300	4667	6.8	22	0.04	0.81	1.5
5	5,300	2	25	5	1.5	0	392	7	22	0.26	0.92	1.8
6	8	1	82	3	5.6	300	3847	6.6	23	0.06	1.06	1
7	212	3	63	6	6.5	200	2599	7.8	23	0.33	1.13	1.3
8	123	2	75	6	6.1	300	3951	6.9	23	0.04	0.94	5.5
10/20/1998												
1	580	3	37	15	5.5	10	2599	6.9	21	0.52	1.69	1
2	1	2	75	13	3	400	5305	6.3	21	0.07	0.93	<1.0
3	100	2	32	6	3.5	5	936	6.5	23	0.13	3.92	1
4	5	2	103	8	3	300	4764	6.2	21	0.04	0.91	1.4
5	600	2	40	5	4.3	0	442	6.6	20	0.21	0.99	5.3
6	9	2	80	7	3.8	300	4223	6.2	21	0.09	1.25	<1.0
7	<1	6	74	13	4.1	20	4243	6.9	22	0.2	1.12	1.2
8	<1	2	76	7	3.1	400	4656	6.2	21	0.05	1.07	<1.0
11/17/1998												
1	37	5	52	10	4.9	10	224	7.4	17	0.95	1.55	2.1
2												
3	78000	6	32	15	7.6	0	104	7.2	18	0.21	0.95	3.1
4												
5	5,818	6	44	13	6.3	0	224	7	17	0.3	1.76	1.7
6												
7	84	3	50	11	7.6	25	4013	7.4	17	0.37	1.34	1.6
8	283	2	67	12	9.1	30	5686	7.1	15	0.14	1.33	1.6
12/8/1998												
1	108	3	98	9	4.4	20	2711	7.4	19	0.91	2.19	2.6
2												
3	1636	2	71	9	2.9	0	774	7.2	20	0.17	2.6	3.6
4												
5	91	<1	53	7	3.5	0	693	6.9	18	0.21	1.23	2.2
6												
7	151	1	66	17	7.1	40	5079	7.4	18	0.38	1.43	2.8
8	371	1	80	5	8.6	40	5548	7.3	17	0.07	1.37	2.8
3/17/1999												
1	1,420	3	37	6	6.7	0	434	7.5	10	0.32	2.35	1.5
2												
3	34300	8	40	5	6.8	0	5189	7	13	5.01	3.38	9.4
4												
5	15800	4	36	8	3.6	0	6098	6.9	13	0.19	1.75	1.6
6												
7	865	2	66	9	9.2	10	1682	7.2	10	0.21	2.27	1.6
8	3,348	<1	80	8	10.7	30	3,083	6.9	10	<0.04	1.32	1.3
6/8/1999												
1	1,430	3	110	4					28	0.65	1.78	5.8
2	15	1	134	9					28	0.3	1.32	4.1
3	700	11	38	22					27	0.59	1.52	5.2
4	56	2	56	6					27	0.15	1.36	4.8
5	42,000	4	339	20					27	0.82	3.66	9.8
6	5	2	49	10					28	0.05	1.74	5.1
7	5,150	12	114	30					28	0.38	1.83	4.5
8	224	2	86	10					27	0.09	1.63	5.6
12/15/1999												
1	135	1	17	4	3.75	0	518.94	6.98	13	0.13	0.96	1.6
2												
3	50	2	17	10	6.87	0	458.88	6.72	16	0.67	1.39	1.2
4												
5	3,100	4	17	10	3.72	0	392.45	6.7	14	0.26	1.52	1.1
6												
7	250	1	29	5	6.06	0	598.64	6.9	12	0.37	1.24	1.9
8	14	1	118	3	7.71	0	439	5.06	12	0.13	2.24	<1.0

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= Data points not meeting NCDENR Div. of Water Quality surface water standards.

Location 1

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class C Streams	< 200 30 day GM, not > 400 20% of samples			< 20	> 5.0 daily, > 4.0 instantaneous			6.0-9.0, > 4.3 Sw	< 2.8 °C above normal			
1/17/1997	143	50	71	5	2.3	50	883	7.8	29			
7/23/1997	>1640	3.5	71	14	2.6	50	915	7.3	27			
7/30/1997	410	1.5	29	6	1.4	0	819	6.7	27			
8/6/1997	470	4	0	8	2.7	50	900	6.5	25			
8/13/1997	450	6.7	162	5	2.1	50	1022	6	29			
8/20/1997	150	5.4	68	18	5	50	1000	6.4	28			
9/17/1997	84	4.2	68	11	5.2	100	1150	7	25			
10/8/1997	860	2.4	13	13	2.5	100	1400	11.1	23			
10/31/1997	24	2.3	12	10	7.2	200	1900	8.2	25			
11/24/1997	3	4	4	12	6.2	200	24650	6.9	13			
12/10/1997	18	2	6	10	4	1.5	790	6.9	14	0.69	2.59	3.9
1/27/1998	96	2	5	8	8.6	400	216	7	12	0.26	5.87	2.3
2/26/1998	46	1	12	4	7	0	246	7.4	10	0.31	1.2	3
3/24/1998	1	0.8	9	4	6.2	0	227	7	11	0.31	1.59	3.5
4/28/1998	230	1.6	27	4	2.8	0	435	6.7	16	0.57	1.67	4.4
5/20/1998	650	1.8	98	5	3.9	10	612	6.7	24	0.46	1.9	15
6/17/1998	220	4	90	4	4.9	0	634	7	28	0.45	1.2	5.3
6/23/1998	106	4	72	6	7.2	0	673	6.5	31	0.51	1.24	5.3
7/15/1998	66	3	73	6	6.6	0	730	6.9	30	0.3	2.93	4.3
7/28/1998	350	5	27	10	8.8	0	334	6.6	29	0.37	2.09	10
8/11/1998	850	2	58	7	4.2	0	804	7.1	28	0.77	1.27	4.2
8/25/1998	66	4	62	7	3	0	771	7.2	27	0.66	1.46	2.4
9/9/1998	890	>2	57	12	1.8	0	758	6.7	21	1.21	2.93	3.1
9/23/1998	264	>4	31	15	3	0	1000	7.7	25	1.01	2.47	2.57
10/7/1998	270	3	38	8	4.1	100	955	7.8	22	0.88	1.54	1.7
10/20/1998	580	3	37	15	5.5	10	2599	6.9	21	0.52	1.69	1
11/17/1998	37	5	52	10	4.9	10	224	7.4	17	0.95	1.55	2.1
12/8/1998	108	3	98	9	4.4	20	2711	7.4	19	0.91	2.19	2.6
3/17/1999	1420	3	37	6	6.7	0	434	7.5	10	0.32	2.35	1.5
6/8/1999	1430	3	110	4					28	0.65	1.78	5.8
12/15/1999	135	1	17	4	3.75	0	518.94	6.98	13	0.13	0.96	1.6

Stormwater Management Analysis
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(shaded) = Data points not meeting NCDENR Div. of Water Quality surface water standards.

Location 2

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997	6	2	75	3	5.2	100	1022	6.7	29			
7/23/1997	3	2	25	3	5.9	50	1161	6.6	29			
7/30/1997	27	1	44	3	5.3	50	1040	6.3	28			
8/6/1997	32	4	44	6	5.5	150	1108	6.6	27			
8/13/1997	5	4.1	153	6	7.5	100	1301	6.4	29			
8/20/1997	2	2.7	56	8	6.2	100	1650	6.6	29			
9/17/1997	21	3.6	34	8	6.9	150	2000	7	26			
10/8/1997	13	1.7	116	8	10.2	250	2200	5.7	24			
10/31/1997	51	1.6	93	6	9.6	400	3500	7.3	23			
11/24/1997												
12/10/1997												
1/27/1998												
2/26/1998												
3/24/1998												
4/28/1998												
5/20/1998												
6/17/1998	30	3	119	2	6.5	0	612	6.2	26	0.06	1.02	3.4
6/23/1998	13	2	114	6	8.7	100	743	6.2	29	0.11	1.48	5.4
7/15/1998	1	1	59	3	6.6	0	697	6.1	29	0.04	3.74	5.7
7/28/1998	26	1	54	4	4.5	0	3.81	5.9	29	0.12	1.22	6
8/11/1998	1	2	79	8	5.5	0	697	6.5	29	0.45	0.52	4.4
8/25/1998	7	0.8	64	3	5.6	0	709	6.4	28	0.08	0.89	1.7
9/9/1998	45	1	80	18	4	300	4000	6.2	25	0.07	2.31	1.8
9/23/1998	22	0.7	74	16	4.3	500	5000	6.5	25	0.04	2.16	3.7
10/7/1998	19	2	60	3	6.7	400	4986	6.8	22	0.04	0.86	2
10/20/1998	1	2	75	13	3	400	5305	6.3	21	0.07	0.93	<1.0
11/17/1998												
12/8/1998												
3/17/1999												
6/8/1999	15	1	134	9					28	0.3	1.32	4.1
12/15/1999												

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Location 3

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997	2100000	40	116	11	0.52	100	1135	6.8	28			
7/23/1997	27273	5	114	19	2.8	50	1374	7.4	26			
7/30/1997	310000	4	10	16	0.9	75	1374	6.9	26			
8/6/1997	45455	4	3	16	0.4	0	687	6.4	26			
8/13/1997	<10,000	3.4	49	6	0.4	100	1178	6.6	26			
8/20/1997	<909	2.9	6.3	10	0.7	0	1000	6.5	26			
9/17/1997	<100	2	0	5	1.5	100	1000	7.2	26			
10/8/1997	21	1.3	7	7	1.1	100	1500	11.2	19			
10/31/1997	21	2	10	22	4.6	100	600	7.8	21			
11/24/1997	7273	3	7	38	1	400	494	6.7	15	0.25	2.35	3.5
12/10/1997	200	7	20	31	6.3	1	508	6.8	2	0.16	2.74	2.4
1/27/1998	0	2	12	4	7.9	100	330	6.8	12	0.14	2.75	1.8
2/26/1998	200	2	33	7	7.5	5	320	7	13	0.08	2.79	3.3
3/24/1998	7200	1.5	21	4	8	50	284	7.1	14	0.1	2.3	2.58
4/28/1998	0	1.8	49	3	6.5	0	553	6.9	20	0.21	2.39	8.4
5/20/1998	90	2	38	9	5.9	10	707	6.3	22	0.12	1.89	<1.0
6/17/1998	21	<1	167	2	5.7	0	405	5.9	27	0.09	1.14	4.1
6/23/1998	1500	6	20	2	4.8	100	981	6.4	26	0.39	1.87	5.5
7/15/1998	0	2	32	7	3.6	0	1135	6.6	28	0.21	9.81	3.5
7/28/1998	1500	2	4	7	7.4	0	578	6.7	27	0.19	2.34	7.9
8/11/1998	133000	>100	105	21	2.4	0	674	6.6	27	0.61	1.13	5.5
8/25/1998	300	3	41	6	2	100	1300	6.9	27	0.29	2.59	2.1
9/9/1998	10300	4	40	6	3.9	0	510	3.9	24	0.14	2.88	4.4
9/23/1998	68000	1	69	8	2.5	0	380	7.4	25	0.26	2.62	4.1
10/7/1998	300	2	20	7	3.8	0	714	7.6	24	0.1	1.51	1.8
10/20/1998	100	2	32	6	3.5	5	936	6.5	23	0.13	3.92	1
11/17/1998	78000	6	32	15	7.6	0	104	7.2	18	0.21	0.95	3.1
12/8/1998	1636	2	71	9	2.9	0	774	7.2	20	0.17	2.6	3.6
3/17/1999	34300	8	40	5	6.8	0	5189	7	13	5.01	3.38	9.4
6/8/1999	700	11	38	22					27	0.59	1.52	5.2
12/15/1999	50	2	17	10	6.87	0	458.88	6.72	16	0.67	1.39	1.2

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Location 4

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997	13	2	90	1	4.4	0	929	6.4	29			
7/23/1997	128	2	75	1	5	50	1022	6.7	29			
7/30/1997	74	1	37	7	4.7	50	899	6.3	28			
8/6/1997	28	3	73	6	5.2	50	1108	6.6	27			
8/13/1997	407	4	141	6	7.3	100	1394	7	29			
8/20/1997	9	3.8	61	12	7.3	100	1600	7	29			
9/17/1997	24	2.6	46	3	5.8	150	1750	5.8	25			
10/8/1997	40	2.2	49	6	10	23	1900	5.6	24			
10/31/1997	30	2.4	38	5	10	500	3700	7.2	23			
11/24/1997												
12/10/1997												
1/27/1998												
2/26/1998												
3/24/1998												
4/28/1998												
5/20/1998												
6/17/1998	132	2	90	5	4.8	0	634	6.8	28	0.26	1.32	3.7
6/23/1998	11	6	65	3	8.2	100	650	5.8	29	0.2	1.03	3.2
7/15/1998	7	2	44	3	6	0	650	6	29	0.06	7.02	5.7
7/28/1998	55	2	58	2	4.7	0	427	5.8	29	0.17	2.28	3.2
8/11/1998	83	2	85	8	5.2	50	604	6.4	29	0.51	0.55	5.9
8/25/1998	6	0.2	69	2	5.4	0	615	6.4	28	0.11	1.14	1.5
9/9/1998	41	1	191	5	3	250	37000	6.1	25	0.25	2.06	1.7
9/23/1998	22	0.7	83	6	3.5	400	3827	6.3	26	0.8	2.98	3.6
10/7/1998	70	2	75	3	6.4	300	4667	6.8	22	0.04	0.81	1.5
10/20/1998	5	2	103	8	3	300	4764	6.2	21	0.04	0.91	1.4
11/17/1998												
12/8/1998												
3/17/1999												
6/8/1999	56	2	56	6					27	0.15	1.36	4.8
12/15/1999												

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Location 5

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997	1980	40	25	3	2.6	100	1178	7.7	26			
7/23/1997	>77,000	6	56	17	0.4	0	196	6.8	26			
7/30/1997	>18000	1	46	13	0.9	50	1200	7.2	25			
8/6/1997	>60,000	3	63	17	0.5	0	500	6.5	25			
8/13/1997	<909	3.2	61	141	7.5	50	1200	7.3	25			
8/20/1997	1545	2.2	51	11	6.5	0	1150	6.8	25			
9/17/1997	7000	2.5	8	3	1.5	50	1000	7.2	24			
10/8/1997	21	1.3	9	4	1	100	1100	11.1	22			
10/31/1997	800	2.2	15	14	2.9	0	400	8.4	23			
11/24/1997	909	4	9	18	2.3	600	778	6.9	13	0.33	2.54	3
12/10/1997	800	5	10	12	4.6	0.5	331	7	13	0.29	2.98	3.8
1/27/1998	6700	2	8	34	5.4	50	378	6.5	13	0.29	3.67	1.4
2/26/1998	0	3	18	11	4.2	30	339	7	13	0.19	2.23	2.6
3/24/1998	11900	2.7	45	2	4.2	50	301	6.9	13	0.15	2.88	5.2
4/28/1998	636	2.4	42	12	1	10	352	6.7	17	1.38	2.17	5.7
5/20/1998	4300	1.6	39	9	1.8	70	566	6.6	22	0.2	1.6	1.9
6/17/1998	53	<1	99	5	5.8	0	600	6.2	25	<0.04	1.29	6.3
6/23/1998	6900	2	55	10	1.1	70	662	6.2	28	0.39	1.73	6.4
7/15/1998	100	3	40	6	3	0	1060	6.6	27	0.2	7.85	4
7/28/1998	29000	2	3	6	2.2	0	662	6.5	28	0.18	2.19	8.7
8/11/1998	147000	3	45	10	7.8	0	1011	7	27	0.32	1.1	7.1
8/25/1998	17300	3	33	4	2.7	100	1079	6.7	26	0.4	3.48	2.4
9/9/1998	56000	2	39	6	1.4	0	499	6.5	23	0.25	2.33	2.3
9/23/1998	6600	2	35	10	1.5	100	918	7.5	24	0.44	3.14	4.3
10/7/1998	5300	2	25	5	1.5	0	392	7	22	0.26	0.92	1.8
10/20/1998	600	2	40	5	4.3	0	442	6.6	20	0.21	0.99	5.3
11/17/1998	5818	6	44	13	6.3	0	224	7	17	0.3	1.76	1.7
12/8/1998	91	<1	53	7	3.5	0	693	6.9	18	0.21	1.23	2.2
3/17/1999	15800	4	36	8	3.6	0	6098	6.9	13	0.19	1.75	1.6
6/8/1999	42000	4	339	20					27	0.82	3.66	9.8
12/15/1999	3100	4	17	10	3.72	0	392.45	6.7	14	0.26	1.52	1.1

Stormwater Management Analysis
Elizabeth City Department of Public Works
Local Watershed Restoration Plan For the Pasquotank River Basin

Location 6

Notes: 1) Sampling locations 2-6 and 8 are found on a designated section of the Pasquotank River from the Norfolk-Southern Railroad bridge to a line across the River from Hospital Point to Cobb Point (30-3-(7)). (Stream Classification: SC)
2) Sampling locations 1 and 7 are found on Charles Creek (30-3-11). (Stream Classification: C;Sw)
[shaded] = Data points not meeting NCDENR Div. of Water Quality surface water standards.

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997	2	2	107	2	4.1	50	836	6.4	29			
7/23/1997	1	2	126	5	4.5	50	836	6.3	29			
7/30/1997	238	0.8	66	3	3.8	50	7.9	5.8	28			
8/6/1997	55	3	32	8	4.5	50	722	6.6	27			
8/13/1997	8	2.8	162	5	6.4	50	1088	6.3	28			
8/20/1997	22	2.6	9.7	8	5.9	100	1100	7.1	29			
9/17/1997	13	1.8	10	4	5	1500	1400	6.5	26			
10/8/1997	15	1.5	85	10	7.4	100	1300	10.3	23			
10/31/1997	29	1.6	78	8	7.6	300	2200	7.9	24			
11/24/1997												
12/10/1997												
1/27/1998												
2/26/1998												
3/24/1998												
4/28/1998												
5/20/1998												
6/17/1998	2300	2	59	3	4.3	0	700	6.9	25	0.17	1.71	4.8
6/23/1998	82	2	112	3	4.4	0	340	5.8	28	0.17	1.84	4.9
7/15/1998	4	0.5	95	2	5.6	0	557	6.4	29	0.09	7.26	5.1
7/28/1998	56	0.8	39	2	4.5	0	232	6.7	29	0.17	2.24	3
8/11/1998	20	0.8	107	7	4.9	0	348	6.2	29	0.48	0.86	5.7
8/25/1998	7	1	112	3	5	0	473	6.3	28	0.15	1.16	2.9
9/9/1998	32	1	92	2	2.6	400	2200	5.9	25	0.13	2.43	2.3
9/23/1998	19	0.8	100	7	3.6	300	2312	6.2	27	0.07	2.43	3
10/7/1998	8	1	82	3	5.6	300	3847	6.6	23	0.06	1.06	1
10/20/1998	9	2	80	7	3.8	300	4223	6.2	21	0.09	1.25	<1.0
11/17/1998												
12/8/1998												
3/17/1999												
6/8/1999	5	2	49	10					28	0.05	1.74	5.1
12/15/1999												

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Notes: 1) Sampling locations 2-6 and 8 are found on a designated section of the Pasquotank River from the Norfolk-Southern Railroad bridge to a line across the River from Hospital Point to Cobb Point (30-3-(7)). (Stream Classification: SC)
2) Sampling locations 1 and 7 are found on Charles Creek (30-3-11). (Stream Classification: C;Sw)
[shaded] = Data points not meeting NCDENR Div. of Water Quality surface water standards.

Location 7

Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class C Streams	< 200 30 day GM, not > 400 20% of samples			< 20	> 5.0 daily, > 4.0 instantaneous			6.0-9.0, > 4.3 Sw	< 2.8 °C above normal			
1/17/1997												
7/23/1997												
7/30/1997												
8/6/1997												
8/13/1997												
8/20/1997												
9/17/1997												
10/8/1997												
10/31/1997												
11/24/1997	145	6	8	19	8.6	200	3139	7.2	11	0.43	2.18	2.2
12/10/1997	3	3	5	13	7.5	2.5	1465	7	13	0.39	3.42	2.2
1/27/1998	53	2	15	6	7.2	0	196	6.8	8	0.29	6.41	1.1
2/26/1998	155	2	6	6	8.6	0	203	7	12	0.25	1.03	3
3/24/1998	3	0.9	30	5	7.9	0	193	7	13	0.31	2.14	4.8
4/28/1998	461	1.8	355	4	6.7	10	256	5.2	19	0.26	2.12	4.3
5/20/1998	241	1.8	157	4	5.9	40	308	6.4	23	0.24	1.32	2
6/17/1998	35	<1	36	4	6.1	0	600	6.1	25	0.08	1.15	5.1
6/23/1998	173	4	95	5	9.5	0	628	6.4	31	0.27	1.68	5.1
7/15/1998	87	2	70	6	6.7	0	1161	6.6	29	0.09	6.77	4.9
7/28/1998	60	2	87	4	7.5	0	319	6.1	30	0.21	2.22	4.7
8/11/1998	545	2	73	10	4.5	0	548	7	30	0.58	1.03	4.9
8/25/1998	86	5	95	5	4.3	0	639	7	30	0.34	1.11	1.6
9/9/1998	175	3	60	12	2.9	100	1664	6.6	23	1.02	2.44	1.5
9/23/1998	89	4.6	74	15	4.7	300	2400	7.9	25	0.59	2.08	2.3
10/7/1998	212	3	63	6	6.5	200	2599	7.8	23	0.33	1.13	1.3
10/20/1998	<1	6	74	13	4.1	20	4243	6.9	22	0.2	1.12	1.2
11/17/1998	84	3	50	11	7.6	25	4013	7.4	17	0.37	1.34	1.6
12/8/1998	151	1	66	17	7.1	40	5079	7.4	18	0.38	1.43	2.8
3/17/1999	865	2	66	9	9.2	10	1682	7.2	10	0.21	2.27	1.6
6/8/1999	5150	12	114	30					28	0.38	1.83	4.5
12/15/1999	250	1	29	5	6.06	0	598.64	6.9	12	0.37	1.24	1.9

Stormwater Management Analysis
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Notes: 1) Sampling locations 2-6 and 8 are found on a designated section of the Pasquotank River from the Norfolk-Southern Railroad bridge to a line across the River from Hospital Point to Cobb Point (30-3-(7)). (Stream Classification: SC)
2) Sampling locations 1 and 7 are found on Charles Creek (30-3-11). (Stream Classification: C;Sw)
[shaded] = Data points not meeting NCDENR Div. of Water Quality surface water standards.

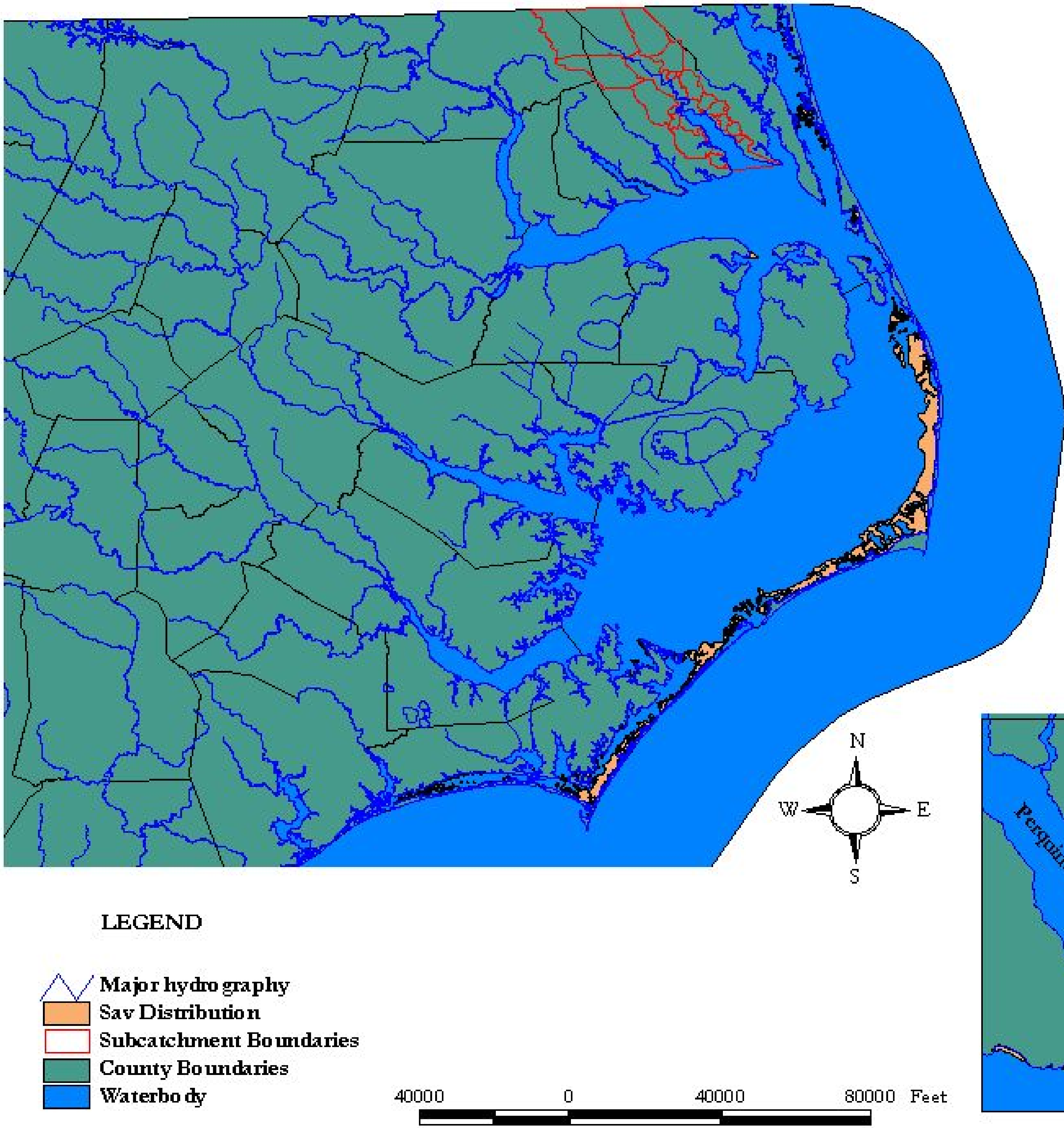
Location 8

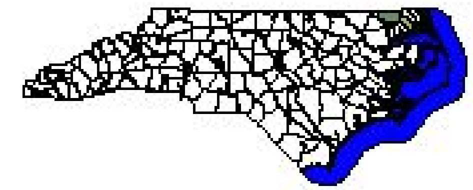
Date	Fecal Coliform (per 100 mls)	BOD (mg/l)	COD (mg/l)	TSS (mg/l)	DO (mg/l)	Salinity (mg/l)	Conductivity (umhos/cm)	pH (units)	Temperature (degrees C)	Total Phosphorus (mg/l)	Total Nitrogen (mg/l)	Oil and Grease (mg/l)
Water Quality Standards for Class SC Streams	< 200 30 day GM, not > 400 20% of samples				> 5.0			6.8-8.5	< 0.8 °C above normal in Jun, Jul, & Aug; < 2.2 °C above normal other months; < 32 °C always			
1/17/1997												
7/23/1997												
7/30/1997												
8/6/1997												
8/13/1997												
8/20/1997												
9/17/1997												
10/8/1997												
10/31/1997												
11/24/1997	37	2	3	16	8	200	3373	6.9	13	0.16	1.81	3.1
12/10/1997	1	2	6	9	9.5	2.5	1428	6.8	12	0.1	2.13	1.6
1/27/1998	31	3	5	6	9.5	75	521	6.4	9	0.1	8.95	2.2
2/26/1998	14	2	22	8	8.4	0	68	5.2	12	0.1	1.6	3.7
3/24/1998	26	0.9	9	6	8.3	0	146	5.6	13	0.09	1.8	2
4/28/1998	22	1.2	186	2	7.1	0	195	2.8	20	0.1	1.82	3.3
5/20/1998	52	0.5	109	5	6.2	10	360	3.7	21	0.1	1.4	<1.0
6/17/1998	2000	>2	97	8	1.3	0	623	6.7	27	0.21	1.22	4.1
6/23/1998	49	7	87	12	7.2	100	662	5.7	28	0.19	1.46	4.6
7/15/1998	24	2	51	7	5.8	0	650	6	29	0.05	6.92	5.1
7/28/1998	82	4	85	6	4.3	0	372	6	29	0.13	2.44	6.4
8/11/1998	619	2	77	6	4.3	0	627	6.3	29	0.4	0.68	3.2
8/25/1998	62	0.3	67	5	5.9	0	662	6.3	28	0.1	0.92	3.9
9/9/1998	171	1	85	8	2.8	200	3000	6.1	25	0.15	2.26	2.8
9/23/1998	398	1	89	12	3.7	300	3179	6.4	27	0.07	2.29	2.4
10/7/1998	123	2	75	6	6.1	300	3951	6.9	23	0.04	0.94	5.5
10/20/1998	<1	2	76	7	3.1	400	4656	6.2	21	0.05	1.07	<1.0
11/17/1998	283	2	67	12	9.1	30	5686	7.1	15	0.14	1.33	1.6
12/8/1998	371	1	80	5	8.6	40	5548	7.3	17	0.07	1.37	2.8
3/17/1999	3348	<1	80	8	10.7	30	3,083	6.9	10	<0.04	1.32	1.3
6/8/1999	224	2	86	10					27	0.09	1.63	5.6
12/15/1999	14	1	118	3	7.71	0	439	5.06	12	0.13	2.24	<1.0

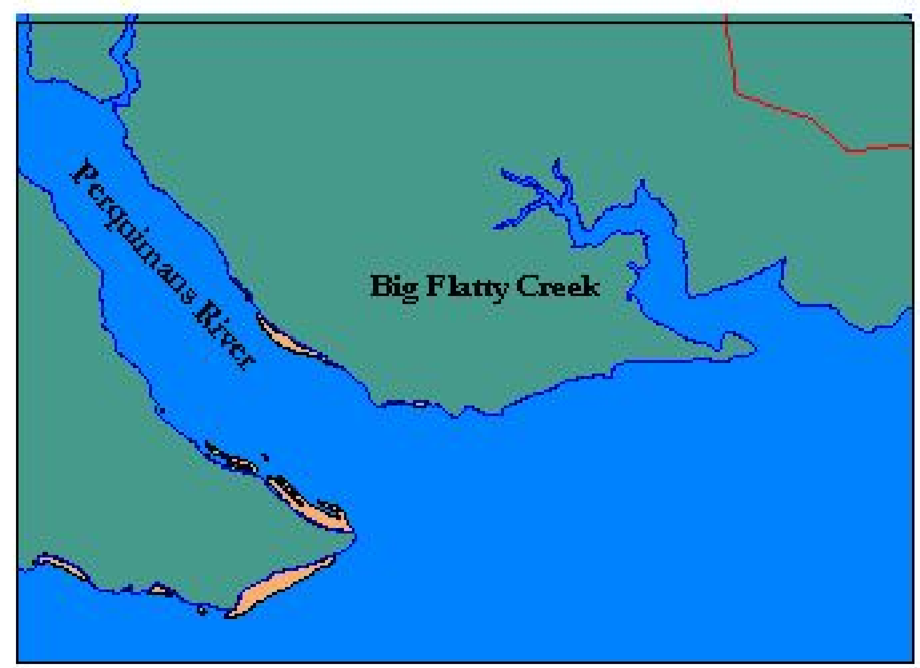
APPENDIX L
SAV DISTRIBUTION MAP

PASQUOTANK RIVER WATERSHED CHARACTERIZATION REPORT

N.C. Wetlands Restoration Program







LEGEND

- Major hydrography
- Sav Distribution
- Subcatchment Boundaries
- County Boundaries
- Waterbody

APPENDIX M

Stakeholder Issues Described Within

Charles Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Flooding in the area due to impervious surfaces and poor land use planning allow contaminants from home lawn practices to enter watershed.					X		x				
Bulkheading along Charles Creek has highly altered shoreline. This impacts stormwater storage capabilities as well as aquatic habitats.					X		x		X		x
Poor drainage in the area due to impervious surfaces and poor land use planning allow contaminants from home lawn practices to enter watershed.	X	x			X	x					
Opportunities											
NCWRP has a proposed wetland/stream mitigation in the area.	X			x	X	x	x		X	x	x

Stakeholder Issues Described Within

The Little Flatty Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Development is beginning to increase in this area, creating need to minimize impact as part of development through land use plans and BMPs.	X	x			X	x	x				
Agricultural lands are drained into Little Flatty Creek	X	x			X	x					
Opportunities											
Agricultural lands appear well buffered along Little Flatty Creek.	X	x									
Wetland areas around creek allow for stormwater storage and cleansing.	X			x	X	x	x				
Buffers provide good wildlife habitat for the area.									X	x	

Stakeholder Issues Described Within

The Newbegun Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Palin Creek is part of this sub-catchment. It is the location of PCB contamination from an adjacent superfund site, impacting habitats and water quality.	X		x						X	x	x
Development in former agricultural fields needs land use/ buffer controls.	X	x			X	x					
Sawmill Park has large impervious surface area which drains directly to Long Swamp, a part of this sub-catchment.	X	x			X	x	x				
Opportunities											
Wetlands behind Weeksville Elementary School are adjacent to agricultural lands and could present a good restoration site.	X				X	x			X	x	x

Stakeholder Issues Described Within

The Cooper Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Opportunities											
There is a general lack of information regarding incentives for instituting BMPs (i.e. no-till, wildlife corridors and buffers, low rise ditching).	**x**	x		x	**x**	x	x	x	**x**	x	

Stakeholder Issues Described Within

The Sawyer's Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	Water Quality	Non-Point Source	Point Source	Floodwater Cleansing	Hydrology	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	Habitat	Terrestrial	Aquatic
Issues											
Sawyer's Creek drains large area of agricultural land.	X	x			X	x					
There was an algal bloom in Sawyer's Creek following Hurricane Floyd.	X			x	X		x		X		x
There is concern that Sawyer's Creek may not be filtering as well as suspected.	X	x		x	X	x			X		x
Opportunities											
Fish habitat appears to be intact.									X		x
Sawyer's Creek appears to have good drainage and flow.					X	x					
Sawyer's Creek appears to have intact buffers surrounding it.	X	x									

Stakeholder Issues Described Within

The Newland Drainage Canal Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Agricultural lands are being converted and developed.	X	x			X	x			X	x	
Water quality is affected by the absence of buffers and wildlife corridors.	X	x							X	x	
There is a threat of increased flooding problems along with new development.					X	x	x				
Habitat functions are affected by the absence of buffers and wildlife corridors.									X	x	
Opportunities											

Stakeholder Issues Described Within

The Great Dismal Swamp Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Drainage ditches from Wildlife Refuge drain into the Dismal Swamp Canal and headwaters of the Pasquotank River. This alters the Refuge hydrology by collecting surface water and transporting it away.	X			x	X	x			X		x
Agricultural fields drain into feeder ditches and The Dismal Swamp Canal.	X	x			X	x					
Logging impacts along HWY 158 have increased since dry conditions have allowed logging within swampy areas. These are not replanted and wetland function is altered.	X			x	X		x		X	x	
Highway 158 creates a "dike effect" within the Dismal Swamp Wildlife Refuge. Water is not properly transported to allow for juvenile recruitment.									X		x
Highway 158 "dike effect" does not allow for proper drainage causing overload of filtration abilities and storage capability.	X			x	X	x	x				
Water quality is affected by HWY 158 releasing contaminants into swamp waters which are not properly drained.	X	x			X	x					
Stability of roadbed on HWY 158 is affected by high water conditions. Proper flow restoration would improve highway maintenance.					X			x			
Pasquotank Dike has not been properly maintained. Maintenance on this structure would restore proper flow.	X	x		x	X	x	x		X		x
Logging roads block flow of Pasquotank River at the end of Horseshoe Road.					X	x	x		x		x

Stakeholder Issues Described Within

The Knobbs Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	Water Quality	Non-Point Source	Point Source	Floodwater Cleansing	Hydrology	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	Habitat	Terrestrial	Aquatic
Issues											
Creek road subdivisions have no buffers.	X	x		x	X	x					
As construction and development continue, there are no silt fences or other BMPs in place to keep sedimentation from entering creek.	X	x			X						
Future lawn practices and other runoff contaminants will be able to enter freely into the creek.	X	x									
There will be increased impervious surface are as development continues within this sub-catchment.	X	x			X	x	x		X		x
Opportunities											

Stakeholder Issues Described Within

The Joyce Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Channelized streams do not allow for slow flow of water necessary for storage and cleansing. These streams are cleared and snagged which also increases rate of flow.	**X**			x	**X**	x	x				
There are sediment control structures in place in filled areas that flood frequently.	**X**	x		x	**X**						
Beaver dams represent a challenge to the habitat v/s drainage function. They block canals heading to creek and cause flooding around South Mills on Connor Farm Road.					**X**		x		**X**	x	
Opportunities											

Stakeholder Issues Described Within

The Raymond Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Opportunities											
Converted agricultural land has good buffers.	X	x		x	X			x	X	x	
There are drainage issues within new devlopments.					X	x					
Most of Raymond Creek has good wildlife corridors/buffers.									X	x	

Stakeholder Issues Described Within

The Milldam Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Logging in this area is adding to sedimentation.	X	x									
Opportunities											

Stakeholder Issues Described Within

The Beaverdam Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Opportunities											

Stakeholder Issues Described Within

The Portohonto Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
A large portion of Portohonto Creek appears to have been converted to channelized stream.					X	x	x				
Culverts along this creek do not allow for upstream fish spawning. Aquatic wildlife will not enter or cross through certain lengths of culverting according to fishery studies.									X		x
A sandmine is located within this sub-catchment.	X	x							X	x	
Opportunities											

Stakeholder Issues Described Within

The Hales Lake Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Drainage from Hales Lake (Edis Creek), which formerly drained to North River, now drains to Pasquotank River.	**X**			x	**X**	x	x		**X**		x
Opportunities											

Stakeholder Issues Described Within

The Areneuse Creek Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
Lumber companies in this sub-catchment contribute to sedimentation and degradation of wetland functions.	X	x		x	X	x	x		X	x	
Opportunities											

Stakeholder Issues Described Within

The Pasquotank River Sub-catchment

Issue and Opportunities (Prior to Ranking)	**Water Quality**	Non-Point Source	Point Source	Floodwater Cleansing	**Hydrology**	Surface Runoff Storage	Floodwater Storage	Shoreline Stabilization	**Habitat**	Terrestrial	Aquatic
Issues											
The Reverse Osmosis Plant in Camden County outputs brine to Pasquotank River increasing salinity and temperature.	X		x						X		x
The Coast Guard base has channelized stream drainage impacting floodwater storage.	X			x	X		x				
Heat pumps drain into canals in Pine Lakes area causing an increase in water quality problems with salinity and temperature.	X		x						X		
Bulkheading throughout sub-catchment represents habitat impact.					X			x	X		x
Residential development impacts water quality from nutrient and sediment runoff.	X	x									
Invasive species (I.e. chinese privet, alligator weed) are impacting hydrology and habitat functions.					X	x			X	x	x
Drop inlets are not adequate throughout Elizabeth City and impervious surfaces are too abundant. Need new designs for temporary water storage and drainage.					X	x	x				
Flooding is common in residential areas, need to improve storage and drainage of runoff.	X	x		x	X	x	x				
Sediments from agricultural lands are transported onto roadways and enter wateshed in runoff.	X	x									
Snagging projects in the upper areas of the watershed are impacting habitat. Balance is needed between drainage and habitat functions.					X	x	x		X	x	x

DECISION SUPPORT PROFESSIONALS
P.O. Box 3368
Kill Devil Hills, NC 27948
Tele: 252-441-0239
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Memo

To: **Decision Support Project**

DSPro-02-010 – Pasquotank Watershed

From: **George Wood**

Date: **June 16, 2003**

Re: **Review of Potential Project in Knobbs Creek Subcatchment**

On June 9, 2003, I visited the Knobbs Creek subcatchment to determine if there were upstream contributors to the wetland area adjacent to Oxford Heights Subdivision that may be causing the unusual flooding associated with this subdivision. I was unable access the channel that runs in the middle of the swamp behind Kmart because of the unusually high waters as a result of the heavy rains on Sunday night. However, I was able to address issues downstream and prepare for the meeting with the Oxford Heights Subdivision Community Watch. It is my belief that there are a number of contributors to the flooding that may be occurring in the Oxford Heights Subdivision. The number one reason is the unusually large amounts of rainfall that we consistently had over the spring. However, I did notice that there were restrictions to flow on a number crossing of the wetland areas which are downstream from Oxford Heights. These restrictions include a restriction to flow on the first railroad crossing that are due in large part to limbs which have been trimmed along the power line and have been left in the swamp. This coupled with the small opening for the transmission of water from the large swamp area to the west at the railroad tressel limits the amount of water that can escape from the Oxford Heights Subdivision. There are further restrictions to flow on the second railroad crossing which is offset to the south of the swamp and is of a very small size. An additional restriction occurs on Church Street extended where there is a small bridge. The main restriction is on Main Street extended where there has been a replacement of a bridge with culverts. It is my recommendation that we consider collaboration with appropriate entities that have jurisdiction over these restrictions in order achieve a plan that would allow the water to escape more readily from the Oxford Heights Subdivision. It is also my recommendation that if restrictions are removed, they must be removed beginning downstream in order to effectively address the amount of water that is in the swamp. It is possible to calculate the appropriate amount of drainage area that is accommodate by the wetland swamp and therefore create pathways for this water to escape at an appropriate rate. It was also brought to my attention at the meeting that there is a manmade dam that exists between the Main Street extended and the U.S. 17 crossing. However, I was unable to visit that site due to unusually high waters.

Stakeholder Issues Described Within

Pasquotank River Watershed Areas

ISSUES (Ranked)	Charles Creek	Little Flatty	Newbegun Creek	Cooper Creek	Sawyer's Creek	Newland Drainage Canal	Great Dismal Swamp	Knobbs Creek	Joyce Creek	Raymond Creek	Milldam Creek	Beaverdam Creek	Portohonto Creek	Hales Lake	Arenuese Creek	Pasquotank River
Residential development	X	X	X		X	X		X	X	X	X		X		X	X
Agricultural drainage	X	X			X	XX	X									
Flooding	X					X	XX	X								X
Sedimentation	X							X	X					X	XX	X
Impervious surfaces	X	X	X		X	X		X	X	X	X		X		X	X
Dike effects	X					X	X	X	X				X			
Absence of buffers	X					X		X								
Channelized streams	X					X			X				X			X
Poor drainage	X					XX	X									
Lawn practices	X	X	X		X	X		X	X	X	X		X		X	X
Shoreline stabilization/Erosion	X							X							X	X
Algal blooms					X			X								X
Culvert sizing	X							X					X			
Bulkheading	X	X	X					X			X			X	X	X
Snagging	X							X								X
Beaverdams		X				X	X		X					X		X
Logging practices							X				X				X	
PCB/Allum contamination			X					X								
Invasive species														X		X
Streambed non-filtering					X											
Roadbed stability					X		X								X	
Drop inlets																X
Brine output																X
Sandmine													X			
Heat pump drainage																X

Stakeholder Issues Described Within

Pasquotank River Watershed Areas

ISSUES (Unranked)	Charles Creek	Little Flatty	Newbegun Creek	Cooper Creek	Sawyer's Creek	Newland Drainage Canal	Great Dismal Swamp	Knobbs Creek	Joyce Creek	Raymond Creek	Milldam Creek	Beaverdam Creek	Portohonto Creek	Hales Lake	Arenuese Creek	Pasquotank River
Flooding	X					X	XX	X								X
Bulkheading	X	X	X					X			X			X	X	X
Shoreline stabilization/Erosion	X							X							X	X
Poor drainage	X					XX	X									
Agricultural drainage	X	X			X	XX	X									
Drainage ditches	X					XX	X	X						X		
Channelized streams	X					X			X				X			X
Residential development	X	X	X		X	X		X	X	X	X		X		X	X
Impervious surfaces	X	X	X		X	X		X	X	X	X		X		X	X
Roadbed stability					X		X								X	
Lawn practices	X	X	X		X	X		X	X	X	X		X		X	X
Culvert sizing	X							X					X			
Heat pump drainage																X
Drop inlets																X
PCB/Allum contamination			X					X								
Absence of buffers	X					X		X								
Brine output																X
Algal blooms					X			X								X
Beaverdams		X				X	X		X					X		X
Invasive species														X		X
Snagging	X							X								X
Streambed non-filtering					X											
Logging practices							X				X				X	
Sandmine													X			
Sedimentation	X							X	X					X	XX	X
Dike effects	X					X	X	X	X				X			

Possible contributors to the large amounts of stormwater in Oxford Heights, which are unconfirmed at this time, include runoff from development from upstream, including that which may occur from Tanglewood Farms and the potential there are reversing flows due to redirection of some drainage patterns within the Charles Creek, Knobbs Creek drainage subcatchments. I assured the Community Watch that upon release of this memo by WRP, that they would receive a copy. At the closing of the meeting with the Community Watch, it was brought to my attention that there may be some needs to address a cleanout underneath the bridge on Providence Drive, and I explained that would be an appropriate thing to do, however, would probably not have a great impact until the downstream restrictions are removed. I further stated that the removal of the downstream restrictions probably would identify other restrictions upstream which are currently not revealed because of the fact that the water is simply not moving due to the large volumes that are unable to escape.

Although no officials from the Town were at the meeting, I assured the Community Watch members that we would continue to be in contact with their local elected officials so that they could be made aware of the findings.

The final question requested was when would we have solutions. I informed the Community Watch members that the first step is to identify the issues and that as we proceed with the Watershed Rehabilitation Plan, solutions would be offered in context of the whole subcatchment and the entire watershed.

Existing Data Included in EPA BASINS for 8 Digit Watershed 03010205

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BASINS GIS Data Dictionary

http://www.epa.gov/waterscience/basins/b3docs/seca.pdf

Existing Data Included in EPA BASINS for 8 Digit Watershed 03010205

Directory of F:\USWatershedOnline\03010205

[.]	dam.shx	ncppl.shp	statsgo.dbf	tri_ui95.dbf
[..]	dws.dbf	ncppl.shx	statsgo.shp	tri_wd87.dbf
1996cwns.dbf	dws.shp	nsi.dbf	statsgo.shx	tri_wd88.dbf
1996cwns.shp	dws.shx	nsi.shp	statsgoc.dbf	tri_wd89.dbf
1996cwns.shx	ecoreg.dbf	nsi.shx	statsgol.dbf	tri_wd90.dbf
acc.dbf	ecoreg.shp	nsi_bio.dbf	stnd_fl.src	tri_wd91.dbf
acc.shp	ecoreg.shx	nsi_ref.dbf	storetag.dbf	tri_wd92.dbf
acc.shx	epa_reg.dbf	nsi_sed.dbf	st_fl.src	tri_wd93.dbf
bac_stat.dbf	epa_reg.shp	nsi_tis.dbf	table_fl.src	tri_wd94.dbf
bac_stat.shp	epa_reg.shx	nsi_wsh.dbf	tri.dbf	tri_wd95.dbf
bac_stat.shx	fhards.dbf	[pcs]	tri.shp	urban.dbf
bc_d7074.dbf	fhards.shp	pcs.dbf	tri.shx	urban.shp
bc_d7579.dbf	fhards.shx	pcs.shp	tri_ai87.dbf	urban.shx
bc_d8084.dbf	filelist.txt	pcs.shx	tri_ai88.dbf	urban_nm.dbf
bc_d8589.dbf	fl.txt	pcs3.dbf	tri_ai89.dbf	urban_nm.shp
bc_d9094.dbf	gage.dbf	pcs3.shp	tri_ai90.dbf	urban_nm.shx
bc_d9597.dbf	gage.shp	pcs3.shx	tri_ai91.dbf	wdm.dbf
bc_p7074.dbf	gage.shx	pcs3_prm.dbf	tri_ai92.dbf	wdm.shp
bc_p7579.dbf	[grids]	pcscode.dbf	tri_ai93.dbf	wdm.shx
bc_p8084.dbf	ifd.dbf	pcsld91.dbf	tri_ai94.dbf	wqcriter.dbf
bc_p8589.dbf	ifd.shp	pcsld92.dbf	tri_ai95.dbf	[wqobs]
bc_p9094.dbf	ifd.shx	pcsld93.dbf	tri_lr87.dbf	wqobs.dbf
bc_p9597.dbf	[landuse]	pcsld94.dbf	tri_lr88.dbf	wqobs.shp
bc_parm.dbf	lfwa96.dbf	pcsld95.dbf	tri_lr89.dbf	wqobs.shx
cat.dbf	lfwa96ad.dbf	pcsld96.dbf	tri_lr90.dbf	wqobs_prm.dbf
cat.shp	lulcndx.dbf	pcs_p91.dbf	tri_lr91.dbf	wq_d7074.dbf
cat.shx	lulcndx.shp	pcs_p92.dbf	tri_lr92.dbf	wq_d7579.dbf
catpt.dbf	lulcndx.shx	pcs_p93.dbf	tri_lr93.dbf	wq_d8084.dbf
catpt.shp	mad.dbf	pcs_p94.dbf	tri_lr94.dbf	wq_d8589.dbf
catpt.shx	mad.shp	pcs_p95.dbf	tri_lr95.dbf	wq_d9094.dbf
cerclis.dbf	mad.shx	pcs_p96.dbf	tri_prm.dbf	wq_d9597.dbf
cerclis.shp	metpt.dbf	pcs_prm.dbf	tri_pw91.dbf	wq_p7074.dbf
cerclis.shx	metpt.shp	rcris.dbf	tri_pw92.dbf	wq_p7579.dbf
cnty.dbf	metpt.shx	rcris.shp	tri_pw93.dbf	wq_p8084.dbf
cnty.shp	met_stat.dbf	rcris.shx	tri_pw94.dbf	wq_p8589.dbf
cnty.shx	met_stat.shp	rf1.dbf	tri_pw95.dbf	wq_p9094.dbf
cntypt.dbf	met_stat.shx	rf1.shp	tri_ui87.dbf	wq_p9597.dbf
cntypt.shp	mines.dbf	rf1.shx	tri_ui88.dbf	wq_parm.dbf
cntypt.shx	mines.shp	[rf3]	tri_ui89.dbf	wq_stat.dbf
csa.dbf	mines.shx	seltype.src	tri_ui90.dbf	wq_stat.shp
csa.shp	nawqa.dbf	sic.dbf	tri_ui91.dbf	wq_stat.shx
csa.shx	nawqa.shp	st.dbf	tri_ui92.dbf	
dam.dbf	nawqa.shx	st.shp	tri_ui93.dbf	
dam.shp	ncppl.dbf	st.shx	tri_ui94.dbf	

217 File(s) 7,164,530 bytes
8,379,867,136 bytes free

Grids folder: DEM in Decimal Degree!
Landuse folder: Level 2 Classification by County
Pcs folder: Permit Compliance System Point Source Data
Rf3 folder: Reach File, Version 3
Wqobs folder: Water Quality Observation Stations Data

BASINS HSPF Data Requirements

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BASINS HSPF and Meteorological Data Dictionary

http://www.epa.gov/waterscience/basins/b3docs/secb.pdf

BASINS HSPF Data Requirements:

Watershed File: Derived in Arcview from DEM, Reach File and Landuse Data
Reach File: Derived in Arcview from Reach File
Channel Geometry File: Should be derived from survey (Not in BASINS)
Point Source File: Some can be found in BASINS

BASINS HSPF Water Quality Simulation Parameters:

Sediment/Solids	- Built in system
Nitrogen cycle	- Built in system
Phosphorus cycle	- Built in system
Dissolved Gases	- Built in system
General Constituent	- User-specified
Pesticide	- User-specified
Trace/cons. Substance	- User-specified

BASINS Files

WinHSPF uses a series of files from BASINS for creating a new project. These files are intended to be produced using the BASINS GIS interface, but since they are text files, they may be built manually.Once a new project has been created, these files will no longer be needed by the project.

The following sections provide detailed descriptions of each of these files and their contents. For examples of these files, see BASINS File Samples within the Appendix. The following is a list of the files:

- Watershed File - *.wsd
- Reach File - *.rch
- Channel Geometry File - *.ptf
- Point Sources File - *.psr

Watershed File

The Watershed File has a .wsd extension. This file contains information related to the amount of each land use contributing to each reach. This file is written from BASINS and is used in creating a new WinHSPF project.

The Watershed File is a space-delimited ASCII file, with one or more spaces used to separate fields.
Each record of the file contains the following information:

- LU Name (land use name, used as LSID in PERLND/IMPLND GEN-INFO table)
- Type (1=impervious/2=pervious, used to specify PERLND vs IMPLND)
- Watershed-id (used to connect each land use to a reach)
- Area (in acres, used as area factor in SCHEMATIC block)
- Slope (used as SLSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)
- Distance (in ft, used as LSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)

An example of the Watershed File is found in the Watershed File section of the Appendix.

The Slope and Distance fields are derived from the fields ‘Slo1’ and ‘Len1’, respectively, in the Subbasins shape file. These values are computed during watershed delineation.

Reach File

The Reach File has an .rch extension. This file contains information related to each reach and the connections between reaches. This file is used in creating a new WinHSPF project.

The Reach File is a space-delimited ASCII file. Each record of the file contains the following information:

- Rivrch (reach id)
- Pname (reach name, used as RCHID in RCHRES GEN-INFO table)
- Watershed-ID (used to connect each reach with associated land segments)
- HeadwaterFlag
- Exits (number of exits, used as NEXITS in RCHRES GEN-INFO table)
- Milept
- Stream/Reservoir Type (S-stream/R-reservoir, used to set LKFG in RCHRES GEN-INFO table)

- Segl (segment length in miles, used as LEN in RCHRES HYDR-PARM2 table)
- Delth (delta h in ft, used as DELTH in RCHRES HYDR-PARM2 table)
- Elev
- Ulcsm
- Urcsm
- Dscsm (downstream reach id, used to establish connectivity for SCHEMATIC block)
- Ccsm
- Mnflow
- Mnvelo
- Svtnflow
- Svtnvelo
- Pslope
- Pdepth
- Pwidth
- Pmile
- Ptemp
- Pph
- Pk1
- Pk2
- Pk3
- Pmann
- Psod
- Pbgdo
- Pbgnh3
- Pbgbod5
- Pbgbod
- Level

Many of the fields in this file are not used by WinHSPF. Those fields that are used by WinHSPF are noted above.

Channel Geometry File

The Channel Geometry File has a .ptf extension. This file contains information related to the channel cross-sections and lengths for each reach. This file is used in creating the FTABLES for a new WinHSPF project.

The Channel Geometry File is a space-delimited ASCII file. Each record of the file contains the following information:

- Reach Number
- Length (ft)
- Mean Depth (ft)
- Mean Width (ft)
- Mannings Roughness Coeff.
- Long. Slope
- Type of x-section
- Side slope of upper FP left
- Side slope of lower FP left
- Zero slope FP width left (ft)

- Side slope of channel left
- Side slope of channel right
- Zero slope FP width right (ft)
- Side slope lower FP right
- Side slope upper FP right
- Channel Depth (ft)
- Flood side slope change at depth
- Max. depth
- No. of exits
- Fraction of flow through exit 1
- Fraction of flow through exit 2
- Fraction of flow through exit 3
- Fraction of flow through exit 4
- Fraction of flow through exit 5

Point Sources File

The Point Sources File has a .psr extension. This file contains information related to point source dischargers in the watershed, the pollutants output and the loading rates. This file is used in creating point source time-series data sets in the project WDM file.

The Point Sources File is a space-delimited ASCII file. The first record of the file contains an integer number of point source dischargers. Following this line is a blank line, followed by a header line. Then the next n lines, where n is the number of point source dischargers, contain the following information:

- Facility Name
- Npdes
- Cuseg
- Mi

The following line is blank, followed by a header line. The rest of the file consists of a series of records containing the following information:

- Ordinal Number
- Pollutant
- Load (lbs/hr)

APPENDIX P

Appendix A
GIS Data Dictionary

BASINS is distributed on CDs with approximately 0.8 to 2 gigabytes of geographic and environmental data per EPA region. Table A.1 shows, in alphabetical order, all the BASINS data products with the corresponding theme and related file names that are used to reference the data within the BASINS GIS environment. This table is followed by a list of all field attributes within each data product and their data definitions.

More detailed documentation following the Federal Geographic Data Committee (FGDC) metadata standard is available from EPA's Geospatial Data Clearing house @http://nsdi.epa.gov/nsdi and www.epa.gov/ost/basins/metadata.htm

Table A.1 BASINS Version 2.0 Data Products

BASINS Data Product	Theme Name	File Name
Bacteria Monitoring Stations & Data Summaries	Bacteria Stations	bc_stat.dbf bc_stat.shp bc_stat.shx
Related Table Names:	Bacteria Data 70-74 Bacteria Data 75-79 Bacteria Data 80-84 Bacteria Data 85-89 Bacteria Data 90-94 Bacteria Data 95-97 Bacteria Parameter Table	bc_d7074.dbf bc_d7579.dbf bc_d8084.dbf bc_d8589.dbf bc_d9094.dbf bc_d9597.dbf bc_parm.dbf
Classified Shellfish Areas	Classified Shellfish Areas	csa.dbf csa.shp csa.shx
Dam Locations	Dam Locations	dam.dbf dam.shp dam.shx
Digital Elevation Model	DEM (CU)	(cu).dbf (cu).shp (cu).shx
Drinking Water Supply (DWS) Sites	Drinking Water Supply Sites	dws.dbf dws.shp dws.shx
EPA Regions	EPA Region Boundaries	epa_reg.dbf epa_reg.shp epa_reg.shx
Gage Sites	USGS Gage Stations	gage.dbf gage.shp gage.shx
Hydrologic Unit Boundaries	Accounting Unit Boundaries Cataloging Unit Boundaries Cataloging Unit Codes	acc.dbf acc.shp acc.shx cat.dbf cat.shp cat.shx catpt.dbf catpt.shp catpt.shx
Industrial Facilities Discharge (IFD) Sites	Industrial Facilities Discharge Sites	ifd.dbf ifd.shp ifd.shx
Land Use and Land Cover	Land Use Index L_(USGS Quadrangle Name)	lulcndx.dbf lulcndx.shp lulcndx.shx l_(quad).dbf l_(quad).shp l_(quad).shx

Table A.1 (continued)

BASINS Data Product	**Theme Name**	**File Name**
Listing of Fish and Wildlife Advisories		
Related Table Names:	Fish and Wildlife Advisory (1996)-Index Fish and Wildlife Advisory (1996)-Listing	lfwa96.dbf lfwa96add.dbf
Lookup Tables		
Related Table Names:	Water Quality Criteria Table State Agency Codes Standard Industrial Classification Codes	wqcriter.dbf storetag.dbf sic.dbf
Major Roads	Major Roads	fhards.dbf fhards.shp fhards.shx
Managed Area Database	Managed Area Database	mad.dbf mad.shp mad.shx
Minerals Available System/Mineral Industry Location (MAS/MILS)	Mineral Data	mines.dbf mines.shp mines.shx
National Water Quality Assessment Study Unit Boundaries	NAWQA Study Unit Boundaries	nawqa.dbf nawqa.shp nawqa.shx
National Sediment Inventory (NSI) Stations & Database	National Sediment Inventory Stations	nsi.dbf nsi.shp nsi.shx
Related Table Names:	NSI Biotoxicity Data NSI Tissue Residue Data NSI Reference Values NSI Sediment Chemistry Data NSI Watershed Summary Data	nsi_bio.dbf nsi_tis.dbf nsi_ref.dbf nsi_sed.dbf nsi_wsh.dbf
Permit Compliance System (PCS) Sites and Computed Loadings	Permit Compliance System	pcs.dbf pcs.shp pcs.shx
Related Table Names:	Permitted Discharges 1991 Permitted Discharges 1992 Permitted Discharges 1993 Permitted Discharges 1994 Permitted Discharges 1995 Permitted Discharges 1996 Permitted Discharges Parameter Table PCS Code Description	pcsld91.dbf pcsld92.dbf pcsld93.dbf pcsld94.dbf pcsld95.dbf pcsld96.dbf pcs_prm.dbf pcs_code.dbf
Populated Place Locations	Place Names - (state postal abbreviation)	(ST)ppl.dbf (ST)ppl.shp (ST)ppl.shx
Reach File, Version 1 (RF1)	Reach File, V1	rf1.dbf rf1.shp rf1.shx
Reach File, Version 3 (RF3) Alpha	Reach File, V3	(cu).dbf (cu).shp (cu).shx

Table A.1 (continued)

BASINS Data Product	Theme Name	File Name
Resource Conservation and Recovery Information System (RCRIS) Sites	Hazardous and Solid Waste Sites	rcris.dbf rcris.shp rcris.shx
State and County Boundaries	State Boundaries	st.dbf st.shp st.shx
	County Boundaries	cnty.dbf cnty.shp cnty.shx
	County Names	cntypt.dbf cntypt.shp cntypt.shx
Superfund National Priority List Sites	National Priority List Sites	cerclis.dbf cerclis.shp cerclis.shx
State Soil and Geographic (STATSGO) Database	State Soil	statsgo.dbf statsgo.shp statsgo.shx
Related Table Names:	Soil Component Data	statsgoc.dbf
	Soil Layer Data	statsgol.dbf
Toxic Release Inventory (TRI) Sites, 1992 Release	Toxic Release Inventory	tri.dbf tri.shp tri.shx
Related Table Names:	TRI Air Emission Data 1987	tri_ai87.dbf
	TRI Air Emission Data 1988	tri_ai88.dbf
	TRI Air Emission Data 1989	tri_ai89.dbf
	TRI Air Emission Data 1990	tri_ai90.dbf
	TRI Air Emission Data 1991	tri_ai91.dbf
	TRI Air Emission Data 1992	tri_ai92.dbf
	TRI Air Emission Data 1993	tri_ai93.dbf
	TRI Air Emission Data 1994	tri_ai94.dbf
	TRI Air Emission Data 1995	tri_ai95.dbf
	TRI Land Release Data 1987	tri_lr87.dbf
	TRI Land Release Data 1988	tri_lr88.dbf
	TRI Land Release Data 1989	tri_lr89.dbf
	TRI Land Release Data 1990	tri_lr90.dbf
	TRI Land Release Data 1991	tri_lr91.dbf
	TRI Land Release Data 1992	tri_lr92.dbf
	TRI Land Release Data 1993	tri_lr93.dbf
	TRI Land Release Data 1994	tri_lr94.dbf
	TRI Land Release Data 1995	tri_lr95.dbf
	TRI POTW Data 1991	tri_pw91.dbf
	TRI POTW Data 1992	tri_pw92.dbf
	TRI POTW Data 1993	tri_pw93.dbf
	TRI POTW Data 1994	tri_pw94.dbf
	TRI POTW Data 1995	tri_pw95.dbf
	TRI Underground Injection Data 1987	tri_ui87.dbf
	TRI Underground Injection Data 1988	tri_ui88.dbf
	TRI Underground Injection Data 1989	tri_ui89.dbf

Table A.1 (continued)

BASINS Data Product	**Theme Name**	**File Name**
Related Table Names (cont):	TRI Underground Injection Data 1990 TRI Underground Injection Data 1991 TRI Underground Injection Data 1992 TRI Underground Injection Data 1993 TRI Underground Injection Data 1994 TRI Underground Injection Data 1995 TRI Water Discharge Data 1987 TRI Water Discharge Data 1988 TRI Water Discharge Data 1989 TRI Water Discharge Data 1990 TRI Water Discharge Data 1991 TRI Water Discharge Data 1992 TRI Water Discharge Data 1993 TRI Water Discharge Data 1994 TRI Water Discharge Data 1995 TRI Parameter Table	tri_ui90.dbf tri_ui91.dbf tri_ui92.dbf tri_ui93.dbf tri_ui94.dbf tri_ui95.dbf tri_wd87.dbf tri_wd88.dbf tri_wd89.dbf tri_wd90.dbf tri_wd91.dbf tri_wd92.dbf tri_wd93.dbf tri_wd94.dbf tri_wd95.dbf tri_parm.dbf
Urbanized Areas	Urban Area Boundaries Urban Area Names	urban.dbf urban.shp urban.shx urban_nm.dbf urban_nm.shp urban_nm.shx
Water Quality Monitoring Stations & Data Summaries	Water Quality Stations	wq_stat.dbf wq_stat.shp wq_stat.shx
Related Table Names:	Water Quality Data 70-74 Water Quality Data 75-79 Water Quality Data 80-84 Water Quality Data 85-89 Water Quality Data 90-94 Water Quality Data 95-97 Water Quality Parameter Table	wq_d7074.dbf wq_d7579.dbf wq_d8084.dbf wq_d8589.dbf wq_d9094.dbf wq_d9597.dbf wq_parm.dbf
Water Quality Stations and Observation Data	Water Quality Observation Stations	wqobs.dbf wqobs.shp wqobs.shx
Related Table Names:	Water Quality Observation Data Table Water Quality Observation Parameter Table	(cu).dbf wqobs_prm.dbf
Weather Data Stations & Database (sample set)	Weather Data Stations	wdm.dbf wdm.shp wdm.shx
Weather Station Sites	Weather Station Area Weather Station Sites	met_stat.dbf met_stat.shp met_stat.shx metpt.dbf metpt.shp metpt.shx
1996 Clean Water Needs Survey	1996 Clean Water Needs Survey	1996cwns.dbf 1996cwns.shp 1996cwns.shx

Data Product: Bacteria Monitoring Stations & Data Summaries
Theme Name: Bacteria Stations

Field Name	**Description**
SHAPE	ArcView internal field
ID	BASINS assigned unique identifier based on station and agency codes
STATION	station code
AGENCY	agency code
LOCATION	description of location
CU	cataloging unit code
SEG	Reach File, V1 segment number
MILEP	Reach File, V1 mile point
ONOFF	on/off reach indicator
COUNTY	county name
STFIPS	state FIPS code
STATE	state postal abbreviation
LONG	longitude
LAT	latitude
TYPE	station type
STCOFIPS	state and county FIPS code
BACID	BASINS assigned number
BCU	BASINS assigned cataloging unit

Data Product: Bacteria Monitoring Stations & Data Summaries
Related Table Name: Bacteria Data 70-74,75-79,80-84,85-89, 90-94,95-97

Field Name	**Description**
ID	BASINS assigned unique identifier based on station and agency codes
STATION	station code
AGENCY	agency code
BACID	BASINS assigned number
PARAMETER	EPA STORET parameter code
NO OBS	number of observations
MEAN	mean value
A15TH_P	15th percentile value
A25TH_P	25th percentile value
A50TH_P	50th percentile value
A75TH_P	75th percentile value
A85TH_P	85th percentile value
STD	standard deviation
BCU	BASINS assigned cataloging unit

Data Product: Bacteria Monitoring Stations & Data Summaries
Related Table Name: Bacteria Parameter Table

Field Name	**Description**
PARM_CODE	EPA STORET parameter code
PARM_NAME	parameter name
UNITS	units

SAMPLE_TYP	sample type
UP_REF_LVL	upper reference level
LW_REF_LVL	lower reference level
UNKNOWN	type of standard
REF_LVLSRC	reference level source

Data Product: Classified Shellfish Areas
Theme Name: Classified Shellfish Areas

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
ELEMENT	geographic element
STATE	two-letter state abbreviation
CHART_ID	NOAA nautical chart number
POLYNAME	shellfish growing water name
CLASS	classification of growing water
UNIQUE_	unique nine digit identification code
WATERQTY	harvest limited classification from water quality
ADMIN	harvest limited classification-admin. decision
NOSURVEY	harvest limited classification-incomplete survey
CONSERV	harvest limited classification-conserv. measures
RESTRICT	list of harvest limited classification reasons
POINT_P	potential point source pollution
POINT_A	actual point source pollution
NPOINT_P	potential nonpoint source pollution
NPOINT_A	actual nonpoint source pollution
UPSTRM_P	potential upstream pollution
UPSTRM_A	actual upstream pollution
POLLTYPE	lists point, nonpoint, & upstream pollution sources
INDUSTRY	point source pollution from industrial sources
WWT	point source pollution-wastewater treatment plants
COMBINED	point source pollution-combined sewer overflows
OTHER_DD	point source pollution from direct discharges
MARINAS	point source pollution from marinas
BOATING	point source pollution from boating
INDI_WWT	nonpoint source pollution-wastewater treat. system
URBAN	nonpoint source pollution from urban runoff
FEEDLOTS	nonpoint source pollution from livestock feeding
OTHER_AG	nonpoint source pollution from agricultural land
WILDLIFE	nonpoint source pollution-high wildlife concentr.
UPSTREAM	stream-borne contaminants
SURVEY	source data Sanitary Survey number
UPGRADE	potential for upgrading classification
RESTORE	current restoration activities
COMMENTS	additional information
RAZORCLM	abundance of razor clams
SURFCLAM	abundance of surf clams
SEASCALL	abundance of sea scallops

NATIVELC	abundance of native littleneck clams
ASIANCLM	abundance of asian clams
OLYMOYST	abundance of olympic oysters
FOOLMUS	abundance of foolish mussels
MUSSELS	abundance of mussels
EASTOYST	abundance of eastern oysters
BAYSCALL	abundance of bay scallops
BSKTCOCK	abundance of basket cockle clams
RIBBMUSS	abundance of ribbed mussels
RANGEICLM	abundance of rangia clams
MANILCLM	abundance of manila clams
OCEANQUA	abundance of ocean quahog
MYTILIDA	abundance of other mussel species
KUMAOYST	abundance of kumamoto oysters
HORSECLM	abundance of horseneck clams
BLUEMUSS	abundance of blue mussels
GEODUCK	abundance of geoduck clams
SOFTCLAM	abundance of softshell clams
BUTTRCLM	abundance of butter clams
PACIFOYS	abundance of pacific oysters
CALIFMUS	abundance of california mussels
HARDCLAM	abundance of hard clams
AREA_SQ_M	shellfish-growing water area in square meters
PERIMTR_M	shellfish-growing water perimeter in meters
AREA_ACRES	shellfish-growing water area in acres
CAF_CODE	NOAA Coastal Assessment Framework Estuary code
CAF_NAME	NOAA Coastal Assessment Framework Estuary name
CAF_NAMEA	unknown
CLASSA	NOAA EDA or CDA classification code
REGION	NOAA Coastal Assessment Framework Region code
LAND	mainland or island classification code
ST_FIPS	two-digit state FIPS code
ST_NAME	state name
ST_ABBR	two-letter state abbreviation
CAF_LEGEND	NOAA EDA or CDA name for ArcView legend use

Data Product: Dam Locations
Theme Name: Dam Locations

Field Name	**Description**
SHAPE	ArcView internal field
NID_ID	National Inventory of Dams identification number
STATE	two-letter state abbreviation
DAM_NAME	official dam name
OTHER_NAME	other common name or reservoir name
HAZARDS	potential hazard to downstream area
EAP	emergency action plan for dam
STATE_NAME	name of state in which dam is located
CONG_DIST	congressional district in which dam is located
COUNTY	county in which dam is located

NEAR_CITY	name of nearest downstream city
DIST_CITY	distance from dam to nearest downstream city
RIVER	official name of river on which dam is built
PRM_PURPOS	primary purpose for which reservoir is used
NID_DAMTP	type of dam
YEAR_COMPL	year original main dam structure was completed
NID_HEIGHT	calculated single height value in feet
NID_STOR	calculated maximum value from normal storage and maximum storage value used to obtain single storage value in acre-ft
DAM_LENGTH	dam length
MAX_DISCH	maximum discharge in cubic feet per second
OWNER	owner of dam
OWN_TYPE	owner type
STATE_AGCY	state agency with regulatory or approval authority
FED_AGCY	federal agency involvement in the dam
NONFED_DAM	federal or nonfederal dam location
SECT_TOWN	dam location in terms of section, township, and range
PURPOSE	purpose for which reservoir is used
DAM_TYPE	type of dam
DAM_HEIGHT	dam height in feet
HYDR_HGT	hydraulic height in feet
STRUCT_HGT	structural height in feet
NORM_STOR	normal storage in acre-feet
MAX_STOR	maximum storage in acre-feet
SURF_AREA	surface area of impoundment-normal retention level in acres
DRAIN_AREA	drainage area of dam in square miles
SPILL_TYPE	type of spillway
SPILL_WDTH	width of spillway in feet
NUM_LOCKS	number of existing navigation locks
LOCK_LEN	length of primary navigation lock in feet
LOCK_WIDTH	width of primary navigation lock in feet
VOLUME	cubic yards of materials used in dam structure
INSP_DATE	date of most recent inspection
PHASEI_INS	Phase I Inspection Program
FD_CONSTRC	federal agency involved in construction of dam
FD_DESIGN	federal agency involved in design of dam
FD_FUNDING	federal agency involved in funding of dam
FD_INSPECT	federal agency involved in inspection of dam
FD_OPERATE	federal agency involved in operation of dam
FD_OTHER	federal agency involved in other aspects of dam
FD_OWNER	federal agency that owns/partly owns dam
FD_REGULAT	federal agency involved in regulation of dam
SUPP_FED	federal agency providing field data
SUPP_DATE	date of transmittal
SOURCE_AGCY	federal or state agency that provided field data
SOURCE_DATE	date of transmittal
SOURCE_ID	official agency identification number for dam
LONGITUDE_X	dam longitude in decimal degrees
LATITUDE_Y	dam latitude in decimal degrees

FIPS_STATE	FIPS code used by US Census Bureau for state
FIPS_CNTY	FIPS code used by US Census Bureau for county
BCU	BASINS assigned cataloging unit

Data Product: Digital Elevation Model
Theme Name: DEM (CU)

Field Name	**Description**
SHAPE	ArcView internal field
ELEV_M	land surface elevation in meters
ELEV_FT	land surface elevation in feet

Data Product: Drinking Water Supply (DWS) Sites
Theme Name: Drinking Water Supply Sites

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
DWS_	ArcInfo internal field
DWS_ID	ArcInfo internal field
STCO	state and county FIPS code
LATDD	site latitude in decimal degrees
LONGDD	site longitude in decimal degrees
CTY	name of the city where the facility is located
CNN	name of the county where the facility is located
STA	abbreviation for state where facility is located
FQMINV	reach number where the facility is located
MILES	mile point on reach where the facility is located
TYPE	facility type-"S"surface water or "G" ground water
OWN	facility owned by individual or municipality
NAME	facility name
WUN	facility owner name
PAVGF	average facility flow in GPD
POPSV	population served by the facility
ACCURACY	accuracy code for longitude/latitude of facility
BREACH	BASINS assigned Reach File, V1 reach number
BFIPS	BASINS assigned state and county FIPS code

Data Product: EPA Regions
Theme Name: EPA Regional Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
EPA_REG_	ArcInfo internal field
EPA_REG_ID	ArcInfo internal field
EPAREG	U.S. EPA region number
LABEL_REG	U.S. EPA region number (Roman numeral)

Data Product: Gage Sites
Theme Name: USGS Gage Sites

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
GAGE_	ArcInfo internal field
GAGE_ID	ArcInfo internal field
AGCY	identifying agency and gage number
STCO	state and county FIPS code
LATDD	latitude of the gage in decimal degrees
LONGDD	longitude of the gage in decimal degrees
REACH	Reach File, V1 reach number gage location
NAME	name of reach
MNFLO	mean stream flow in cfs
SVTEN	seven/ten stream low flow in cfs
JAN	mean stream flow for month of January in cfs
FEB	mean stream flow for month of February in cfs
MAR	mean stream flow for month of March in cfs
APR	mean stream flow for month of April in cfs
MAY	mean stream flow for month of May in cfs
JUN	mean stream flow for month of June in cfs
JUL	mean stream flow for month of July in cfs
AUG	mean stream flow for month of August in cfs
SEP	mean stream flow for month of September in cfs
OCT	mean stream flow for month of October in cfs
NOV	mean stream flow for month of November in cfs
DEC	mean stream flow for month of December in cfs
ACCURACY	accuracy code for latitude and longitude of gage
BREACH	BASINS assigned Reach File, V1 reach number
BFIPS	BASINS assigned state and county FIPS code

Data Product: Hydrologic Unit Boundaries
Theme Name: Accounting Unit Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
ACC_	ArcInfo internal field
ACC_ID	ArcInfo internal field
ACC	accounting unit number
NAME	name of accounting unit

Data Product: Hydrologic Unit Boundaries
Theme Name: Cataloging Unit Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units

PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
CAT_	ArcInfo internal field
CAT_ID	ArcInfo internal field
PLYTYPE	polygon type
HUC	cataloging unit code (numeric)
WORKB	disregard data element
ACC_UNIT	accounting unit code
CU	cataloging unit code (character)
BEXT	BASINS internal field
CRS1	BASINS internal field

Data Product: Hydrologic Unit Boundaries
Theme Name: Cataloging Unit Codes

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
CAT_	ArcView internal field
CAT_ID	disregard data element
HUC	cataloging unit code (numeric)
ACC	accounting unit code
NAME	name of cataloging unit
CU	cataloging unit code (character)
BEXT	BASINS internal field
CRS1	BASINS internal field

Data Product: Industrial Facilities Discharge (IFD) Sites
Theme Name: Industrial Facilities Discharge Sites

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
IFD_	ArcInfo internal field
IFD_ID	ArcInfo internal field
NPD	NPDES number
NAM	facility name
ADR	facility address
CTY	facility city
STA	facility state abbreviation
ZIP	facility ZIP code
LAT	facility latitude in decimal degrees
LONG	facility longitude in decimal degrees
STCOFIPS	state and county FIPS code
NDC	number of discharges from the facility
FRW	receiving water name

FCU	facility cataloging unit code
FSG	facility reach file segment number
FHF	facility hit flag indicating facility discharges to a reach
FFL	discharge flow in thousands of gallons per day
FS1	facility SIC from PCS
FS2	SIC code 2
FS3	SIC code 3
FS4	SIC code 4
FS5	SIC code 5
MAJOR	major/minor flag (from PCS)
MILES	facility reach file mile point
XEGS	effluent guidelines subcategory index
E308SN	effluent guidelines survey number
EGF	effluent guidelines flow thousands of gallons/day
EGS	effluent guidelines subcategory code
ACCURACY	accuracy code for facility latitude and longitude
FLOW	discharge flow in thousands of gallons per day
CU	cataloging unit code
BREACH	BASINS assigned Reach File, V1 reach number
BFIPS	BASINS assigned state and county FIPS code
CUSEG	Reach File, V1 reach number

Data Product: Land Use and Land Cover
Theme Name: Land Use Index

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
LULCNDX#_	ArcView internal field
LULCNDX#_I	disregard data element
COVERNAME	coverage name
COVNAME	alternate coverage name
QNAME	quadrangle name
EPA_REG	U.S. EPA region number
CREATE_DAT	date coverage was created
VERIFY_DAT	date coverage was verified
COMMENT1	comments concerning the coverage

Data Product: Land Use and Land Cover
Theme Name: L_(USGS Quadrangle Map Name, e.g., L_BANGME)

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
L_(QUAD)_	ArcView assigned polygon ID
L_(QUAD)_I	disregard data element
LUCODE	Anderson level I land use code
LEVEL2	Anderson level II land use code

Data Product: Listing of Fish and Wildlife Advisories
Related Table Name: Fish and Wildlife Advisory (1996)-Index

Field Name	Description
WATERBODY	name of waterbody where advisory is applied
STATE	two-letter state code used by US Postal Service
REGION	EPA region code
ADV_EXTENT	geographic extent of advisory
ISSUER	agency type that issued the advisory
ADV_TYPE	waterbody type that the advisory is located on
ADVNUM	unique number assigned to advisory
ADVINDEX	advisory index
DATE_RESCI	date the advisory was rescinded
COUNT	count
ADV_STATUS	advisory status
ADV_SIZE	advisory size in miles for river advisories, acres for lake advisories.
YEAR	year the entry in the source was updated

Data Product: Listing of Fish and Wildlife Advisories
Related Table Name: Fish and Wildlife Advisory (1996)-Listing

Field Name	Description
ADVNUM	unique number assigned to advisory
POLLUTANT	name of pollutant associated with the advisory
SPECIES	name of fish or wildlife associated with the advisory
POPULATION	type of popolation affected in the advisory
STATUS	advisory status
DATE_RESCI	date the advisory was rescinded
YEAR	year the entry in the source was updated

Data Product: Lookup Tables
Related Table Name: Water Quality Criteria Table

Field Name	Description
PARM_CODE	EPA STORET parameter code
CAS_NUMBER	Chemical Abstract Service number
PARM_NAME	parameter name
SAMPLE_TYP	sample type
UNITS	units
FRES_ACUTE	threshold value (standard) for acute freshwater
FRES_CHRON	threshold value (standard) for chronic freshwater
MARI_ACUTE	threshold value (standard) for acute marine
MARI_CHRON	threshold value (standard) for chronic marine
HHPC_WATER	threshold value (standard) for human health (published criteria) in water
HHPC_ORGAN	threshold value (standard) for human health (published criteria) in organic tissue
HHRV_WATER	threshold value (standard) for human health (recalculated value) in water
HHRV_ORGAN	threshold value (standard) for human health (recalculated value) in organic tissue
DR_WTR_MCL	drinking water maximum contaminant level

UNKNOWN	unknown
REF_LVL_SRC	reference level source

Data Product: Lookup Tables
Related Table Name: STORET Agency Codes

Field Name	Description
AGENCY	agency code
PROGRAM	name of program
CONTACT	contact person
PHONE	telephone number

Data Product: Lookup Tables
Related Table Name: Standard Industrial Classification Codes

Field Name	Description
SIC_1987	1987 Standard Industrial Classification (SIC) code
SIC_NAME	SIC name
NAICS_1997	1997 North American Industry Classification System (NAICS) code
NAICS_NAME	NAICS name

Data Product: Major Roads
Theme Name: Major Roads

Field Name	Description
SHAPE	ArcView internal field
FNODE_	ArcInfo internal field
TNODE_	ArcInfo internal field
LPOLY_	ArcInfo internal field
RPOLY_	ArcInfo internal field
LENGTH	length of line segment in coverage units
FHARDS_	ArcInfo internal field
FHARDS_ID	ArcInfo internal field
RECTYPE	character which defines type of file from dataset
VERSION	file version number
RECID	unique line identification number
SOURCE	flag used to identify original source of coordinate information
STFIPS	two-digit state FIPS code
CTFIPS	three-digit county FIPS code
ORNL_ID	Oakridge National Laboratory assigned identifier
LGURB	large urbanized area
SMURB	adjusted small urban area
FNODE	record in node file that corresponds to starting position of link
TNODE	record in node file that corresponds to ending position of link
SIGN1	primary sign route
SIGN2	alternate sign route
SIGN3	alternate sign route
LNAME	name or identification for the link
MILES	accurate measurement in miles of link chain
KM	accurate measurement in kilometers of link chain
FACTYPE	permissible flow of traffic over the link
TOLL	links with one or more toll features

LANES	number of lanes in both directions
ACONTROL	degree of access control to link from adjoining roads
MEDIAN	type of median
SURFACE	predominant surface
FCLASS	assigned functional class of each link
ACLASS	administrative class associated with the link
RUCODE	rural/urban classification
STATUS	availability of link to through traffic
NHS	subnetwork for proposed National Highway System
STRAHNET	special subnetwork for Strategic Highway Corridor Network
TRANSAM	special subnetwork for the Trans-America Corridor

Data Product: Managed Area Database
Theme Name: Managed Area Database

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
MAD_POLY_ID	ArcInfo internal field
MAD_POLY_ID	ArcInfo internal field
SITE_CODE	unique number for each area for database relations
SITE_CODE2	unique number for each area for database relations
SITE_CODE3	unique number for each area for database relations
AREANAME	proper name of each managed area represented
AREANAME2	alternate name of each managed area represented
AREANAME3	alternate name of each managed area represented
CMCCODE	unused WCMC variable
LAT	latitudinal location
LONG	longitudinal location
ISLATLON	unused WCMC variable
DESIGNATE	designation type for each managed area
DESIGNATE2	designation type for each managed area
DESIGNATE3	designation type for each managed area
LUCNCAT	code used by WCMC representing level of protection status for each designation type
LUCNCAT2	code used by WCMC representing level of protection status for each designation type
LUCNCAT3	code used by WCMC representing level of protection status for each designation type
GAPCAT	level of management based on GAP program
GAPCAT2	level of management based on GAP program
GAPCAT3	level of management based on GAP program
SIZE	area size as published by WCMC
YEAR	year of area establishment as published by WCMC
REALM	unused WCMC variable
PROVINCE	unused WCMC variable
BIOME	unused WCMC variable
STATE	state in which area is located
SOURCE	map source where the polygon borders were taken
AVSORT	condensed list of management designations

Data Product: Minerals Available System/Mineral Industry Location (MAS/MILS)
Theme Name: Mineral Data

Field Name	**Description**
SHAPE	ArcView internal field
LAT	latitude in decimal degrees
LON	longitude in decimal degrees
SEQ_NUM	unique identifier referencing info pertaining to a mineral property
STATE	state in which mine is located
COUNTY	county in which mine is located
NAME	name of mineral deposit or mining operation
TYPE	type of existing/proposed/past type of operation
CURR_STAT	operating status of site at time of last modification
ELEVATION	elevation of mine in meters
DATUM	datum of elevation provides for elevations to be expressed above or below either sea level or a local datum.
ZONE	UTM zone number
RIVER	name of river basin
HUC	hydrologic unit code
YEAR_LAST	year of last production
COMPANY	principle owner/company name identified with operation
MINE_MET	most predominant mining method at site
MILL_MET	most predominant milling method at site
COM1	name of one of the commodities found at site
MOC1	modifier of the commodity
COM2	name of one of the commodities found at site
MOC2	modifier of the commodity
COM3	name of one of the commodities found at site
MOC3	modifier of the commodity
COM4	name of one of the commodities found at site
MOC4	modifier of the commodity
COM5	name of one of the commodities found at site
MOC5	modifier of the commodity
SIC	Standard Industrial Classification Code
BCU	BASINS assigned cataloging unit code

Data Product: National Water Quality Assessment Study Unit Boundaries
Theme Name: NAWQA Study Unit Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
NAWQA_DD_	ArcInfo internal field
NAWQA_DD_ID	Arcinfo internal field
NAWQA	NAWQA study unit number
NAME	river basin name
GROUP	group number
PILOT	pilot code
ABBV	river basin name abbreviation
CANADA	code to designate study units that crosses Canadian boundary

MI2	area in square miles
RANK	rank
REGION	region designation (northeastern, southeastern, central, western US)

Data Product: NSI Stations & Database
Theme Name: National Sediment Inventory Stations

Field Name	**Description**
SHAPE	ArcView internal field
NSI_STAT	unique station identification assigned during data processing
SOURCE	identification of data origin
FIPS	FIPS code
STATE	state
EPA_REG	EPA region
LONG	longitude (decimal degrees)
LAT	latitude (decimal degrees)
TIER	NSI station classification
AL_SED	NSI aquatic life classification using sediment chemistry data
AL_TOX	NSI aquatic life classification using biotoxicity data
HH_TIS	NSI Human Health Classification using tissue residue data
HH_SED	NSI Human Health Classification using sediment chemistry data
RF1_NAME	USEPA Reach File, version 1 reach name
RF1_ID	USEPA Reach File, version 1 reach number
AGENCY	identification of group responsible for collecting data
STATION	monitoring station identification code
COUNTY	county
LOCATION	location
REFER	reference, literature citation
WATERBOD	waterbody
DEPTH	water depth (m)
SR_SCI	senior scientist
ORIGIN	origin
GEOCODE	geologic code
DEPT_MAX	maximum water depth (m)
DEPT_MIN	minimum water depth (m)
DREDGESI	dredged site
MON_PROG	name of monitoring program or group
CU	cataloging unit code
BCU	BASINS assigned cataloging unit

Data Product: NSI Stations & Database
Related Table Name: NSI Biotoxicity Data

Field Name	**Description**
NSI_STAT	unique station identification assigned during NSI processing
SPECIES	organism species
DATE	date of sample collection
TEST	percent mortality in test
PHASE	phase code to indicate the phase (i.e., medium) in which the bioassay organisms are housed
CONTROL	percent mortality in control

SIG	significance of result
BCU	BASINS assigned cataloging unit

Data Product: NSI Stations & Database
Related Table Name: NSI Sediment Chemistry Data

Field Name	**Description**
NSI_STAT	Unique station identification assigned during NSI processing
DATE	date of sample collection
CAS	CAS number for analyte
P	result associated with PARM (μg/kg, ppb)
R	remark code associated with PARM and P
FOC	fraction organic carbon
CHEMICAL	chemical name
SQC	draft sediment quality criteria flag
SEM	simultaneously extracted metals flag
AETH	apparent effects threshold-high flag
AETL	apparent effects threshold-low flag
ERM	effects range-median flag
ERL	effects range-low flag
SQAL	sediment quality advisory level flag
PEL	probable effects levels flag
RSK	EPA Cancer/Non-cancer risk flag
FDA	FDA Tolerance/Action/Guidance flag
TEL	threshold effects levels flag
BCU	BASINS assigned cataloging unit

Data Product: NSI Stations & Database
Related Table Name: NSI Tissue Residue Data

Field Name	**Description**
DATE	date of sample collection
CAS	chemical abstract system number for analyte
P	result associated with PARM
R	remark code associated with PARM and P
CHEMICAL	chemical name
HH	tissue level of dioxin or PCBs in resident species exceed EPA risk levels
RSK	tissue level in resident species exceed EPA risk levels
FDA	tissue level in resident species exceed FDA action levels
COM_NAME	common species name
ANATOMY	anatomy analyzed
BCU	BASINS assigned cataloging unit

Data Product: NSI Stations & Database
Related Table Name: NSI Watershed

Field Name	**Description**
CU	hydrologic unit code (8-digit)
NAME	hydrologic unit code name
CLASS	NSI watershed classification

TIER1	number of tier stations in watershed based on NSI station classification
TIER2	number of tier 2 stations in watershed
TIER3	number of tier 3 stations in watershed
NUM_STA	number of stations evaluated in watershed
TIER1_2	number of stations classified as tier 1 or tier 2
PERC1_2	percent of stations classified as tier 1 or tier 2
AL_TIER1	number of stations that would be classified as tier 1 using NSI aquatic life classification criteria
AL_TIER2	number of stations that would be classified as tier 2 using NSI aquatic life classification criteria
HH_TIER1	number of stations that would be classified as tier 1 using NSI human health classification criteria
HH TIER2	number of stations that would be classified as tier 2 using NSI human health classification criteria
BCU	BASINS assigned cataloging unit

Data Product: NSI Stations & Database
Related Table Name: NSI Reference Table

Field Name	**Description**
CHEMICAL	chemical name
CAS	chemical abstract system number
SQC	draft sediment quality criteria used for NSI evaluation
ERL	effects range-low used for NSI evaluation
ERM	effects range-median used for NSI evaluation
AETL	apparent effects threshold-low used for NSI evaluation
AETH	apparent effects threshold-high used for NSI evaluation
SQAL	sediment quality advisory level used for NSI evaluation
TEL	threshold effects level used for NSI evaluation
PEL	probable effects level used for NSI evaluation
RSK	cancer/noncancer risk level used for NIS evaluation
CANRSK	EPA cancer risk level used for NSI evaluation
NONCAN	EPA noncancer risk level used for NSI evaluation
FDA	FDA tolerance/action/guidance level
WLD	wildlife criteria
BSAF	biota-sediment accumulation factor
SF	cancer slope factor
RFD	noncancer reference dose

Data Product: PCS Sites and Computed Loadings
Theme Name: Permit Compliance System

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
US_NW_	ArcView internal field
US_NW_ID	ArcView internal field
LDIP_CODE	source of record
ID	unique ID from respective program system

MAD_ID	assigned sequential reference number
LOCAL_REF_ID	assinged sequential reference number
FAC_ID	EPA Facility Index System (FINDS) identifier
FACILITY_N	name of the facility or site
LATITUDE	latitude of facility, site, or operable unit
LONGITUDE	longitude of facility, site, or operable unit
BND_FLAG	boundary flag
NPL_STAT_I	npl_stat_ind
Y_COORD	facility latitude based on NAD 83
X_COORD	facility longitude based on NAD 83
ALBERS_SRC	source for Albers coordinate
BVFLAG	accurate location for an EPA facility as defined by FINDS
MADI	major discharge identifier
REGION	EPA region code
CITY	city code
CITY_NAME	city name
CNTY	county code
CNTY_NAME	county name
SIC	standard industrial classification code
LOCATION_N	name of entity located at facility's physical address
ADDRESS	street address of facility
LOCATION_C	name of city or town where facility is located
LOCATION_S	state or territory code where facility is located
ZIP	ZIP code of address where facility is located
TELE	telephone number of facility
INACTIVE_C	code indicating if facility is currently active
PERMIT_EXP	date current permit will expire
PERMIT_ISS	date current permit was issued/signed
DRAFT_PERM	date on which public notification was given
APPL_RECEI	date on which application for a NPDES permit recieved
INACTIVE_D	date on which facility became inactive or active
TYPE_OF_OW	code describing ownership classification
TYPE_OF_PE	code indicating whether EPA or state issued permit
RIVER_BASI	six-digit river basin identifier
RECEIVING_	name of water body into which effluent discharged
CURR_YEAR_	status of reportable noncompliance as it appeared on quarterly noncompliance report for current year for major facilities
FEDERAL_GR	publicly owned waste treatment works with a SIC code of 4952 which obtained federal grant money to construct
FINAL_LIMI	final effluent limits when all necessary construction is completed
FLOW_RATE	average flow facility designed to accommodate in million gallons/day
PRETREATME	code indicating whether municipality is required to develop pretreatment program
NMP_FINAN_	financial fitness of Publicly Owned Treatment Works
NPM_FINAN_	indicates whether a final and enforcible Municipal Compliance Plan (MCP)schedule has been establised
NPM_QUARTE	fiscal quarter which final MCP was established
LAT	latitude
LON	longitude
CODE_OF_AC	technical accuracy of latitude and longitude data

METHOD	latitude/longitude method code
DATUM	datum used to determine lat and lon coordinates
SCALE	scale used to determine lat and lon coordinates
DESCRIPT	text description of a code
USGS_HYDRO	code assigned by USGS to identify drainage water basins for facilities by their geographic location
STREAM_SEG	code for facilities indentifying stretches of water from one significant event to another
MILEAGE_IN	length of a particular facility stream segment in miles downstream from beginning of segment
RECVNG_STR	related facility stream segment type
PRS1	BASINS internal field
PRS2	BASINS internal field
BFIPS	BASINS county FIPS code
BREACH	BASINS internal field
CU_IFD	cataloging unit obtained from the IFD database
CUSEG	cataloging unit reach file segment
MI	Reach File, V1 segment mile point
HITFLAG	unknown
BCU	BASINS assigned cataloging unit
NPDES	NPDES permit number
CU	cataloging unit

Data Product: PCS Sites and Computed Loadings
Related Table Name: Permitted Discharges 1991, 1992, 1993, 1994, 1995, 1996

Field Name	**Description**
NPDES	NPDES permit number
PARAMETER	STORET parameter code
LBY0	estimated loading calculated with remarked data set to zero (lb/yr)
LBYE	estimated loading calculated with remarked data set to half-detection limit (lb/yr)
LBY1	estimated loading calculated with remarked data set to detection limit (lb/yr)
LBYOVER	portion of estimated loading over permit in lb/yr
BCU	BASINS assigned cataloging unit

Data Product: PCS Sites and Computed Loadings
Related Table Name: Permitted Discharges Parameter Table

Field Name	**Description**
PARAMETER	STORET parameter code
PRAM_NAME	parameter name
CHEMICAL_N	chemical name
CAS_NUMBER	chemical abstract registry number

Data Product: PCS Sites and Computed Loadings
Related Table Name: Permitted Discharges Code

Field Name	Description
TABLE_ID	three-digit code indicating the type of code described
CODE	ten-digit code
DESCRIPTIO	description

Data Product: Populated Place Locations
Theme Name: Place Names - (State Postal Abbreviation)

Field Name	Description
SHAPE	ArcView internal field
AREA	BASINS internal field
PERIMETER	BASINS internal field
(ST)PPL_	BASINS internal field
(ST)PPL_ID	BASINS internal field
NAME	place name which can be used to label the place on a map display
DESIG	designation that this is a populated place
COUNTY	county name
FIPS1	state and county FIPS code
LAT_IN	place latitude in DDMMSS
LONG_IN	place longitude in DDDMMSS
ELEV	elevation of the place in meters (character)
QCODE	code for the accuracy of the latitude and longitude of place
ELEVNUM	elevation of the place in meters (integers)

Data Product: Reach File, Version 1 (RF1)
Theme Name: Reach File, V1

Field Name	Description
SHAPE	ArcView internal field
HUC	cataloging unit code
FNODE_	ArcInfo internal field
TNODE_	ArcInfo internal field
LPOLY_	ArcInfo internal field
RPOLY_	ArcInfo internal field
LENGTH	ArcInfo internal field
RF1_	ArcInfo internal field
RF1_ID	ArcInfo internal field
SEG	reach segment number
MILEPT	indicates the beginning of the reach
SEQNO	reach sequence number
RFLAG	reach flag "1" is a stream reach
OWFLAG	open water flag "1" is a open water reach
TFLAG	terminal reach flag "1" is a terminal reach
SFLAG	start reach flag "1" is a start reach
TYPE	reach segment type
SEGL	length of the reach in miles
LEV	reach level order
J	reach junction number

K	reach divergence number
PMILE	path mile
ARBSUM	milage distance upstream from the stream discharge
USDIR	upstream reach direction
TERMID	terminal stream system ID
TRMBLV	terminal base level
PNAME	primary reach name
PNMCD	primary name code
OWNAME	open water name
OWNMCD	open water name code
DSHUC	downstream cataloging unit number
DSSEG	downstream reach segment number
DSMLPT	downstream mile point
MNFLOW	mean flow in the reach in cfs
SVTNFLOW	seven/ten low flow in the reach in cfs
MNVELO	stream velocity in the reach at mean flow in ft/s
SVTNVELO	stream velocity in the reach at seven/ten low flow in ft/s
RIVRCH	reach number
CU	cataloging unit
DESSEQ	downstream segment number
USSEQ	upstream segment number
USDIR	upstream reach direction (L or R)
DSCSM	downstream CU, segment, mile point
CCSM	complement CU, segment, mile point
CDIR	complement bank direction
ULCSM	upstream left CU, segment, mile point
URCSM	upstream right CU, segment, mile point
MDLAT	midpoint latitude
MDLONG	midpoint longitude
PSNPDAT	date of snapshot (yymm); zero if current
PLOWFL	stream-only low flow in cfs
PMEANFL	stream-only mean flow in cfs
PTOPELE	top of reach elevation in feet
PBOTELE	bottom of reach elevation in feet
PSLOPE	slope: NOT DERIVED from elevations
PDEPTH	mean depth (feet)
PWIDTH	mean width (feet)
PTEMP	mean temperature in Celcius
PPH	mean pH
PLOWVEL	total low-flow velocity in cfs
PK1	CBOD decay rate constant (if known)
PK2	rearation rate constant (if known)
PK3	NH_3 decay rate constant (if known)
PMANN	“Roughness” coefficient (if known)
PSOD	sediment oxygen demand in mg/L
PBGDO	background DO in mg/L
PBGNH3	background NH_3 in mg/L
PBGBOD5	background CBOD in mg/L
PBGNBOD	background NBOD in mg/L

Data Product: Reach File, Version 3 (RF3) Alpha
Theme Name: Reach File, V3

Field Name	**Description**
SHAPE	ArcView internal field
RF3RCH#	ArcInfo internal field
RF3RCH-ID	user assigned feature number
RF3RCHID	unique river reach identifier concatenated from cataloging unit code, segment and mile point
SEG	segment number
MI	marker index
UPMI	upstream marker index
RFLAG	reach flag
OWFLAG	open water flag
TFLAG	terminal flag
SFLAG	start flag
REACHTYPE	reach type code
LEVEL	stream level
JUNC	level of downstream reach
DIVERGENCE	divergence code
USDIR	upstream direction of main path
TERMID	terminal stream ID (future use)
TRMBLV	terminal base level (future use)
PNAME	primary name
PNMCD	primary name code
CNAME	common name
CNMCD	common name code
OWNAME	open water name
OWNMCD	open water name code
DSCU	downstream CU
DSSEG	downstream SEG
DSMI	downstream MI
CCU	complement CU
CSEG	complement SEG
CMI	complement MI
CDIR	complement direction
ULCU	upstream left CU
ULSEG	upstream left SEG
ULMI	upstream left MI
URCU	upstream right CU
URSEG	upstream right SEG
URMI	upstream rght MI
SEGL	reach length (miles)
RFORGFLAG	RF origin flag
ALTPNMCD	alternate primary name code (future use)
ALTOWNMC	alternate OW name code (future use)
DLAT	downstream latitude
DLONG	downstream longitude
ULAT	upstream latitude
ULONG	upstream longitude

MINLAT	minimum latitude
MINLONG	minimum longitude
MAXLAT	maximum latitude
MAXLONG	maximum longitude
NDLGREC	number of DLG records
LN1AT2	DLG line attribute 1
LN2AT2	DLG line attribute 2
AR1AT2	DLG area attribute
AR1AT4	DLG area attribute
AR2AT2	DLG area attribute
AR2AT4	DLG area attribute
UPDATE1	update date #1
UPDTCD1	update type Code #1
UPDTSRC1	update source #1
UPDATE2	update date #2 (future use)
UPDTCD2	update type code #2 (future use)
UPDTSRC2	update source #2 (future use)
UPDATE3	update date #3 (future use)
UPDTCD3	update type Code #3 (future use)
UPDTSRC3	update source #3 (future use)
DIVCU	divergent CU
DIVSEG	divergent SEG
DIVMI	divergent MI
DLGID	DLG number (special use)
FILLER	filler (future use)
RF3RCHID	unique river reach identifier concatenated from CU, SEG, and MI
CURF3RCHID	unique complement reach identifier
ULRF3RCHID	unique upstream left reach identifier
URRF3RCHID	unique upstream right reach identifier
DIVRF3RCHID	unique divergent reach identifier

Data Product: Resource Conservation and Recovery Information System
Theme Name: Hazardous and Solid Waste Sites

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
LDIP_CODE	source of record
ID	unique ID from respective program system
MAD_ID	assigned sequential reference number
LOC_REF_ID	assigned sequential reference number
FAC_ID	EPA Facility Index System (FINDS) identifier
FACILITY_ID	name of facility or site
LATITUDE	latitude of facility, site, or operable unit
LONGITUDE	longitude of facility, site, or operable unit
BND_FLAG	boundary flag
NPL_STAT_I	npl_stat_ind
Y_COORD	national albers coordinate based on NAD 83 datum
X_COORD	national albers coordinate based on NAD 83 datum
ALBERS_SRC	source for Albers coordinate

BVFLAG	indicator of most accurate location for an EPA facility as defined by FINDS
EXIST_DATE	date operation commenced or expected date
OFF_SITE	indicates if handler accepts hazardous waste from other sites
NON_ACSBLT	indicates reason why handler is not accessible for normal RCRA tracking and processing
NON_NTFR	handler identified through source other than notification and is suspected of conducting RCRA-regulated activities without proper authority
STREET_NAM	street address of handler location
CITY_NAME	city or town in the handler location
STATE	two letter postal code for state in handler location address
ZIP	ZIP code in the handler location address
PRVS_HANDL	identification number used to regulate the handler under the Federal RCRA program
REGION	EPA region in which the handler is located
LAND_TYPE	current ownership status of land where facility is located
FIPS_STATE	two-letter postal code for state in which the handler is located
FIPS_COUNT	FIPS code for county where facility is located
BCU	BASINS assigned cataloging unit

Data Product: State and County Boundaries
Theme Name: State Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
ST_	ArcInfo internal field
ST_ID_	ArcInfo internal field
ST	state name abbreviation
EPAREG	state region

Data Product: State and County Boundaries
Theme Name: County Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
CNTY_	ArcInfo internal field
CNTY_ID	ArcInfo internal field
FIPS	county FIPS code
ST	state postal abbreviations
CNTYNAME	county name
PLYTYPE	polygon type
WORKB	BASINS internal field
STCOFIPS	state and county FIPS code
BEXT	BASINS internal field

Data Product: State and County Boundaries
Theme Name: County Names

Field Name	Description
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
CNTY	ArcInfo internal field
CNTY_ID	ArcInfo internal field
FIPS	county FIPS code
ST	state postal abbreviations
CNTYNAME	county name
PLYTYPE	polygon type
WORKB	BASINS internal field
STCOFIPS	state and county FIPS code
BEXT	BASINS internal field

Data Product: Superfund National Priority List Sites
Theme Name: National Priority List Sites

Field Name	Description
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
LDIP_CODE	source of record
ID	unique ID from respective program system
MAD_ID	ArcView internal field
LOC_REF_ID	ArcView internal field
FAC_ID	EPA FINDS identifier
FACILITY_N	name of the facility or site
LATITUDE	latitude of facility, site, or operable unit
LONGITUDE	longitude of facility, site, or operable unit
BND_FLAG	boudary flag
NPL_STAT_I	indicates site's NPL status
Y_COORD	national Albers coordinate based on NAD 83
X_COORD	national Albers coordinate based on NAD 83
ALBERS_SRC	source for Albers coordinate
BVFLAG	indicator of most accurate location for an EPA facility as defined by FINDS
POINT_ORIG	specifies the region code
RECORD_TYPE	specifies the scheme record number
ACTION_COD	specifies action taken when records are downloaded from the IBM mainframe
REGION_COD	region in which site is physically located
STATE	state or territory which site is phsically located
STREET_NAM	street address, route number, or other identifier of the physical location of the site or incident
CITY_NAME	name of city, town, or other municipality in which site is located or

	incident occurs
ZIP	US Postal Service ZIP code in which site is located
COUNTY	county in which site is located
COUNTY_COD	code that identifies county in which site is located
DIOXIN_TIE	reserved for headquarters definition
USGS_HYDRO	hydrologic location of site
BCU	BASINS assigned cataloging unit

Data Product: State Soil and Geographic (STATSGO) Database
Theme Name: State Soil

Field Name	**Description**
SHAPE	Arcview internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
MUID	map unit identification symbol created by concatenation of state FIPS code and a three-digit Arabic number

Data Product: State Soil and Geographic (STATSGO) Database
Related Table Name: Soil Component Data

Field Name	**Description**
MUID	map unit identification symbol created by concatenation of state FIPS code and a three-digit Arabic number
SEQNUM	identifies sequence of components in a map unit
MUIDSEQNUM	concatenation of MUID and sequence number
COMPNAME	soil series name associated with component or sequence number
S5ID	soil interpretation record
COMPPCT	percentage of the component of the map unit
SLOPEL	minimum value for range of slope of a soil component in percent
SLOPEH	maximum value for range of slope of a soil component in percent
SURFTEX	surface layer soil texture using USDA codes
ANFLOOD	annual flooding frequency
WTDEPL	minimum value for range in depth to water table in feet
WTDEPH	maximum value for range in depth to water table in feet
WTKIND	type of water table
ROCKDEPL	minimum value for range in depth to bedrock in inches
ROCKDEPH	maximum value for range in depth to bedrock in inches
HYDGRP	soil hydrologic group
DRAINAGE	soil drainage class identifying natural drainage condition of the soil
HYDRIC	hydric soil rating
CLNIRR	nonirrigated capability class
CLIRR	irrigated capability class
PRIMFML	prime farmland classification

Data Product: State Soil and Geographic (STATSGO) Database
Related Table Name: Soil Layer Data

Field Name	**Description**
MUID	map unit identification symbol created by concatenation of state FIPS code and a three digit Arabic number
SEQNUM	identifies sequence of components in a map unit
MIEDSEQNUM	concatenation of MUID and sequence number

S5ID	soil interpretation record
LAYERNUM	identifies sequence in the soil profile
LAYDEPL	depth to upper boundary of soil layer or horizon in inches
LAYDEPH	depth to lower boundary of soil layer or horizon in inches
TEXTURE1	USDA soil texture class for specified layer
TEXTURE2	USDA soil texture class for specified layer
TEXTURE3	USDA soil texture class for specified layer
KFACT	soil erodibility factor
KFFACT	soil erodibility factor, rock fragments free
TFACT	soil loss tolerance factor
WEG	wind erodibility group
NO200L	percent passing sieve no. 200-minimum value
NO200H	percent passing sieve no. 200-maximum value
CLAYL	percent clay-minimum value
CLAYH	percent clay-maximum value
LLL	minimum percent liquid limit
LLH	maximum percent liquid limit
PIL	minimum percent plasticity limit
PIH	maximum percent plasticity limit
UNIFIED1	Unified Engineering Classification (1)
UNIFIED2	Unified Engineering Classification (2)
UNIFIED3	Unified Engineering Classification (3)
UNIFIED4	Unified Engineering Classification (4)
AASHTO1	ASSHTO Engineering Classification (1)
AASHTO2	ASSHTO Engineering Classification (2)
AASHTO3	ASSHTO Engineering Classification (3)
AASHTO4	ASSHTO Engineering Classification (4)
AWCL	low available water capacity (in/in)
AWCH	high available water capacity (in/in)
BDL	low bulk density (g/cc)
BDH	high bulk density (g/cc)
OML	minimum percent organic matter
OMH	maximum percent organic matter
PHL	minimum pH value
PHH	maximum pH value
SALINL	minimum salinity value (mmhos/cm)
SALINH	maximum salinity value (mmhos/cm)
SARL	minimum sodium absorbtion ratio
SARH	maximum sodium absorbtion ratio
CECL	lower cation exchange capacity
CECH	higher cation exchange capacity
CACO3L	minimum percent calcium carbonate
CACO3H	maximum percent calcium carbonate
GYPSUML	minimum percent sulfate
GYPSUMH	maximum percent sulfate
PERML	minimum permeability (in/hr)
PERMH	maximum permeability (in/hr)
SHRINKSW	shrink-swell potential upon drying and wetting

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Theme Name: Toxic Release Inventory

Field Name	**Description**
SHAPE	ArcView internal field
AREA	degenerate area of point in map units
PERIMETER	degenerate perimeter of point in map units
LDIP_CODE	source of record
ID	unique ID form respective program system
MAD_ID	assigned sequential reference number
LOC_REF_ID	assigned sequential reference number
FAC_ID	EPA facility index system (FINDS) identifier
FACILITY_N	name of facility or site
LATITUDE	latitude of facility, site, or operable unit
LONGITUDE	longitude of facility, site, or operable unit
BND_FLAG	boundary flag
NPL_STAT_I	npl_stat_ind
Y_COORD	Albers y coordinate based on NAD 83 datum
X_COORD	Albers x coordinate based on NAD 83 datum
ALBERS_SRC	source for Albers coordinate
BVFLAG	most accurate location for an EPA facility as defined by FINDS
STREET_NAM	street name in address of reporting facility
CITY_NAME	name of city where facility is located
COUNTY_NAM	name of county where facility is located
STFIPS	combined two digit state abbreviation and county code
STATE	two-letter state code used by US Postal Service
ZIP	ZIP code assigned by US Postal Service
REGION	EPA region
SIC	Standard Industrial Classification (SIC) Code
BCU	BASINS assigned cataloging unit
CLOSE_IND	flag indicating if facility has been closed down
DUNS	Dun and Brandstreet number assigned to facility
FEDERAL	indicates ownership status of a facility
ASSIG_AGEN	code assigned by the Emergency Preparedness and Community Right-to-Know Act (EPCRA) Operations Department

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI Air Emission Data 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995

Field Name	**Description**
TRI_FACILI	unique identifier of facility-first five consonants of name
DOC_CONTROL	unique identification assigned to each submission
FUGITIVE_S	code used to distinguish between fugitive or non-point air emissions of the chemical and stack or point air emissions
REL_EMISS_	code that corresponds to the amount of toxic chemical released annually by facility, reported as a range of release less than 1000lbs. Permitted values are: 4 = 500 to 999 lbs/year; 3 = 11 to 499 lbs/year; 2 = 1 to 499 lbs/year; 1 = 0.5 to 10 lbs/year and 0 = none.

REL_EST	estimate provided by facility of the amount of toxic chemicals released for releases greater than 1000 lb
REL_EST_FL	indicates "not applicable" was entered on release estimate form
REL_EST_BA	principle method by which the total release estimate was calculated
REL_TRANSF	sequence number within a document control number to make each unique record of releases reported by a facility
TRI_CHEM_I	CAS number or category code assigned to chemicals regulated under section 313 of EPCRA
TRADE_SECR	indicates toxic chemical reported is claimed to be a trade secret
REPORTING_	calender year in which reported activity occured

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI Land Release Data 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995

Field Name	**Description**
TRI_FACILI	unique identifier of facility-first five consonants of name
DOC_CONTROL	unique identification assigned to each submission
LAND_DISP	type of on-site land release of the toxic chemical
REL_EMISS_	code that corresponds to the amount of toxic chemical released annually by facility, reported as a range of release less than 1000lbs. Permitted values are: 4 = 500 to 999 lbs/year; 3 = 11 to 499 lbs/year; 2 = 1 to 499 lbs/year; 1 = 0.5 to 10 lbs/year and 0 = none.
REL_EST_FL	indicates "not applicable" was entered on release estimate form
REL_EST	estimate provided by facility of the amount of toxic chemicals released for releases greater than 1000 lb
REL_EST_BA	principle method by which the total release estimate was calculated
REL_TRANSF	sequence number within a document control number to make each unique record of releases reported by a facility
TRI_CHEM_I	CAS number or category code assigned to chemicals regulated under section 313 of EPCRA
TRADE_SECR	indicates toxic chemical reported is claimed to be a trade secret
REPORTING_	calender year in which reported activity occurred

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI POTW Data 1991,1992,1993,1994,1995

Field Name	**Description**
REPORTING_	calender year in which reported activity occured
DOC_CONTRO	unique identification assigned to each submission
REL_EMISS_	code that corresponds to the amount of toxic chemical released annually by facility, reported as a range of release less than 1000lbs. Permitted values are: 4 = 500 to 999 lbs/year; 3 = 11 to 499 lbs/year; 2 = 1 to 499 lbs/year; 1 = 0.5 to 10 lbs/year and 0 = none.
REL_EST_FL	indicates "not applicable" was entered on release estimate form
REL_EST	estimate provided by facility of the amount of toxic chemicals released for releases greater than 1000 lb
REL_EST_BA	principle method by which the total release estimate was calculated

REL_TRANSF	sequence number within a document control number to make each unique record of releases reported by a facility
TRI_FACILI	unique identifier of facility-first five consonants of name
TRI_CHEM_I	CAS number or category code assigned to chemicals regulated under section 313 of EPCRA
TRADE_SECR	indicates toxic chemical reported is claimed to be a trade secret

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI Underground Injection Data 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995

Field Name	Description
TRI_FACILI	unique identifier of facility-first five consonants of name
DOC_CONTRO	unique identification assigned to each submission
	code that corresponds to the amount of toxic chemical released annually by facility, reported as a range of release less than 1000lbs. Permitted values are: 4 = 500 to 999 lbs/year; 3 = 11 to 499 lbs/year; 2 = 1 to 499 lbs/year; 1 = 0.5 to 10 lbs/year and 0 = none.
REL_EST_FL	indicates "not applicable" was entered on release estimate form
REL_EST	estimate provided by facility of the amount of toxic chemicals released for releases greater than 1000 lb
REL_EST_BA	principle method by which the total release estimate was calculated
REL_TRANSF	sequence number within a document control number to make each unique record of releases reported by a facility
TRI_CHEM_I	CAS number or category code assigned to chemicals regulated under section 313 of EPCRA
TRADE_SECR	indicates toxic chemical reported is claimed to be a trade secret
REPORTING_	calender year in which reported activity occured

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI Water Release Data 1987,1988,1989, 1990, 1991, 1992, 1993, 1994, 1995

Field Name	Description
TRI_FACILI	unique identifier of facility-first five consonants of name
DOC_CONTRO	unique identification assigned to each submission
STREAM_COD	surface water body or receiving stram into which chemical is directly discharged
STREAM_NAM	name of stream or water body into which chemical is directly discharged
REL_EMISS_	code that corresponds to the amount of toxic chemical released annually by facility, reported as a range of release less than 1000lbs. Permitted values are: 4 = 500 to 999 lbs/year; 3 = 11 to 499 lbs/year; 2 = 1 to 499 lbs/year; 1 = 0.5 to 10 lbs/year and 0 = none.
REL_EST_FL	indicates "not applicable" was entered on release estimate form
REL_EST	estimate provided by facility of the amount of toxic chemicals released for releases greater than 1000 lb
REL_EST_BA	principle method by which the total release estimate was calculated
STORM_WATE	percentage of the total quantity of chemicals released to water which

	was contributed by storm water runoff
STORM_WATE	percentage of the total quantity of chemicals released to water which was contributed by storm water runoff
RELF_TRANS	sequence number within a document control number to make each unique record of releases reported by a facility
TRI_CHEM_I	CAS number or category code assigned to chemicals regulated under section 313 of EPCRA
TRADE_SECR	indicates toxic chemical reported is claimed to be a trade secret
REPORTING_	calender year in which reported activity occured

Data Product: Toxic Release Inventory (TRI) Sites and Pollutant Release Data
Related Table Name: TRI Parameter Table

Field Name	**Description**
CAS_NUM	chemical abstract registry number
CHEM_NAME	chemical name
ACTIVE_DAT	date on which chemical was regulated
INACTIVE_D	date on which chemical was deregulated

Data Product: Urbanized Areas
Theme Name: Urban Area Boundaries

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
POLY_	ArcInfo internal field
POLY_ID	ArcInfo internal field
RINGS_OK	ArcInfo internal field
RINGS_NOK	ArcInfo internal field
URBAN_	ArcInfo internal field
URBAN_ID	ArcInfo internal field
CITYNAME	urbanized area name

Data Product: Urbanized Areas
Theme Name: Urban Area Names

Field Name	**Description**
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
ANAME_	ArcInfo internal field
UANAME_ID	ArcInfo internal field
UA_CODE	unique code for the urbanized area
CITYNAME	urbanized area name

Data Product: Water Quality Monitoring Stations & Data Summaries
Theme Name: Water Quality Stations

Field Name	**Description**
SHAPE	ArcView internal field
ID	BASINS assigned unique ID
STATION	station code
AGENCY	agency code
LOCATION	description of location
CU	cataloging unit code
SEG	Reach File, V1 segment number
MILEP	Reach File, V1 mile point
ONOFF	on/off reach indicator
COUNTY	county name
STFIPS	state FIPS code
STATE	state postal abbreviation
LONG	longitude
LAT	latitude
TYPE	station type
STCOFIPS	state and county FIPS code
BWQID	BASINS asigned unique station number
BCU	BASINS assigned cataloging unit
WRS1	BASINS internal field
WRS2	BASINS internal field

Data Product: Water Quality Monitoring Stations & Data Summaries
Related Table Name: Water Quality Data 70-74, 75-79, 80-84, 85-89, 90-94, 95-97

Field Name	**Description**
ID	BASINS assigned unique ID
STATION	station
AGENCY	agency
BWQID	BASINS assigned unique ID
PARAMETER	EPA STORET parameter code
NO OBS	number of observations
MEAN	mean value
A15TH_P	15th percentile value
A25TH_P	25th percentile value
A50TH_P	50th percentile value
A75TH_P	75th percentile value
A85TH_P	85th percentile value
STD	standard deviation
BCU	BASINS assigned cataloging unit code

Data Product: Water Quality Monitoring Stations & Data Summaries
Related Table Name: Water Quality Parameter Table

Field Name	**Description**
PARM_CODE	EPA STORET parameter code
PARM_NAME	parameter name
UNITS	units

SAMPLE_TYP	sample type
UP_REF_LVL	upper reference level
LW_REF_LVL	lower reference level
UNKNOWN	type of standard
REF_LVLSRC	reference level source

Data Product: Water Quality Stations and Observation Data
Theme Name: Water Quality Observation Stations

Field Name	**Description**
SHAPE	ArcView internal field
ID	BASINS assigned unique ID
AGENCY	agency code
AGENCY_COD	unknown
STATION	station code
ST_DEPTH	station depth
STATE	state code
LAT	latitude
LONG	longitude
TYPE	station type
LOCATION	description of location
CU	cataloging unit code
SEG	Reach File, V1 segment number
MILE	Reach File, V1 mile point
ONOFF	on/off reach indicator
BCU	BASINS assigned cataloging unit
BSTAT_ID	BASINS assigned unique identifier

Data Product: Water Quality Stations and Observation Data
Related Table Name: Water Quality Observation Parameter Table

Field Name	**Description**
PARM_CODE	EPA STORET parameter code
PARM_NAME	parameter name
UNITS	units
SAMPLE_TYP	sample type

Data Product: Watershed Data Stations & Database
Theme Name: Watershed Data Stations

Field Name	**Description**
SHAPE	ArcView internal field
LONGITUDE	longitude
LATITUDE	latitude
ELEVATION	elevation
STAT_NAME	station name
COUNTY	county
PPT_PERIOD	duration of precipitation
COV_PCT	percent of sampling period covered
REGION	EPA region

Data Product: Weather Station Sites
Theme Name: WDM Weather Data Stations

Field Name	Description
SHAPE	ArcView internal field
STA_NAM	weather station name
STATE	2-digit state abbreviation
COOP_ID	cooperative network index station number
NWS_ID	National Weather Service identification number
LATDD	latitude of weather station in decimal degrees
LONGDD	longitude of weather station in decimal degrees
ELEV_FT	elevation of the weather station in meters
BEGIN_DATA	data of first record in WDM file
END_DATE	date of last record in WDM file
DATA_PREC	precipitation data source
DATA_EVAP	evaporation data source
DATA_ATEM	air temperature data source
DATA_WIND	wind movement data source
DATA_SOLR	solar radiation data source
DATA_PEVT	potential evapotranspiration data source
DATA_DEWP	dew point temperature data source
DATA_CLOU	cloud cover data source

Data Product: Weather Station Sites
Theme Name: Weather Station Sites

Field Name	Description
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_ID	ArcInfo internal field
MET_STAT_	ArcInfo internal field
MET_STAT_I	ArcInfo internal field
ID	weather station identification code
LATDD	latitude of weather station in decimal degrees
LONGDD	longitude of weather station in decimal degrees
ELEVFT	elevation of the weather station in meters
STATNAME	weather station name
VIG_ID	BASINS internal field

Data Product: Weather Station Sites
Theme Name: Weather Station Area

Field Name	Description
SHAPE	ArcView internal field
AREA	area of polygon in map units
PERIMETER	perimeter of polygon in map units
TMP_B_	ArcInfo internal field
TMP_B_ID	ArcInfo internal field
POLY	ArcInfo internal field
POLY_ID	ArcInfo internal field

RINGS_OK	ArcInfo internal field
RINGS_NOK	ArcInfo internal field
MET_STAT_	ArcInfo internal field
MET_STAT_I	ArcInfo internal field
ID	weather station identification code
LATDD	latitude in decimal degrees
LONGDD	longitude in decimal degrees
ELEVFT	elevation in meters
STATNAME	weather station name
VIG_ID	BASINS internal field

Data Product: 1996 Clean Water Needs Survey
Theme Name: 1996 Clean Water Needs Survey

Field Name	**Description**
SHAPE	ArcView internal field
FACID	authority/facility identification number
NPDES	National Pollution Discharge Elimination System (NPDES) number
FACNAME	facility name according to local sewer authority
CITYNAM	city name where facility is physically located
CNTYNUM	county number
CNTYNAM	county name where facility is physically located
REGION	EPA region
STATE	state postal code
FACSTAT	operational status as of January 1, 1996
PRESNAT	type of existing facility
PROJNAT	type of facility projected for the future
FACCHNG	type of change for the facility
PPRRT	present resident population currently receiving treatment at the facility
PFRRT	projected resident population expected to receive treatment
PPRRC	present resident population currently receiving collection
PFRRC	projected resident population expected to receive collection
FEXTOT	actual 12-month average flow-through facility, in million gallons/day
FPDTOT	total current design flow capacity for facility, in million gallons/day
FFDTOT	total projected year design flow of the facility, in million gallons/day
EFFPRES	present effluent classification
EFFPROJ	projected effluent classification
NEDTROT	total EPA design year needs
NEDI	EPA design year category I needs
NEDII	EPA design year category II needs
NEDIIIA	EPA design year category IIIA needs
NEDIIIB	EPA design year category IIIB needs
NEDIVA	EPA design year category IVA needs
NEDIVB	EPA design year category IVB needs
NEDV	documented EPA design year category V needs
CSOMODL	modeled EPA design year category V needs
NEDVI	EPA design year category VI needs
NEDVIIA	EPA design year category VIIA needs
NEDVIIB	EPA design year category VIIB needs
NEDVIIC	EPA design year category VIIC needs

Appendix B
NPSM Data

This section contains information concerning BASINS ***Nonpoint Source Model*** data.

Section B.1 contains an HSPF data dictionary that can be used as an aid in populating an ***NPSM*** default data set. The HSPF data dictionary is a list of all HSPF input parameters and their corresponding definitions, units, default values, and minimum and maximum acceptable values.

Section B.2 contains information concerning the BASINS Watershed Data Management (WDM) files, which contain meteorological time series data for ***NPSM***. The section presents procedures for developing WDM files, as well as a record of procedures followed to develop the WDM files packaged with the BASINS system.

B.1 HSPF Data Dictionary

The following data dictionary has been adapted from *Hydrological Simulation Program—FORTRAN User's Manual for Release 11.0 (*Bicknell, et al., 1996)*.* The data table presents input parameter names, definitions, units, default values, and minimum and maximum acceptable values. The table is divided into three major parts, corresponding to the three HSPF application modules:

- PERLND simulation of a pervious land segment (Table B.1.1)
- IMPLND simulation of an impervious land segment (Table B.1.2)
- RCHRES simulation of a river/reservoir reach (Table B.1.3)

Each module is made up of model sections (corresponding with specific HSPF functions), each section containing multiple input data tables. The data table names correspond with both HSPF data tables and the NPSM data editor hierarchy.

Table B.1.1 PERLND (Pervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	ATEMP (Correct Air Temperature for Elevation Difference)			
ATEMP-DAT				
ELDAT	elevation difference between temperature gage and pervious land segment (PLS)	0.0 ft 0.0 m	none none	none none
AIRTMP	Initial air temperature above PLS	60 F 15 C	-60 -50	140 60
	SNOW (Simulate Accumulation and Melting of Snow and Ice)			
SNOW - PARM1				
LAT	latitude (+ in northern hemisphere, - in southern)	40	-90	90
MELEV	mean elevation	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
SHADE	fraction of PLS covered by shade (vegetation)	0.0	0.0	1.0
SNOWCF	correction factor to account for poor catch efficiency of the gage	none	1.0	100.0
COVIND	maximum pack (water equivalent) at which entire PLS will be covered with snow	none in none mm	0.01 0.25	none none
SNOW - PARM2				
RDCSN	density of cold (< 0 deg. F), new snow relative to water	0.15	0.01	1.0
TSNOW	baseline air temp. below which precipitation will be snow	32.0 F 0.0 C	30.0 -1.0	40.0 5.0
SNOEVP	adapts the snow evaporation (sublimation) equation to field conditions	0.1	0.0	1.0
CCFACT	adapts the snow condensation/convection melt equation to field conditions	1.0	0.0	2.0
MWATER	maximum liquid water content of the snow pack, in depth water per depth water equiv.	0.03	0.0	1.0
MGMELT	max. rate of snowmelt by ground heat, in depth of water eqiv per day.	0.01 in/day 0.25 mm/day	0.0 0.0	1.0 25.0
SNOW - INIT1				
Pack-snow	quantity of snow in the pack (water equiv.)	0.0 in 0.0 mm	0.0 0.0	none none
Pack-ice	quantity of ice in the pack (water equiv.)	0.0 in 0.0 mm	0.0 0.0	none none
Pack-water	quantity of liquid water in the pack	0.0 in 0.0 mm	0.0 0.0	none none
RDENPF	density of the pack, relative to water	0.2	0.01	1.0
DULL	index to the dullness of the pack surface, from which albedo is estimated	400.0	0.0	800.0
PAKTMP	mean temp. of the frozen contents of the pack	32.0 F 0.0 C	none none	32.0 0.0
PACKF	frozen contents of the pack			

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SNOW - INIT2				
COVINX	index to areal snow coverage	0.01 in 0.25 mm	0.01 0.25	none none
XLNMLT	current remaining possible increment to the ice storage in the pack. It is only relevant if ice formation is simulated	0.0 in 0.0 mm	0.0 0.0	none none
SKYCLR	fraction of sky which is assumed to be clear	1.0	0.15	1.0
	PWATER **(Simulate Water Budget for a Pervious Land Segment [PLS])**			
PWAT – PARM1				
CSNOFG	flag for simulating snow	0	0	1
RTOPFG	flag for overland flow routing method	0	0	1
UZFG	flag for upper zone inflow computation method	0	0	1
VCSFG	flag for interception storage capacity	0	0	1
VUZFG	flag for upper zone nominal storage	0	0	1
VNNFG	flag for Manning's n for overland flow plane	0	0	1
VIFWFG	flag for interflow inflow parameter	0	0	1
VIRCFG	flag for Interflow recession constant	0	0	1
VLEFG	flag for lower zone E-T parameter	0	0	1
PWAT - PARM2				
FOREST	Fraction of the PLS which is covered by forest which will continue to transpire in winter. Only use when CSNOFG = 1 (i.e. snow being simulated)	0.0	0.0	1.0
LZSN	lower zone nominal storage	none in none mm	0.01 0.25	100.0 2500.0
INFILT	index to the infiltration capacity of the soil	none in/hr none mm/hr	0.0001 0.0025	100.0 2500.0
LSUR	length of the assumed overland flow plane	none ft none m	1.0 0.3	none none
SLSUR	slope	none	0.0000001	10.0
KVARY	parameter which affects the behavior of groundwater recession flow, enabling it to be nonexponential in its decay with time	0.0 (1/in) 0.0 (1/mm)	0.0 0.0	none none
AGWRC	basic groundwater recession rate if KVARY is zero and there is no inflow to groundwater	None 1/day	0.001	0.999
PWAT - PARM3				
PETMAX	air temp. below which E-T will arbitrarily be reduced below the value obtained from the input time series (only when CSNOFG = 1)	40.0 F 4.5 C	none none	none none
PETMIN	temp. below which E-T will be zero regardless of the value in the input time series (only when CSNOFG = 1)	35.0 F 1.7 C	none none	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
INFEXP	exponent in the infiltration equation	2.0	0.0	10.0
INFILD	ratio between the max and mean infiltration capacities over the PLS	2.0	1.0	2.0
DEEPFR	fraction of groundwater inflow which will enter deep (inactive) groundwater and be lost	0.0	0.0	1.0
BASETP	fraction of potential E-T which can be satisfied from baseflow (groundwater outflow)	0.0	0.0	1.0
AGWETP	fraction of remaining potential E-T which can be satisfied from active groundwater storage if enough is available	0.0	0.0	1.0
PWAT - PARM4				
CEPSC	interception storage capacity	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
UZSN	upper zone nominal storage	none in none mm	0.01 0.25	10.0 250.0
NSUR	Manning□s n for the assumed overland flow plane	0.1	0.001	1.0
INTFW	interflow inflow parameter	none	0.0	none
IRC	interflow recession parameter.	none 1/day	1.0E-30	0.999
LZETP	lower zone E-T parameter. It is an index to the density of deep-rooted vegetation	0.0	0.0	0.999
MON - INTERCEP				
CEPSCM(12)	monthly values of interception storage. Only required if VCSFG = 1. The values apply to the first day of the month.	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
MON - UZSN				
UZSNM(12)	monthly values of upper zone nominal storage. Only required if VUZFG = 1	none in none mm	0.01 0.25	10.0 250.0
MON - MANNING				
NSURM(12)	monthly values of Manning□s constant for overland flow. Only required if VNNFG = 1	0.10	0.001	1.0
MON –INTERFLW				
INTFWM(12)	monthly values of the interflow inflow parameter. Only required if VIFWFG = 1	none	0.0	none
MON – IRC				
IRCM(12)	monthly values of the interflow recession parameter. Only required if VIRCFG = 1	none 1/day	1.0E-30	0.999
MON -LZETPARM				
LZETPM(12)	monthly values of the lower zone ET parameter. Only required if VLEFG = 1	0.0	0.0	0.999
PWAT - STATE1				
CEPS	interception storage	0.0 in 0.0 mm	0.0 0.0	100 2500
SURS	surface (overland flow) storage	0.0 in	0.0	100

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
		0.0 mm	0.0	2500
UZS	flag for upper zone storage	0.001 in 0.025 mm	0.001 0.025	100 2500
IFWS	interflow storage	0.0 in 0.0 mm	0.0 0.0	100 2500
LZS	lower zone storage	0.001 in 0.025 mm	0.001 0.025	100 2500
AGWS	active groundwater storage	0.0 mm 0.0 in	0.0 0.0	100 2500
GWVS	index to groundwater slope; measure of antecedent active groundwater inflow	0.0 in 0.0 mm	0.0 0.0	100 2500
	SEDMNT **(Production and Removal of Sediment in Pervious Land)**			
SED – PARM1				
CRVFG	flag for erosion related cover	0	0	1
VSIVFG	Atmospheric deposition rate	0	0	2
SDOPFG	flag that determines the algorithm used to simulate removal of sediment from land surface	0	0	1
SED - PARM2				
SMPF	supporting management practice factor. It is used to simulate the reduction in erosion achieved by use of erosion control practices.	1.0	0.001	1.0
KRER	coefficient in the soil detachment equation	0.0	0.0	none
JRER	exponent in the soil detachment equation	none	none	none
AFFIX	fraction by which detached sediment storage decreases each day, as a result of soil compaction	0.0 (1/day)	0.0	1.0
COVER	fraction of land surface which is shielded from erosion by rainfall (not considering snow cover)	0.0	0.0	1.0
NVSI	rate at which sediment enters detached storage from the atmosphere. A negative value can be used to simulate removal	0.0 lb/ac.day 0.0 kg/ha.day	none none	none none
SED - PARM3				
KSER	coefficient in the detached sediment washoff equation	0.0	0.0	none
JSER	exponent in the detached sediment washoff equation	none	none	none
KGER	coefficient in the matrix soil scour equation (simulates gully erosion, etc.)	0.0	0.0	none
JGER	exponent in the matrix soil scour equation	none	none	none
MON - COVER				
COVERM(12)	monthly values of the COVER parameter. Only required if CRVFG = 1	0.0	0.0	1.0
MON – NVSI				

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
NVSIM(12)	monthly values of the net vertical sediment input. Only required if VSIFG>0	0.0 lb/ac.day 0.0 kg/ha.day	none none	none none
SED – STOR				
DETS	initial storage of detached sediment	tons/ac 0.0 tonnes/ha	0.0 0.0	none none
PSTEMP (Simulation of Soil Temperature)				
PSTEMP – PARM1				
SLTVFG	flag for surface temperature and gradient	0	0	1
ULTVFG	flag for upper layer temperature and gradient	0	0	1
LGTVFG	flag for lower layer and G.W. temperature and gradient	0	0	1
TSOPFG	flag for subsurface soil temperature calculation	0	0	2
PSTEMP – PARM2				
ASLT	surface layer temperature, when the air temperature is 32 degrees F. It is the intercept of the surface layer temperature regression	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
BSLT	slope of the surface layer temperature regression equation	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
FOR TSOPFG = 0 or 2				
ULTP1	smoothing factor in upper layer temperature calculation	none	none	none
ULTP2	mean difference between upper layer soil temperature and air temperature	none F none C	none none	none none
LGTP1	smoothing factor for calculating lower layer/ groundwater soil temperature	none	none	none
LGTP2	mean departure from the upper layer soil temperature for calculating lower layer/groundwater soil temperature	none F none C	none none	none none
FOR TSOPFG = 1				
ULTP1	intercept in the upper layer soil temperature regression equation	none F none C	none none	none none
ULTP2	slope in the upper layer soil temperature regression equation	none F/F none C/C	none none	none none
LGTP1	lower layer/groundwater layer soil temperature	none F none C	none none	none none
LGTP2	not used	none	none	none
MON – ASLT				
ASLTM(12)	monthly surface layer temperature when air is 32 degrees F. Only required if SLTVFG = 1	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
MON – BSLT				
BSLTM(12)	monthly slope of surface layer temperature regression equation. Only required if SLTVFG = 1	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
MON - ULTP1				
ULTP1M(12)	monthly parameter for estimating upper layer temperature. Only required if ULTVFG = 1 (see ULTP1 for units)	none none	none none	none none
MON - ULTP2				
ULTP2M(12)	monthly parameter for estimating upper layer temperature. Only required if ULTVFG = 1 (see ULTP2 for units)	none none	none none	none none
MON - LGTP1				
LGTP1M(12)	monthly parameter for estimating lower layer and active groundwater layer temperature calculations. Only required if LGTVFG = 1 (see LGTP1 for units)	none none	none none	none none
MON - LGTP2				
LGTP2M(12)	monthly parameter for estimating lower layer and active groundwater layer temperature calculations. Only required if LGTVFG = 1 (see LGTP2 for units)	none none	none none	none none
PSTEMP – TEMPS				
AIRTC	air temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
SLTMP	surface layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
ULTMP	upper layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
LGTMP	lower layer/groundwater layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
		PWTGAS		
PWT - PARM1				
IDVFG	flag for interflow dissolved oxygen concentration	0	0	1
ICVFG	flag for interflow CO2 concentration	0	0	1
GDVFG	flag for groundwater dissolved oxygen concentration	0	0	1
GCVFG	flag for groundwater CO2 concentration	0	0	1
PWT - PARM2				
ELEV	elevation of the PLS above sea level (used to adjust saturation concentrations of dissolved gasses in surface outflow)	0.0 ft 0.0 m	-1000.0 -300.0	30000.0 9100.0
IDOXP	concentration of dissolved oxygen in interflow outflow	0.0 mg/l	0.0	20.0
ICO2P	concentration of dissolved CO2 in interflow outflow	0.0 mg c/l	0.0	1.0
ADOXP	concentration of dissolved oxygen in active groundwater outflow	0.0 mg/l	0.0	20.0
ACO2P	concentration of dissolved CO2 in active groundwater outflow	0.0 mg c/l	0.0	1.0
MON – IFWDOX				
IDOXPM(12)	monthly parameter for concentration of DO in interflow outflow (only required if IDVFG = 1)	0.0 mg/l	0.0	20.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
MON - IFWCO2				
ICO2PM(12)	monthly parameter for concentration of dissolved CO2 in interflow outflow (only required if ICVFG = 1)	0.0 mg c/l	0.0	1.0
MON – GRNDDOX				
ADOXPM(12)	monthly parameter for concentration of DO in active groundwater outflow (only required if GDVFG = 1)	0.0 mg/l	0.0	20.0
MON - GRNDCO2				
ACO2PM(12)	monthly parameter for concentration of dissolved CO2 in active groundwater outflow (only required if GCVFG = 1)	0.0 mg c/l	0.0	1.0
PWT – TEMPS				
SOTMP	initial surface outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
IOTMP	initial interflow outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
AOTMP	initial active groundwater outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
PWT – GASES				
SODOX	DO concentration in surface outflow	0.0 mg/l	0.0	20.0
SOCO2	CO2 concentration in surface outflow	0.0 mg c/l	0.0	1.0
IODOX	DO concentration in interflow outflow	0.0 mg/l	0.0	20.0
IOCO2	CO2 concentration in interflow outflow	0.0 mg c/l	0.0	1.0
AODOX	DO concentration in active groundwater outflow	0.0 mg/l	0.0	20.0
AOCO2	CO2 concentration in active groundwater outflow	0.0 mg c/l	0.0	1.0
	PQUAL			
QUAL – PROPS				
QSDFG	sediment associated constituent flag	0	0	1
VPFWFG	flag for washoff potency factor	0	0	2
VPFSFG	flag for scour potency factor	0	0	1
QSOFG	overland flow associated constituent flag	0	0	1
VQOFG	flag for accumulation and limiting storage factor	0	0	1
QIFWFG	interflow associated constituent flag	0	0	1
VIQCFG	flag for interflow outflow concentration	0	0	4
QAGWFG	groundwater associated constituent flag	0	0	1
VAQCFG	flag for groundwater outflow concentration	0	0	4
QUAL – INPUT				
SQO	initial storage of (sediment associated constituent) QUALOF on the surface of the PLS	0.0 qty/ac 0.0 qty/ha	0.0 0.0	none none
POTFW	washoff potency factor	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
POTFS	scour potency factor	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
ACQOP	rate of accumulation of QUALOF	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
SQOLIM	maximum storage of QUALOF	0.000001 qty/ac 0.000002 qty/ha	0.000001 0.000002	none none
WSQOP	rate of surface runoff which will remove 90 percent of stored QUALOF per hour	1.64 in/hr 41.7 mm/hr	0.01 0.25	none none
IOQC	concentration of the constituent in interflow outflow (only if QIFWFG = 1)	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
AOQC	concentration of the constituent in active (only if QAGWFG = 1) groundwater outflow	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
MON – POTFW				
POTFWM(12)	monthly parameter for washoff potency factor. Only required if VPFWFG > 0	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
MON – POTFS				
POTFSM(12)	monthly parameter for scour potency factor. Only required if VPFSFG = 1	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
MON – ACCUM				
ACQOPM(12)	montly parameter for rate of accumulation of QUALOF. Only required if VQOFG = 1	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
MON – SQOLIM				
SQOLIM(12)	monthly parameter for maximum storage of QUALOF. Only required if VQOFG = 1	1. 0 E-6 qty/ac 2.0 E-6 qty/ha	1.0 E-6 2.0 E-6	none none
MON - IFLW – CONC				
IOQCM(12)	monthly parameter for concentration of QUAL in interflow. Only required if VIQCFG > 0	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
MON - GRND – CONC				
AOQCM(12)	monthly parameter for concentration of QUAL in groundwater. Only required if VAQCFG > 0	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
		MSTLAY		
UZSN – LZSN				
UZSN	nominal upper zone storage	none in none mm	0.01 0.25	10.0 250.0
LZSN	nominal lower zone storage	none in none mm	0.01 0.25	100.0 2500.0
SURS	initial surface detention storage	0.001 in 0.025 mm	0.001 0.025	100.0 2500.0
MST – PARM				
SLMPF	factor to adjust solute percolation rates from the surface layer storage to the upper layer principal storage.	1.0	0.001	1.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ULPF	factor to adjust solute percolation rates from the upper layer principal storage to the lower layer storage.	1.0	1.0	10.0
LLPF	factor to adjust solute percolation rates from the lower layer storage to the active and inactive groundwater.	1.0	1.0	10.0
MST – TOPSTOR				
SMSTM	initial moisture content in the surface storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
UMSTM	initial moisture content in the upper principal storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
IMSTM	initial moisture content in the upper transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
MST – TOPFLX				
FSO	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FSP	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FII	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FUP	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FIO	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
MST – SUBSTOR				
LMSTM	initial moisture storage in the lower layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMSTM	initial moisture storage in the active groundwater layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
MST – SUBFLX				
FLP	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
FLDP	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
FAO	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
	PEST			
PEST – FLAGS				
<ITMXPS(*)>	maximum number of iterations used in solving Freundich adsorption isotherm	30	1	100
SOIL – DATA				
<depths>	thicknesses of the surface, upper, lower, and groundwater layers	none in none mm	0.001 0.0025	1000 2500

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
<bulkdens>	bulk densities of the surface, upper, lower, and groundwater layers	103 lb/ft^3 1.65 gm/cc	50 0.80	150 2.40
PEST – ID				
<PESTID(*)>	names of pesticides being simulated	none	none	none
PEST – THETA				
THDSPS	adjusts the desorption rate parameter to reflect temperature dependence (by modified Arrhenius equation)	1.05	1.00	2.00
THADPS	adjusts the adsorption rate parameter to reflect temperature dependence (by modified Arrhenius equation)	1.05	1.00	2.00
PEST – FIRSTPM				
KDSPS	desorption rate at 35 deg C	0.0 (1/day)	0.0	none
KADPS	adsorption rate at 35 deg C	0.0 (1/day)	0.0	none
PEST – CMAX				
CMAX	maximum solubility of the pesticide in water	0.0 ppm	0.0	none
PEST – SVALPM				
XFIX	maximum concentration (on the soil) of pesticide which is permanently fixed to the soil	0.0 ppm	0.0	none
K1	coefficient parameter for the Freundlich adsorption/ desorption equation.	0.0 (1/kg)	0.0	none
N1	exponent for the Freundlich adsorption/desorption equation	none	1.0	none
PEST – NONSVPM				
XFIX	maximum concentration (on the soil) of pesticide which is permanently fixed in the soil. Only used if ADOPFG = 3 (non-single value Freundlich Method)	0.0 ppm	0.0	none
K1	coefficient parameter for the adsorption Freundlich curve	0.0 (1/kg)	0.0	none
N1	exponent parameter for the adsorption Freundlich curve	none	1.0	none
N2	exponent for the auxiliary (desorption) curve	none	1.0	none
PEST – DEGRAD				
SDGCON	degradation rate of the pesticide in the surface layer	0.0 (1/day)	0.0	1.0
UDGCON	degradation rate of the pesticide in the upper layer	0.0 (1/day)	0.0	1.0
LDGCON	degradation rate of the pesticide in the lower layer	0.0 (1/day)	0.0	1.0
ADGCON	degradation rate of the pesticide in groundwater	0.0 (1/day)	0.0	1.0
PEST - STOR1 <for surface, upper lower, and groundwater layers, separately>				
PSCY	initial storage of pesticide in crystalline form	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PSAD	initial storage of pesticide in adsorbed form	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PSSU	initial storage of pesticide in solution	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PEST - STOR2				
IPS	Initial storage of pesticide in the upper layer transitory (interflow) storage. Only dissolved pesticide is used here	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
	NITR			
NIT – FLAGS				
VNUTFG	flag for plant uptake parameters	0	0	1
FORAFG	flag for ammonium adsorption/desorption option	0	0	1
ITMAXA	plant nitrogen uptake reaction rate parameter for lower layer	30	1	100
BNUMN	number of timesteps between biochemical recalculation	none	1	1000
CNUMN	number of timesteps between adsorption recalculation	none	1	1000
NIT – UPTAKE				
SKPLN	plant nitrogen uptake reaction rate parameter for surface layer	0.0 (1/day)	0.0	none
UKPLN	plant nitrogen uptake reaction rate parameter for upper layer	0.0 (1/day)	0.0	none
LKPLN	plant nitrogen uptake reaction rate parameter for lower layer	0.0 (1/day)	0.0	none
AKPLN	plant nitrogen uptake reaction rate parameter for active groundwater layer	0.0 (1/day)	0.0	none
MON – NITUPT <for surface, upper, lower, and groundwater layers, separately>				
KPLNM(*)	monthly parameter for plant nitrogen uptake reaction rate	0.0 (1/day)	0.0	none
NIT – FSTGEN				
NO3UTF	fraction of nitrogen uptake which comes from nitrate	1.0	0.001	1.0
NH4UTF	fraction of nitrogen uptake which comes from ammonium	0.0	0.0	1.0
<temperature correction coefficients for the following reactions>				
THPLN	plant uptake	1.07	1.0	2.0
THKDSA	Ammonium desorption	1.05	1.0	2.0
THKADA	Ammonia adsorption	1.05	1.0	2.0
THKIMN	nitrate immobilization	1.07	1.0	2.0
THKAM	organic N ammonification	1.07	1.0	2.0
THKDNI	NO3 denitrification	1.07	1.0	2.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
THKNI	Nitrification	1.05	1.0	2.0
THKIMA	Ammonium immobilization	1.07	1.0	2.0
NIT – FSTPM <first-order reaction rate parameters for the following reactions				
KDSAM	Ammonium desorption	0.0 (1/day)	0.0	none
KADAM	Ammonium adsorption	0.0 (1/day)	0.0	none
KIMNI	Nitrate immobilization	0.0 (1/day)	0.0	none
KAM	Organic N ammonification	0.0 (1/day)	0.0	none
KDNI	Denitrification of NO3	0.0 (1/day)	0.0	none
KNI	Nitrification	0.0 (1/day)	0.0	none
KIMAM	Ammonium immobilization	0.0 (1/day)	0.0	none
NIT – CMAX				
CMAX	Maximum solubility of ammonium in water	0.0 ppm	0.0	none
NIT – SVALPM				
XFIX	Information in this data group is analogous to PEST-SVALPM (used only if FORAFG = 1)			
K1				
N1				
NIT - STOR1 <for surface, upper, lower, and groundwater layers, separately>				
ORGN	Initial storage of organic N	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMAD	Initial storage of adsorbed ammonium	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMSU	Initial storage of solution ammonium	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
NO3	Initial storage of nitrate	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PLTN	Initial N stored in plants, derived from this layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
NIT - STOR2				
IAMSU	Initial quantity of ammonium in upper layer transitory storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
INO3	Initial quantity of nitrate in upper layer transitory storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
		PHOS		
PHOS-FLAGS				
VPUTFG	flag for plant uptake parameters	0	0	1
FORPFG	flag for phosporus adsorption/desorption option	0	0	1
ITMAXP	maximum number of iterations for Freudlich method	30	1	100

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
BNUMP	number of timesteps between biochemical recalculation	none	1	1000
CNUMP	number of timesteps between adsorption recalculation	none	1	1000
PHOS-UPTAKE				
SKPLP	This data set is analogous to *NIT-UPTAKE*			
UKPLP				
LKPLP				
AKPLP				
MON – PHOSUPT				
KPLPM(*)	This data set is analogous to MON-NITUPT			
PHOS-FSTGEN <temperature correction coefficients for the following reactions>				
THPLP	plant uptake	1.07	1.0	2.0
THKDSP	phosphate desorption	1.05	1.0	2.0
THKADP	phosphate adsorption	1.05	1.0	2.0
THKIMP	phosphate immobilization	1.07	1.0	2.0
THKMP	organic P mineralization	1.07	1.0	2.0
PHOS-FSTPM				
KDSP	phosphate desorption	0.0 (1/day)	0.0	none
KADP	phosphate adsorption	0.0 (1/day)	0.0	none
KIMP	phosphate immobilization	0.0 (1/day)	0.0	none
KMP	organic P mineralization	0.0 (1/day)	0.0	none
PHOS-CMAX				
CMAX	maximum solubility of phosphate	0.0 ppm	0.0	none
PHOS – SVALPM				
XFIX	this data set is identical to NIT-SVALPM. It is only used if FORPFG = 1			
K1				
N1				
PHOS - STOR1 <for surface, upper, lower, and groundwater layers, separately>				
ORGP	initial storage of organic P	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
P4AD	initial storage of adsorbed phosphate	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
P4SU	initial storage of phosphate in solution	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PLTP	initial P stored in plants, derived from this layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PHOS - STOR2				
IP4SU	initial storage of phosphate in upper layer transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
	TRACER			
TRAC – ID				
TRACID(*)	name of tracer substance	none	none	none
TRAC-TOPSTOR				
STRSU	initial quantity of tracer (conservative) in surface storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
UTRSU	initial quantity of tracer in upper principal storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
ITRSU	initial quantity of tracer in upper transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
TRAC – SUBSTOR				
LTRSU	initial storage of tracer in lower layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
ATRSU	initial storage of tracer in active groundwater layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	ATEMP			
IMPLND ATEMP	This section is analogous to ATEMP in the PERLND group			
	SNOW			
IMPLND SNOW	This section is analogous to ATEMP in the PERLND group			
	IWATER			
IWAT-PARM1				
CSNOFG	flag to consider effects of snow accumulation and melt	0	0	1
RTOPFG	flag for overland flow routing method	0	0	1
VRSFG	flag for retention storage capacity	0	0	1
VNNFG	flag for Manning□s n for the overland flow plane	0	0	1
RTLIFG				
IWAT-PARM2				
LSUR	length of the assumed overland flow plane	none ft none m	1.0 0.3	none none
SLSUR	slope of the assumed overland flow plane	none	0.000001	10.0
NSUR	Manning□s n for the overland flow plane	0.1	0.001	1.0
RETSC	retention (interception) storage capacity of the surface	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
IWAT - PARM3				
PETMAX	air temp. below which ET will arbitrarily be reduced below the value obtained from the input time series. Only use if CSNOFG = 1	40.0 F 4.5 C	none none	none none
PETMIN	temp. below which ET will be zero regardless of the value in the input time series.	35.0 F 1.7 C	none none	none none
MON - RETN				
RETSCM(12)	monthly retention storage capacity values. Only use if VRSFG = 1	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
MON – MANNING				
NSURM(12)	monthly values for Manning□s n values. Only required if VNNFG = 1	0.10	0.001	1.0
IWAT - STATE1				
RETS	retention storage	0.001 in 0.025 mm	0.001 0.025	100 2500
SURS	surface (overland flow) storage	0.001 in 0.025 mm	0.001 0.025	100 2500
	SOLIDS			
SLD – PARM1				
VASDFG	flag for solid accumulation rate	0	0	1
VRSDFG	flag for solid removal rate option	0	0	1
SDOPFG	flag that determines the algorithm used to simulate removal of sediment from the land surface	0	0	1

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SLD - PARM2				
KEIM	coefficient in the solids washoff equation	0.0	0.0	None
JEIM	exponent in the solids washoff equation	none	none	none
ACCSDP	rate at which solids accumulate on the land surface	0.0 tons/ac.day 0.0 tonnes/ha.day	0.0 0.0	none none
REMSDP	fraction of solids storage which is removed each day when no runoff	0.0 (1/day)	0.0	1.0
MON – SACCUM				
ACCSDM(12)	monthly solids accumulation rates. Only needed if VASDFG = 1	0.0 tons/ac.day 0.0 tonnes/ha.day	0.0 0.0	none none
MON – REMOV				
REMSDM(12)	monthly solids unit removal rate. Only needed if VRSDFG = 1	0.0 1/day	0.0	1.0
SLD – STOR				
SLDS	initial storage of solids	0.0 tons/ac 0.0 tonnes/ha	0.0 0.0	none none
		IWTGAS		
IWT – PARM1				
WTFVFG	flag to choose constant or monthly temperature regression parameters	0	0	1
CSNOFG	flag to consider effects of snow accumulation and melt	0	0	1
IWT - PARM2				
ELEV	elevation of the impervious land segment (ILS) above sea level	0.0 ft 0.0 m	-1000.0 -300.0	30000.0 9100.0
AWTF	surface water temperature, when the air temperature is 32 degrees F	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
BWTF	slope of the surface water temperature regression equation	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
MON - AWTF				
AWTFM(12)	monthly values for AWTF. Only required if WTFVFG = 1	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
MON – BTWF				
BWTFM(12)	monthly values for slope of the surface water temperature regression equation. Only required if WTFVFG = 1	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
IWT – INIT				
SOTMP	initial temperature of the surface runoff	60.0 F 16.0 C	32.0 0.01	100.0 38.0
SODOX	initial DO content of the surface runoff	0.0 mg/l	0.0	20.0
SOCO2	initial CO_2 content of the surface runoff	0.0 mg c/l	0.0	1.0

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	IQUAL			
QUAL – PROPS				
QSDFG	flag for sediment associated constituent	0	0	1
VPFWFG	flag for scour potency factor	0	0	1
QSOFG	flag for overland flow associated constituent	0	0	1
VQOFG	flag for accumulation and limiting storage	0	0	1
QUAL – INPUT				
SQO	initial storage of overland flow associated constituent (QUALOF) on the surface of the ILS	0.0 qty/ac 0.0 qty/ha	0.0 0.0	none none
POTFW	Washoff potency factor. Only applicable if the constituent is sediment associated constituent (QUALSD)	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
ACQOP	rate of accumulation of QUALOF	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
SQOLIM	maximum storage of QUALOF	0.000001 qty/ac 0.000002 qty/ha	0.000001 0.000002	none none
WSQOP	rate of surface runoff which will remove 90% of stored QUALOF per hour	1.64 in/hr 41.7 mm/hr	0.01 0.25	none none
MON - POTFW	this data set is identical to the corresponding table in PERLND			
MON - ACCUM	this data set is identical to the corresponding table in PERLND			
MON - SQOLIM	this data set is identical to the corresponding table in PERLND			

Table B.1.3 RCHRES (River / Reservoir Reach)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	HYDR			
HYDR – PARM1				
VCONFG	flag for F[VOL] outflow demand components	0	0	1
AUX1FG	flag to calculate depth, stage, surface area, average depth, and top width	0	0	1
AUX2FG	flag to calculate average velocity and average cross-sectional area	0	0	1
AUX3FG	flag to calculate shear velocity and bed shear stress	0	0	1
ODFVFG	flag for F[VOL] component of the outflow demand	0	-5	8
ODGTFG	flag for G[T] component of the outflow demand	0	0	5
FUNCT	flag for combining outflow demand components	1	1	3
HYDR - PARM2				
FTBDSN	WDM table dataset number containing the F-Table	0	0	999
FTABNO	if FTBDSN = 0, then FTABNO is the user's number for the F-Table which contains the geometric and hydraulic properties of RCHRES. Else, it is the WDM table indicator	none	1	999
LEN	length of the RCHRES	none miles none km	0.01 0.016	none none
DELTH	drop in water elevation from the upstream to the downstream extremities of the RCHRES	0.0 ft 0.0 m	0.0 0.0	none none
STCOR	correction to the RCHRES depth to calculate stage	0.0 ft 0.0 m	none none	none none
KS	weighting factor for hydraulic routing	0.0	0.0	0.99
DB50	median diameter of the bed sediment (assumed constant throughout the run)	0.01 in 0.25 mm	0.0001 0.0025	100.0 2500.0
MON – CONVF				
CONVFM(12)	monthly F(VOL) adjustment factors	0.0	0.0	none
HYDR – INIT				
VOL	initial volume of water in RCHRES	0.0 acre-ft 0.0 Mm^3	0.0 0.0	none none
COLIND(5)	for an exit, it indicates the pair of columns used to evaluate the initial value of the F(VOL) component of outflow demand for the exit	4.0	4.0	8.0
OUTDGT(5)	specifies the G(T) component of the initial outflow demand for each exit from RCHRES	0.0 ft^3/s 0.0 m^3/s	0.0 0.0	none none
	ADCALC			
ADCALC – DATA				
CRRAT	ratio of maximum velocity to mean velocity in the RCHRES cross section under typical flow conditions	1.5	1.0	none
VOL	volume of water in the RCHRES at the start of the simulation. Not required if **HYDR** is active	0.0 acre-ft 0.0 Mm^3	0.0 0.0	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	CONS			
CONS - DATA				
CONID(5)	name of the conservative constituent	none	none	none
CON	initial concentration of the constituent	0.0	0.0	none
CONCID	specifies the concentration units of the constituent	none	none	none
CONV	conversion factor from QTYID/VOL to CONCID	none	1.0E-30	none
QTYID	specifies the units which the total flow of the constituent into or out of RCHRES will be expressed	none	none	None
	HTRCH			
HEAT – PARM				
ELEV	mean RCHRES elevation	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
ELDAT	difference in elevation between the RCHRES and the air temperature gage (positive if RCHRES is higher than the gage)	0.0 ft 0.0 m	none none	none none
CFSAEX	fraction of RCHRES surface exposed to radiation	1.0	0.001	2.0
KATRAD	longwave radiation coefficient	9.37	1.0	20.0
KCOND	conduction - convection heat transport coefficient	6.12	1.0	20.0
KEVAP	evaporation coefficient	2.24	1.0	10.0
HEAT – INIT				
TW	initial water temperature in RCHRES	60.0 F 15.5 C	32.0 0.0	200.0 95.0
AIRTMP	initial air temperature at RCHRES	60.0 F 15.5 C	-90.0 -70.0	150.0 65.0
	SEDTRN			
SANDFG				
SANDFG	flag to choose method for sand load simulation: Toffaletti, Colby, or user-specified power function	3	1	3
SED – GENPARM				
BEDWID	width of the cross-section over which HSPF will assume bed sediment is deposited regardless of stage, top-width, etc. Used to estimate bed sediment depth	none ft none m	1.0 0.3	none none
BEDWRN	bed depth, which if exceeded will create warning message	100.0 ft 30.5 m	0.001 0.0003	none none
POR	porosity of the bed (volume voids / total volume) used to estimate bed depth	0.5	0.1	0.9
SED – HYDPARM				
LEN	length of RCHRES	none mi none km	0.01 0.016	none none
DELTH	drop in water elevation	0.0 ft 0.0 m	0.0 0.0	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
DB50	median diameter of bed sediment	0.01 in 0.25 mm	0.0001 0.0025	100.0 2500.0
SAND - PM				
D	effective diameter of the transported sand particles	none in none mm	0.001 0.025	100.0 2500.0
W	corresponding fall velocity in still water	none in/sec none mm/sec	0.02 05	500.0 12500.0
RHO	density of the sand particles	2.65 gm/cm^3	1.0	4.0
KSAND	coefficient in the sand load power function formula	0.0	0.0	none
EXPSND	exponent in the sand load power function formula	0.0	0.0	none
SILT - CLAY - PM				
D	effective diameter of the particles	0.0 in 0.0 mm	0.0 0.0	0.003 0.07
W	fall velocity in still water	0.0 in/sec 0.0 mm/sec	0.0 0.0	0.2 5.0
RHO	density of the particles	2.65 gm/cm^3	2.0	4.0
TAUCD	critical bed shear stress for deposition. Above this stress, there will be no deposition	1.0E10 lb/ft^2 1.0E10 kg/m^2	1.0E-10 1.0E-10	none none
TAUCS	critical bed shear stress for scour. Below this value there will be no scour	1.0E10 lb/ft^2 1.0E10 kg/m^2	1.0E-10 1.0E-10	none none
M	erodibility coefficient of the sediment	0.0 lb/ft^2.d 0.0 kg/m^2.d	0.0 0.0	none none
SSED – INIT				
SSED(3)	three values are initial concentrations of suspended sand, silt, and clay, respectively	0.0 mg/l	0.0	none
BED – INIT				
BEDDEP	initial total depth (thickness) of the bed	0.0 ft 0.0 m	0.0 0.0	none none
<fracsand>	initial fraction (by weight) of sand in bed material	1.0	0.0001	1.0
<fracsilt>	initial fraction of silt	0.0	0.0	0.9999
<fracclay>	initial fraction of clay	0.0	0.0	0.9999
	GQUAL			
GQ - GENDATA				
TEMPFG	flag for source of water temperature data	2	1	3
PHFLAG	flag for source of pH data	2	1	3
ROXFG	flag for source of free radical oxygen data	2	1	3
CLDFG	flag for source of cloud cover data	2	1	3
SDFG	flag for source of total sediment concentration data	2	1	3
PHYTFG	flag for source of phytoplankton data	2	1	3
LAT	latitude of RCHRES	0 degrees	-54	54

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
GQ - QALDATA				
GQID	name of constituent (qual)	none	none	none
DQAL	initial dissolved concentration of qual	0.0	0.0	none
CONCID	concentration units (implied “per liter”)	none	none	none
CONV	factor to convert from qty/vol to concentration units	none	1.0E-30	none
QTYID	name of qty unit for qual	none	none	none
GQ – HYDPM				
KA	second order acid rate constant for hydrolysis	none 1/sec	1.0E-30	none
KB	second order base rate constant for hydrolysis	none 1/sec	1.0E-30	none
KN	first order rate constant of neutral reaction with water	none 1/sec	1.0E-30	none
THHYD	temperature correction coefficient for hydrolysis	1.0	1.0	2.0
GQ – ROXPM				
KOX	second order rate constant for oxidation by free radical oxygen	none 1/sec	1.0E-30	none
THOX	temperature correction coefficient for oxidation by free radical oxygen	1.0	1.0	2.0
GQ – PHOTPM				
PHOTPM(1-18)	molar absorption coefficients for qual for 18 wavelength ranges of light	0.0 (1/cm)	0.0	none
PHOTPM(19)	quantum yield for the qual in air-saturated pure water	1.0	0.0001	10.0
PHOTPM(20)	temperature correction coefficient for photolysis	1.0	1.0	2.0
GQ - CFGAS				
CFGAS	ratio of volatilization rate to oxygen reaeration rate	none	1.0E-30	none
GQ – BIOPM				
BIOCON	second order rate constant for biodegradation of qual by biomass	none 1/mg.day	1.0E-30	none
THBIO	temperature correction coefficient for biodegradation of qual	1.07	1.0	2.0
BIO	concentration of biomass causing biodegradation of qual	none mg/l	0.00001	none
MON – BIO				
BIOM(12)	monthly values of biomass	none mg/l	0.00001	none
GQ – GENDECAY				
FSTDEC	first order decay rate for qual	none 1/day	0.00001	none
THFST	temperature correction coefficient for first order decay of qual	1.07	1.0	2.0
GQ – SEDDECAY				
ADDCPM(1)	decay rate for qual adsorbed to suspended sediment	0.0 (1/day)	0.0	none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ADDCPM(2)	temperature correction for decay of qual on suspended sediment	1.07	1.0	2.0
ADDCPM(3)	decay rate for qual adsorbed to bed sediment	0.0 (1/day)	0.0	none
ADDCPM(4)	temperature correction coefficient for decay of qual on bed sediment	1.07	1.0	2.0
GQ – KD				
ADPM(1,1)	distribution coefficient for qual with suspended sand	none 1/mg	1.0E-10	none
ADPM(2,1)	with suspended silt	none 1/mg	1.0E-10	none
ADPM(3,1)	with suspended clay	none 1/mg	1.0E-10	none
ADPM(4,1)	with bed sand	none 1/mg	1.0E-10	none
ADPM(5,1)	with bed silt	none 1/mg	1.0E-10	none
ADPM(6,1)	with bed clay	none 1/mg	1.0E-10	none
GQ – ADRATE				
ADPM(1,2)	transfer rate between adsorbed and desorbed states for qual with suspended sand	none 1/day	0.00001	none
ADPM(2,2)	with suspended silt	none 1/day	0.00001	none
ADPM(3,2)	with suspended clay	none 1/day	0.00001	none
ADPM(4,2)	with bed sand	none 1/day	0.00001	none
ADPM(5,2)	with bed silt	none 1/day	0.00001	none
ADPM(6,2)	with bed clay	none 1/day	0.00001	none
GQ – ADTHETA				
ADPM(1,3)	temperature correction coefficients for adsorption / desorption on suspended sand	1.07	1.0	2.0
ADPM(2,3)	on suspended silt	1.07	1.0	2.0
ADPM(3,3)	on suspended clay	1.07	1.0	2.0
ADPM(4,3)	on bed sand	1.07	1.0	2.0
ADPM(5,3)	on bed silt	1.07	1.0	2.0
ADPM(6,3)	on bed clay	1.07	1.0	2.0
GQ – SEDCONC				
SQAL(1)	initial concentration of qual on suspended sand	0.0 concu/mg	0.0	none
SQAL(2)	on suspended silt	0.0 concu/mg	0.0	none
SQAL(3)	on suspended clay	0.0 concu/mg	0.0	none
SQAL(4)	on bed sand	0.0 concu/mg	0.0	none
SQAL(5)	on bed silt	0.0 concu/mg	0.0	none
SQAL(6)	on bed clay	0.0 concu/mg	0.0	none
GQ – VALUES				
TWAT	water temperature (if modeled as constant, i.e., TEMPFG = 2)	60.0 F 15.5 C	32.0 0.1	212.0 100.0
PHVAL	pH (if modeled as constant i.e., PHFLAG = 2)	7.0	1.0	14.0

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ROC	free radical oxygen concentration (if modeled as constant, i.e., ROXFG = 2)	0.0 mol/l	0.0	none
CLD	cloud cover (if modeled as constant, i.e., CLDFG = 2)	0.0 tenths	0.0	10.0
SDCNC	total suspended sediment concentration (if modeled as constant, i.e., SDFG = 2)	0.0 mg/l	0.0	none
PHY	phytoplankton concentration (as biomass) (if modeled as constant, i.e., PHYTFG = 2)	0.0 mg/l	0.0	none
MON – WATEMP				
TEMPM(12)	monthly values of water temperature (if TEMPFG = 3)	60.0 F 15.5 C	32.0 0.0	212.0 100.0
MON – PHVAL				
PHVALM(12)	monthly values of pH (if PHFLAG = 3)	7.0	1.0	14.0
MON – ROXYGEN				
ROCM(12)	monthly values of free radical oxygen (if ROXFG = 3)	0.0 mol/l	0.0	none
GQ - ALPHA				
ALPH(18)	Values of base absorbance coefficient	none 1/cm	0.00001	none
GQ – GAMMA				
GAMM(18)	Values of sediment absorbance coefficient	0.0 (1/mg.cm)	0.0	none
GQ - DELTA				
DEL(18)	values of phytoplankton absorbance	0.0 (1/mg.cm)	0.0	none
GQ – CLDFACT				
KCLD(18)	light extinction efficiency of cloud cover	0.0	0.0	1.0
MON - CLOUD				
CLDM(12)	monthly values of average cloud cover	0.0 tenths	0.0	10.0
MON – SEDCONC				
SEDCNCM(12)	monthly average suspended sediment concentration	0.0 mg/l	0.0	none
MON – PHYTO				
PHYM(12)	monthly values of phytoplankton concentration	0.0 mg/l	0.0	none
GQ – DAUGHTER				
C(2,1)	indicates the amount of qual #2 which is produced by decay of qual #1 through all simulated decay processes	0.0	0.0	none
C(3,1)		0.0	0.0	none
C(3,2)		0.0	0.0	none
		RQUAL		
BENTH – FLAG				
BENRFG	flag to choose benthal influences	0	0	1

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SCOUR – PARMS				
SCRVEL	velocity above which effects of scouring on benthal release rates is considered	10.0 ft/sec 3.05 m/sec	0.01 0.01	none none
SCRMUL	multiplier to increase benthal releases during scouring	2.0	1.0	none
	OXRX			
OX - FLAGS				
REAMFG	flag to choose reaeration calculation method	2	1	3
OX - GENPARM				
KBOD20	unit BOD decay rate @ 20 degrees C	none 1/hr	1.0E-30	none
TCBOD	temperature correction coefficient for BOD decay	1.075	1.0	2.0
KODSET	rate of BOD settling	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
SUPSAT	maximum allowable dissolved oxygen supersaturation (expressed as multiple of DO saturation concentration)	1.15	1.0	2.0
ELEV				
ELEV	mean elevation of RCHRES (above seal level)	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
OX - BENPARM				
BENOD	benthal oxygen demand at 20 degrees C (with unlimited DO concentration)	0.0 $mg/m^2.hr$	0.0	none
TCBEN	temperature correction coefficient for benthal oxygen demand	1.074	1.0	2.0
EXPOD	exponential factor in the dissolved oxygen term of the benthal oxygen demand equation	1.22	0.1	none
BRBOD(1)	benthal release of BOD at high oxygen concentration	72.0 $mg/m^2.hr$	0.0001	none
BRBOD(2)	increment to benthal release of BOD under anaerobic conditions	100.0 $mg/m^2.hr$	0.0001	none
EXPREL	exponential factor in the dissolved oxygen term of the benthal BOD release equation	2.82	0.1	none
OX - CFOREA				
CFOREA	correction factor in the lake reaeration equation, to account for good or poor circulation characteristics	1.0	0.001	10.0
OX - TSIVOGLOU				
REAKT	empirical constant in Tsivoglou's equation for reaeration (escape coefficient)	0.08 1/ft	0.001	1.0
TCGINV	temperature correction coefficient for surface gas invasion (if REAMFG = 1)	1.047	1.0	2.0
OX - LEN – DELTH				
LEN	length of RCHRES	none mi none km	0.01 0.01	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
DELTH	drop (energy) over its length	none ft none m	0.00001 0.00001	none none
OX – TCGINV				
TCGINV	temperature correction coefficient for surface gas invasion (if REAMFG = 2)	1.047	1.0	2.0
OX – REAPARM				
TCGINV	see above (if REAMFG = 3)	1.047	1.0	2.0
REAK	empirical constant for equation used to calculate reaeration coefficient	none 1/hr	1.0E-30	none
EXPRED	exponent to depth used in calculation of reaeration coefficient	0.0	none	0.0
EXPREV	exponent to velocity used in calculation of reaeration coefficient	0.0	0.0	none
OX – INIT				
DOX	dissolved oxygen	0.0 mg/l	0.0	20.0
BOD	biochemical oxygen demand	0.0 mg/l	0.0	none
SATDO	dissolved oxygen saturation concentration	10.0 mg/l	0.1	20.0
	NUTRX			
NUT - FLAGS				
TAMFG	flag to simulate total ammonia	0	0	1
NO2FG	flag to simulate nitrite	0	0	1
PO4FG	flag to simulate ortho-phosphorus	0	0	1
AMVFG	flag to simulate ammonia evaporization	0	0	1
DENFG	flag to simulate denitrification	0	0	1
ADNHFG	flag to simulate NH4 adsorption	0	0	1
ADPOFG	flag to simulate PO4 adsorption	0	0	1
PHFLAG	flag for source of pH data	2	1	3
CONV - VAL1				
CVBO	Conversion from milligrams biomass to milligrams oxygen	1.98 mg/mg	1.0	5.0
CVBPC	Conversion from biomass expressed as phosphorus to carbon equivalency	106.0 mol/mol	50.0	200.0
CVBPN	conversion from biomass expressed as phosphorus to nitrogen equivalency	16.0 mol/mol	10.0	50.0
BPCNTC	percentage, by weight, of biomass which is carbon	49.0	10.0	100.0
NUT – BENPARM				
BRTAM(2)	benthal release of total ammonia. (1) indicates aerobic rate and (2) indicates anaerobic rate	0.0 $mg/m^2.hr$	0.0	none
BRPO4(2)	benthal release of ortho-phosphate. Subscripts same as above	0.0 $mg/m^2.hr$	0.0	none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ANAER	concentration of dissolved oxygen below which anaerobic conditions exist	0.005 mg/l	0.0001	1.0
NUT – NITDENIT				
KTAM20	nitrification rate of ammonia at 20 degrees C	none 1/hr	0.001	none
KNO220	nitrification rate of nitrite at 20 degrees C	none 1/hr	0.001	none
TCNIT	temperature correction coefficient for nitrification	1.07	1.0	2.0
KNO320	nitrification rate of nitrate at 20 degrees C	none 1/hr	0.001	none
TCDEN	temperature correction coefficient for denitrification	1.07	1.0	2.0
DENOXT	dissolved oxygen concentration threshold for denitrification	2.00 mg/l	0.0	none
NUT - NH3VOLAT				
EXPNVG	exponent in the gas layer mass transfer coefficient equation for NH_3 volatilization	0.5	0.1	2.0
EXPNVL	exponent in the liquid layer mass transfer coefficient equation for NH_3 volatilization	0.6667	0.1	2.0
NUT – BEDCONC				
BNH4(3)	constant bed concentrations of NH4-N adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
BPO4(3)	constant bed concentrations of PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
NUT – ADSPARM				
ADNHPM(3)	partition coefficients for NH4-N adsorbed to (1) sand, (2) silt, and (3) clay	1.0E-10 ml/g	1.0E-10	none
ADPOPM(3)	partition coefficients for PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	1.0E-10 ml/g	1.0E-10	none
NUT – DINIT				
NO3	initial concentration of nitrate (as N)	0.0 mg/l	0.0	none
TAM	initial concentration of total ammonia	0.0 mg/l	0.0	none
NO2	initial concentration of nitrite	0.0 mg/l	0.0	none
PO4	initial concentration of ortho-phosphorus (as P)	0.0 mg/l	0.0	none
PHVAL	constant (annual) (if PHFLAG = 2) or initial value (if PHFLAG = 1 or 3) of pH	7.0	0.0	14.0
NUT – ADSINIT				
SNH4(3)	initial concentrations of NH3-N adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
SPO4(3)	initial concentrations of PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
	PLANK			
PLANK - FLAGS				
PHYFG	flag to simulate phytoplankton	0	0	1
ZOOFG	flag to simulate zooplankton	0	0	1

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
BALFG	flag to simulate benthic algae	0	0	1
SDLTFG	flag to simulate influence of sediment washload on light extinction	0	0	1
AMRFG	flag to simulate ammonia retardation of nitrogen limited growth	0	0	1
DECFG	flag to simulate linkage between carbon dioxide and phtytoplankton growth	0	0	1
NSFG	flag to simulate ammonia as part of available nitrogen supply in nitrogen limited growth calculations	0	0	1
ZFOOD	flag to indicate quality of zooplankton food	2	1	3
SURF - EXPOSED				
CFSAEX	used to adjust the input solar radiation to make it applicable to RCHRES. e.g., account for shading by trees	1.0	0.001	1.0
PLNK - PARM1				
RATCLP	ratio of chlorophyll content of biomass to phosphorus content	0.6	0.01	none
NONREF	nonrefractory fraction of algae and zooplankton biomass	0.5	0.01	1.0
LITSED	multiplication factor to total sediment concentration to determine sediment contribution to light extinction	0.0 (1/mg.ft)	0.0	none
ALNPR	fraction of nitrogen requirements for phytoplankton growth satisfied by nitrate	1.0	0.01	1.0
EXTB	base extinction coefficient for light	none 1/ft none 1/m	0.001 0.001	none none
MALGR	maximal unit algal growth rate	0.3 1/hr	0.001	none
PLNK - PARM2				
CMMLT	Michaelis-Menten constant for light limited growth	0.033 ly/min	1.0E-6	none
CMMN	nitrate Michaelis-Menten constant for nitrogen limited growth	0.045 mg/l	1.0E-6	none
CMMNP	nitrate Michaelis-Menten constant for phosphorus limited growth	0.0284 mg/l	1.0E-6	none
CMMP	phosphate Michaelis-Menten constant for phosphorus limited growth	0.0150 mg/l	1.0E-6	none
TALGRH	temperature above which algal growth ceases	95.0 F 35.0 C	50.0 10.0	212.0 100.0
TALGRL	temperature below which algal growth ceases	43.0 F 6.1 C	32.0 0.0	212.0 100.0
TALGRM	temperature below which algal growth is retarded	77.0 F 25.0 C	32.0 0.0	212.0 100.0
PLNK - PARM3				

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ALR20	algal unit respiration rate at 20 degrees C	0.004 1/hr	1.0E-6	none
ALDH	high algal unit death rate	0.01 1/hr	1.0E-6	none
ALDL	low algal unit death rate	0.001 1/hr	1.0E-6	none
OXALD	increment to phytoplankton unit death rate due to anaerobic conditions	0.03 1/hr	1.0E-6	none
NALDH	inorganic nitrogen concentration below which high algal death rate occurs (as nitrogen)	0.0 mg/l	0.0	none
PALDH	inorganic phosphorus concentration below which high algal death rate occurs (as phosphorus)	0.0 mg/l	0.0	none
PHYTO – PARM				
SEED	concentration of plankton not subject to advection under high flow conditions	0.0 mg/l	0.0	none
MXSTAY	concentration of plankton not subject to advection at very low flow conditions	0.0 mg/l	0.0	none
OREF	outflow at which concentration of plankton not subject to advection is midway between SEED and MXSTAY	0.0001 ft^3/s 0.0001 m^3/s	0.0001 0.0001	none none
CLALDH	chlorophyll A concentration above which high algal death rate occurs	50.0	0.01	none
PHYSET	rate of phytoplankton settling	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
REFSET	rate of settling for dead refractory organics	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
ZOO - PARM1				
MZOEAT	maximum zooplankton unit ingestion rate	0.055 mg phyto/mg zoo.hr	0.001	none
ZFIL20	zooplankton filtering rate at 20 degrees C	none 1/mg zoo.hr	0.001	none
ZRES20	zooplankton unit respiration rate at 20 degrees C	0.0015 1/hr	1.0E-6	none
ZD	natural zooplankton unit death rate	0.0001 1/hr	1.0E-6	none
OXZD	increment to unit zooplankton death rate due to anaerobic conditions	0.03 1/hr	1.0E-6	none
ZOO - PARM2				
TCZFIL	temperature correction coefficient for filtering	1.17	1.0	2.0
TCZRES	temperature correction coefficient for respiration	1.07	1.0	2.0
ZEXDEL	fraction of nonrefractory zooplankton excretion which is immediately decomposed when ingestion rate > MZOEAT	0.7	0.001	1.0
ZOMASS	average weight of a zooplankton organism	0.0003 mg/org	1.0E-6	1.0
BENAL – PARM				
MBAL	maximum benthic algae density (as biomass)	600.0 mg/m^2	0.01	none
CFBALR	ratio of benthic algal to phytoplankton respiration	1.0	0.01	1.0
CFBALG	ratio of benthic algal to phytoplankton growth rate	1.0	0.01	1.0

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PLNK – INIT				
PHYTO	phytoplankton concentration, as biomass	0.96E-6 mg/l	1.0E-10	none
ZOO	zooplankton concentration	0.03 org/l	1.0E-6	none
BENAL	benthic algae concentration, as biomass	1.0E-8 mg/m^2	1.0E-10	none
ORN	dead refractory organic nitrogen concentration	0.0 mg/l	0.0	none
ORP	dead refractory organic phosphorus concentration	0.0 mg/l	0.0	none
ORC	dead refractory organic carbon concentration	0.0 mg/l	0.0	none
	PHCARB			
PH – PARM1				
PHCNT	maximum number of iterations used to solve for pH	25	1	100
ALKCON	number of the conservative substance used to simulate alkalinity	1	1	10
PH - PARM2				
CFCINV	ratio of carbon dioxide invasion rate to oxygen reaeration rate	0.913	0.001	1.0
BRCO2(1)	benthal release of CO_2 (as carbon) for aerobic conditions	62.0 mg/m^2.hr	0.01	none
BRCO2(2)	benthal release of CO_2 for anaerobic conditions	62.0 mg/m^2.hr	0.01	none
PH - INIT				
TIC	initial total inorganic carbon	0.0 mg/l	0.0	none
CO2	initial carbon dioxide (as carbon)	0.0 mg/l	0.0	none
PH	initial pH	7.0	1.0	15.0

B.2 Weather Data Files (WDM)

Nonpoint source modeling using BASINS requires the development of a Watershed Data Management (WDM) file. The WDM file is a binary file containing time series data for all meteorological parameters required by Hydrological Simulation Program - FORTRAN (HSPF) algorithms. Section B.2.1 provides a summary of the general procedure required to develop WDM files. Section B.2.2 provides a description of the specific procedures followed during the development of the WDM files provided with BASINS Version 2.0.

B.2.1 Developing WDM Files

1. Obtain meteorological data for the desired period. (See Section B.2.2 for meteorological data sources used in the BASINS 2.0 WDM files.) BASINS requires data collected at hourly intervals for nonpoint source modeling, although daily data can be converted to hourly data through the use of METCMP (computer program for meteorological data generation - HSPF). If all meteorological parameters are not available, METCMP can be used to calculate a number of parameters, including potential evapotranspiration, evaporation, and solar radiation. BASINS currently supports the use of standard U.S. units. The required input data and units are as follows:

Data Description	U.S. units
Measured air temperature	deg. F
Measured precipitation	in/hr
Measured dewpoint temperature	deg. F
Measured wind movement	mph
Measured solar radiation	Ly/hr
Cloud cover (range: 0-10)	tenths
Potential evapotranspiration	in/hr
Potential surface evaporation	in/hr

2. Convert the meteorological data into a format recognized by HSPF and its utility programs (a sequential time series format is desirable). Data processing can be performed using a number of methods. Due to the enormous size of meteorological data files, the development of FORTRAN programs to extract and convert these data is recommended. Each meteorological parameter should be contained in a unique file. The required sequential time series file formats for meteorological data collected at hourly and daily intervals, as listed in the *Hydrologic Simulation Program-FORTRAN User's Manual*, are as follows:

   Hourly data:

   1. Alphanumeric state PO code (this field is not read)
   2. Station number or identifier (this field is not read)
   3. Year
   4. Month
   5. Card no:
      1 is for a.m. hours
      2 is for p.m. hours
   6. Twelve fields for hourly data

   The default format is: (A2, 1X, I4, 1X, I4, 1X, I2, 1X, I1, 12F5.2)

Daily data:

1. Alphanumeric state PO code (this field is not read)

2. Station number or identifier (this field is not read)

3. Last 2 digits of the calendar year

4. Month

5. Card no:
   1 is for days 1-10
   2 is for days 2-20
   3 is for days 21-

6. Ten fields, for the daily data (eleven fields for card number 3)

The default format is: (A2, I4, 1X, I2, A2, A1, 11F6.1)

Due to the nature of the HSPF model, every parameter but measured precipitation must have a value for each record during the entire time period of the file. For measured precipitation, a value must be present for every hour of each day precipitation was recorded. If data are missing, appropriate values must be assigned.

3. Create a WDM file using ANNIE (computer program for interactive hydrologic data management - see http://h2o.usgs.gov/software/annie.html) and declare the data sets into which time series data will be imported. HSPF requires a unique data set for each meteorological parameter to be imported. BASINS allocates 20 data set fields relating to specific meteorological parameters for each WDM station. Using ANNIE, data sets in WDM files are designated by a unique number and other pertinent information relating to the time series data field in which the data are imported. The following list displays data sets and a brief description of the information contained in each data set, for a template WDM file used to import both hourly and daily data sets for 10 WDM stations.

Data set Fields	Data set	Data set Numbers	Description Parameter
1	PREC	(11,31,51,...191)	hourly precipitation
2	EVAP	(12,32,52,...192)	hourly evaporation
3	ATEM	(13,33,53,...193)	hourly temperature
4	WIND	(14,34,54,...194)	hourly windspeed
5	SOLR	(15,35,55,...195)	hourly solar radiation
6	PEVT	(16,36,56,...196)	hourly potential evapotranspiration
7	DEWP	(17,37,57,...197)	hourly dewpoint temperature
8	CLOU	(18,38,58,...198)	hourly cloud cover
9	TMAX	(19,39,59,...199)	daily maximum temperature
10	TMIN	(20,40,60,...200)	daily minimum temperature
11	DWND	(21,41,61,...201)	daily windspeed
12	DCLO	(22,42,62,...202)	daily cloud cover
13	DPTP	(23,43,63,...203)	daily dewpoint temperature
14	DSOL	(24,44,64,...204)	daily solar radiation
15	DEVT	(25,45,65,...205)	daily evapotranspiration
16	DEVP	(26,46,66,...206)	daily evaporation
17	—	(27,47,67,...207)	empty
18	—	(28,48,68,...208)	empty
19	—	(29,49,69,...209)	empty
20	—	(30,50,70,...210)	empty

Data sets are numbered from 11 to 210. Note that all hourly information is listed in data fields 1 to 8. These hourly values are used by HSPF algorithms. The remaining data fields (9 to 16) contain daily time series data, as well as intermediate time series data used in the conversion of HSPF parameters.

4. Create the .inf file. The .inf file is used to relate information in the WDM file to the BASINS Nonpoint Source Model (NPSM). Each WDM file is required to have an .inf file with exactly the same name (only the extensions are different: .wdm versus .inf). The information required for the .inf file includes the number of stations in the WDM file, various station information (state, name, ID #, elevation, period of record, and the evaporation coefficient), and the data set numbers for each of the meteorological parameters for each station. Refer to .inf files packaged with BASINS for the standard format. Each state WDM file with BASINS has a corresponding .inf file located in the BASINS\DATA\MET_DATA directory.

5. Create .uci files. These files are used to import meteorological data into the WDM file. They are essentially HSPF input files which perform the import function. Refer to the *Hydrologic Simulation Program-FORTRAN User's Manual* for development of an input file for importing data into a WDM file.

6. Import meteorological data from each file (which are currently in a sequential time series format) into the corresponding WDM file data sets. This is done by running HSPF for each .uci file as follows:

   - Hourly precipitation data is imported into data sets denoted by PREC

- Hourly evaporation data are imported into data sets denoted by EVAP
- Hourly temperature data are imported into data sets denoted by ATEM
- Hourly windspeed data are imported into data sets denoted by WIND
- Hourly solar radiation data are imported into data sets denoted by SOLR
- Hourly potential evapotranspiration data are imported into data sets denoted by PEVT
- Hourly dewpoint temperature data are imported into data sets denoted by DEWP
- Hourly cloud cover data are imported into data sets denoted by CLOU
- Daily maximum temperature data are imported into data sets denoted by TMAX
- Daily minimum temperature data are imported into data sets denoted by TMIN
- Daily total wind movement data are imported into data sets denoted by DWND
- Daily cloud cover data are imported into data sets denoted by DCLO
- Daily dewpoint temperature data are imported into data sets denoted by DPTP
- Daily solar radiation data are imported into data sets denoted by DSOL
- Daily potential evapotranspiration data are imported into data sets denoted by DEVT
- Daily evaporation data are imported into data sets denoted by DEVP

7. If all meteorological data are not in an hourly format, develop additional time series data required by HSPF. This is done using METCMP (computer program for meteorological data generation - HSPF). METCMP enables a user to disaggregate daily time series data into hourly time series data for certain meteorological parameters, as well as calculate additional meteorological time series data required by HSPF algorithms.

B.2.2 BASINS WDM Files

WDM files, providing meteorological coverage for the United States and U.S. territories were prepared for BASINS 2.0 through the following steps:

1. Data were obtained from the following sources.

    a. Hourly observed precipitation data for the United States and U.S. territories were obtained from the National Climatic Data Center (NCDC) Hourly and Fifteen Minute Precipitation database, compiled by EarthInfo, Inc. This four CD-ROM data set contains precipitation data from NCDC's TD-3240 file. Included in the database are over 6000 weather stations with recorded precipitation for the general period of 1948-1995.

    b. Hourly surface observation data for the United States and U.S. territories were obtained from NCDC's Solar and Meteorological Surface Observational Network (SAMSON) and Hourly U.S. Weather Observations 1990-1995 (HUSWO) databases. SAMSON is a three CD-ROM data set containing both observational and modeled hourly solar radiation data, as well as hourly cloud cover, drybulb temperature, dewpoint temperature, and wind movement data from 237 NWS stations for the period of 1961-1990. The HUSWO data set, contained on a single CD-ROM, updates meteorological data from the SAMSON data set, excluding solar radiation data for the period of 1990-1995.

    c. The remaining parameters—potential evapotranspiration, evaporation, and solar radiation (for the period of 1991-1995)—were calculated using METCMP.

2. A coverage of WDM weather stations for BASINS 2.0 was created in ArcView using latitude and longitude coordinates from selected weather stations included in NCDC's Hourly and Fifteen Minute Precipitation database. These stations, which included the precipitation data, were then assigned meteorological data from the set of NWS stations available from the SAMSON data set. The selection of weather stations used to create the WDM station coverage, as well as the assignment of meteorological data to these stations, was performed in ArcView using an array of GIS coverages. This was done to provide a spatially distributed coverage of the United States and U.S. territories, based on information relating to annual rainfall, climatic divisions in the conterminous United States, completeness of weather station data, elevation, physical divisions in the conterminous United States, and proximity to NWS stations. A complete list of the ArcView coverages used in the selection of WDM weather stations is detailed in B.2.2.a. The resulting ArcView coverage consisted of 477 WDM weather stations for the United States and U.S. territories. This coverage was then divided by EPA regions. EPA regional coverage included WDM weather stations that closely bordered the region or were contained within HUCs intersecting the region. A complete list of the WDM stations is included in B.2.2.b.

3. The data were extracted and converted into a sequential time series format.

    a. Hourly precipitation data were extracted from the EarthInfo, Inc., NCDC Hourly and Fifteen Minute Precipitation database by exporting data for individual stations into ASCII tabular formatted files. These raw data were then preprocessed through a FORTRAN program for conversion to a sequential file format.

Missing precipitation data were assigned appropriate values. A value of 0.0 was normally used where no reading was available.

Preprocessing also included the identification and editing of rainfall accumulation values within the file. Rainfall accumulation values occurred where hourly precipitation values for a time period were not recorded.

The following assumptions and corresponding actions refer to rainfall accumulation data.

- If an accumulation value was recorded for an accumulation period of ≤ 24 hours, then the accumulation value was divided by the number of hours in the period.

    - If the resulting hourly value was ≥ 0.01 in. and < 2.0 in., then each hour in the accumulation period was given the resulting hourly value. The state code, station identifier, accumulation period end date and hour, accumulation value, number of hours in the accumulation period, resulting hourly value, and “Value Distributed” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

    - If the resulting hourly value was < 0.01 in., then each hour in the accumulation period was given a value of 0.0 in. The accumulation value (which in all situations will be ≤ 0.24 in.) was left unchanged, i.e. the original recorded accumulation value was used. The state code, station identifier, accumulation period end date and hour, accumulation value, number of hours in the accumulation period, resulting hourly value of 0.0 in., and “Calculated Value < .01, Accumulated Value Reported” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

    - If the resulting hourly value was ≥ 2.0 in., then each hour in the accumulation period was given a value of 0.0 in. The accumulation value is additionally deleted from the record. This prevented the existence of a large spike precipitation value in the data (which in all situations was ≥ 4.0 in. for the accumulation period). The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Calculated Value > 2.0, Accumulated Value Deleted” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

- If an accumulation value was recorded for an accumulation period of > 24 hours, then the accumulation value was not distributed evenly over the accumulation period.

    - If the accumulation value was < 2.0 in., then the value was not changed. The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Accumulation Interval > 24 hrs and Observed Value < 2 Accumulated Value Reported” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

    - If the accumulation value was ≥ 2.0 in., then the value was deleted from the record. The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Accumulation Interval > 24 hrs and Observed Value > 2 Accumulated Value Deleted” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

b. Hourly meteorological data were extracted from NOAA's Solar and Meteorological Surface Observational Network (SAMSON) database by exporting the yearly data files for an individual station from a CD ROM and unzipping them into an ASCII text file. These raw data were then preprocessed through a FORTRAN program to organize the data into a sequential time series format, convert the data into U.S. units, and calculate daily variables required by METCMP for the estimation of Solar Radiation (for the years 1991-95), Pan Evaporation, and Potential Evapotranspiration.

Hourly data files included:

- ATEM average hourly air temperature
- WIND average hourly wind speed
- SOLR total hourly solar radiation
- DEWP average hourly dew point temperature
- CLOU average hourly cloud cover

Daily data files included:

- TMAX maximum daily air temperature
- TMIN minimum daily air temperature
- DWND total daily wind movement
- DSOL total daily solar radiation
- DPTP average daily dew point temperature
- DCLO average daily cloud cover

Due to the nature of the data, missing data was assigned the previously recorded value.

Data conversions included:

- ATEM and DEWP from $^{\circ}$C to $^{\circ}$F
- WIND from m/s to mph
- SOLR from Wh/m^2 to Langleys (calories/cm^2)

Data calculations included:

- TMAX from ATEM
- TMIN from ATEM
- DCLO from CLOU
- DPTP from DEWP
- DSOL from SOLR
- DWND from WIND

4. WDM, .inf, and .uci iles were created using the templates described in B.2.1 steps 4 and 5 and then imported the data into WDM files as described in B.2.1 step 6.

5. Once time series data for precipitation and other meteorological data were imported into WDM file data sets, additional meteorological time series data were created. This was done using METCMP (computer program for meteorological data generation - HSPF). METCMP enables a user to

calculate additional meteorological time series data required by HSPF algorithms, as well as disaggregate daily time series data into hourly time series data for certain meteorological parameters.

- Daily solar radiation for the period 1991-1995 was computed in METCMP using daily cloud cover (DCLO) as an input. The daily solar radiation time series was placed in the DSOL data set. The METCMP disaggregate function then was used to distribute daily solar radiation into hourly values. Hourly solar radiation values were placed in the SOLR data set.

- Daily pan evaporation was computed using the Penman Method in METCMP. Required inputs were: daily maximum (TMAX) and daily minimum (TMIN) temperatures, daily dewpoint temperature (DPTP), daily wind movement (DWND), and daily solar radiation (DSOL). Daily evapotransporation was placed in the DEVP data set. Daily evaporation was distributed into hourly values using the disaggregate function. Hourly evaporation values were placed in the EVAP data set.

- Daily potential evapotranspiration was computed using the Hamon Method in METCMP. Required inputs were: daily maximum (TMAX) and daily minimum (TMIN) temperatures. Daily evapotranspiration was placed in the DEVT data set. Daily potential evapotranspiration was distributed into hourly values using the disaggregate function. Hourly potential evapotranspiration values were placed in the PEVT data set.

B.2.2.a Coverages used in BASINS WDM File Development

- A coverage of cooperative network stations from NCDC's Hourly and Fifteen Minute Precipitation database data set created using latitude and longitude coordinates. The information in this coverage includes:

Station ID#	a cooperative network index number between 1-9999.
State	the state's 2 digit postal code.
Station name	NCDC's assigned station name.
Begin date	first month, day, and year of the period of record.
End date	last month, day, and year of the period of record.
Elevation	meters above sea level (this was converted to feet).
Latitude	in degrees and minutes (always North) (this was converted to decimal degrees).
Longitude	in degrees and minutes (always west) (this was converted to decimal degrees).
Recorded years	the number of years with recorded data (there may be gaps).
Percent coverage	percent of the days between begin and end dates that have reported data.
Precipitation data	a column denoting the database containing the hourly precipitation data.
Relate column	an empty column reserved for the ID# of the NOAA weather station containing meteorological data that will be assigned to the station.

- A coverage of National Weather Service stations from NOAA's Solar and Meteorological Surface Observation Network (SAMSON) data set created using latitude and longitude coordinates. The information included in this coverage included:

Station ID#	the stations Weather Bureau Army Navy number.
State	the state's 2 digit postal code.
Station name	NCDC's assigned station name.
Timezone	lagged by universal time.
Elevation	meters above sea level (this was converted to feet).
Latitude	in degrees and minutes (always North) (this was converted to decimal degrees).
Longitude	in degrees and minutes (always west) (this was converted to decimal degrees).
Evap data	a column denoting the database containing the hourly evaporation data.
Temp data	a column denoting the database containing the hourly temperature data.
Wind data	a column denoting the database containing the hourly windspeed data.
Solar data	a column denoting the database containing the hourly solar radiation data.
Pevt data	a column denoting the database containing the hourly potential evapotranspiration data.
Dew pt data	a column denoting the database containing the hourly dew point temperature data.
Cloud data	a column denoting the database containing the hourly cloud cover data.

- A coverage of the U.S. state boundaries provided by ESRI on-line ArcData (www.esri.com).

- A coverage of annual precipitation for North America provided by ESRI on-line ArcData (www.esri.com). This data set was intended as a thematic data layer representing average annual precipitation, in millimeters per year, for North America.

- A coverage of Climate Divisions provided by the National Climatic Data Center (NCDC). This coverage was used to display seasonal maps of precipitation and temperature for the conterminous United States.

- A coverage of Hydrologic Unit Boundaries and Codes provided by the National Climatic Data Center (NCDC). This data set was used to display drainage basins for the conterminous United States.

- A coverage of Physiographic Divisions in the conterminous United States provided by the National Climatic Data Center (NCDC). It was automated from Fennemans 1:7,000,000-scale map, "Physical Divisions of the United States," which is based on eight major divisions, 25 provinces, and 86 sections representing distinctive areas having common topography, rock types and structure, and geologic and geomorphic history.

- A coverage of average annual runoff in the conterminous United States, 1951-1980 provided by the National Climatic Data Center (NCDC). This coverage is intended as a thematic data layer representing average annual runoff, in inches per year, for the conterminous United States. Appropriate maps of the data can show the geographical distribution of runoff in tributary streams for the years 1951-80 and can describe the magnitudes and variations of runoff nationwide. The data was prepared to reflect the runoff of tributary streams rather than in major rivers in order to represent more accurately the local or small scale variation in runoff with precipitation and other geographical characteristics.

B.2.2.b BASINS WDM Files Weather Station List

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
AK	1	ANCHORAGE WSCMO AP	280	61.1667	-150.017
AK	2	ANNETTE WSO AIRPORT	352	55.0333	-131.567
AK	3	COLD BAY WSO AIRPORT	2102	55.2	-162.717
AK	4	FAIRBANKS WSO AIRPOR	2968	64.8167	-147.867
AK	5	KING SALMON WSO AP	4766	58.6833	-156.65
AK	6	MCGRATH WSO AIRPORT	5769	62.9667	-155.617
AK	7	ST PAUL ISLAND WSO A	8118	57.15	-170.217
AK	8	YAKUTAT WSO AIRPORT	9941	59.5167	-139.667
AL	1	ABBEVILLE 1 NNW	8	31.5833	-85.2833
AL	2	BIRMINGHAM FAA ARPT	831	33.5667	-86.7
AL	3	DADEVILLE 2	2124	32.8333	-85.75
AL	4	HALEYVILLE	3620	34.2333	-87.6333
AL	5	HUNTSVILLE WSO AP	4064	34.65	-86.7833
AL	6	JACKSONVILLE	4209	33.8167	-85.7667
AL	7	MOBILE WSO ARPT	5478	30.6833	-88.25
AL	8	MONTGOMERY WSO ARPT	5550	32.3	-86.4
AL	9	THOMASVILLE	8178	31.9167	-87.7333
AL	10	TUSCALOOSA OLIVER DA	8385	33.2167	-87.6
AR	1	ALUM FORK	130	34.8	-92.85
AR	2	BATESVILLE LIVESTOCK	458	35.8333	-91.7667
AR	3	BULL SHOALS DAM	1020	36.3667	-92.5667
AR	4	CLARKSVILLE 6 NE	1457	35.5333	-93.4
AR	5	EUREKA SPRINGS 3 WNW	2356	36.4167	-93.7833
AR	6	FORT SMITH WSO AIRPO	2574	35.3333	-94.3667
AR	7	MENA	4756	34.5667	-94.2667
AR	8	MILLWOOD DAM	4839	33.6833	-93.9833
AR	9	MONTICELLO 3 SW	4900	33.6	-91.8
AR	10	STUTTGART 9 ESE	6920	34.4667	-91.4167
AZ	1	AJO	80	32.3667	-112.867
AZ	2	COCHISE 4 SSE	1870	32.0667	-109.9
AZ	3	FLAGSTAFF AP	3010	35.1333	-111.667
AZ	4	KEAMS CANYON	4586	35.8167	-110.2
AZ	5	PAYSON	6323	34.2333	-111.333
AZ	6	PHOENIX AIRPORT	6481	33.4333	-111.983
AZ	7	TUCSON WSO AP	8820	32.1333	-110.933
AZ	8	TUWEEP	8895	36.2833	-113.067

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
AZ	9	WHITERIVER 1 SW	9271	33.8167	-109.983
AZ	10	YUMA WSO AP	9660	32.6667	-114.6
CA	1	BAKERSFIELD AP	442	35.4333	-119.05
CA	2	BLUE CANYON	897	39.2833	-120.7
CA	3	EUREKA WFO WOODLEY I	2910	40.8	-124.167
CA	4	FRESNO AIR TERMINAL	3257	36.7833	-119.717
CA	5	LOS ANGELES WSO ARPT	5114	33.9333	-118.4
CA	6	SACRAMENTO FAA ARPT	7630	38.5167	-121.5
CA	7	SAN DIEGO WSO AIRPOR	7740	32.7333	-117.167
CA	8	SAN FRANCISCO WSO AP	7769	37.6167	-122.383
CA	9	SANTA MARIA WSO ARPT	7946	34.9	-120.45
CA	10	YOSEMITE PARK HDQTRS	9855	37.75	-119.583
CO	1	AKRON 4 E	109	40.15	-103.15
CO	2	ALAMOSA WSO AP	130	37.45	-105.867
CO	3	BOULDER 2	843	40.0333	-105.283
CO	4	COLORADO SPRINGS WSO	1778	38.8167	-104.717
CO	5	GRAND JUNCTION WSO A	3488	39.1	-108.5
CO	6	KIM 15 NNE	4538	37.45	-103.317
CO	7	NUNN	6023	40.7	-104.783
CO	8	PUEBLO WSO AP	6740	38.2833	-104.5
CO	9	SUGARLOAF RESERVOIR	8064	39.25	-106.367
CO	10	TELLURIDE 4 WNW	8204	37.95	-107.867
CT	1	BRIDGEPORT SIKORSKY	806	41.1667	-73.1333
CT	2	HARTFORD BRADLEY AP	3456	41.9333	-72.6833
CT	3	JEWETT CITY	3857	41.6333	-71.9
CT	4	THOMASTON DAM	8330	41.7	-73.05
DE	1	GEORGETOWN 5 SW	3570	38.6333	-75.45
DE	2	WILMINGTN NEW CASTLE	9595	39.6667	-75.6
FL	1	DAYTONA BEACH REG AP	2158	29.1833	-81.05
FL	2	JACKSONVILLE INTL AP	4358	30.4833	-81.7
FL	3	KEY WEST INTL ARPT	4570	24.55	-81.75
FL	4	MIAMI INTL ARPT	5663	25.8	-80.3
FL	5	NICEVILLE	6240	30.5167	-86.5
FL	6	ORTONA LOCK 2	6657	26.7833	-81.3
FL	7	RAIFORD STATE PRISON	7440	30.0667	-82.1833
FL	8	TALLAHASSEE MUNI AP	8758	30.3833	-84.3667
FL	9	TAMPA INTL ARPT	8788	27.9667	-82.5333
FL	10	W PALM BEACH INTL AP	9525	26.6833	-80.1167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
GA	1	ATHENS MUNI AP	435	33.95	-83.3167
GA	2	ATLANTA HARTSFIELD	451	33.65	-84.4333
GA	3	AUGUSTA BUSH FIELD	495	33.3667	-81.9667
GA	4	CALHOUN EXP STATION	1474	34.4833	-84.9667
GA	5	COLUMBUS METRO AP	2166	32.5167	-84.95
GA	6	DAHLONEGA 3 NNW	2479	34.5833	-84
GA	7	EDISON	3028	31.5667	-84.7333
GA	8	JESUP	4671	31.6167	-81.8833
GA	9	MACON LEWIS B WILSON	5443	32.7	-83.65
GA	10	SAVANNAH INTL AP	7847	32.1333	-81.2
HI	1	HILO WSO AP 87	1492	19.7167	-155.067
HI	2	HONOLULU WSFO AP 703	1919	21.3333	-157.917
HI	3	KAHULUI WSO AP 398	2572	20.9	-156.433
HI	4	KANALOHULUHULU 1075	3099	22.1333	-159.667
HI	5	KEAIWA CAMP 22.1	3925	19.2333	-155.483
HI	6	KUALAPUU 534	4778	21.15	-157.033
HI	7	LALAMILO FLD OF 191.	5260	20.0167	-155.683
HI	8	LIHUE WSO AP 1020.1	5580	21.9833	-159.35
HI	9	PAAKEA 350	7194	20.8167	-156.117
HI	10	PUNALUU PUMP 905.2	8314	21.5833	-157.9
IA	1	CENTERVILLE	1354	40.7333	-92.8667
IA	2	DES MOINES AP	2203	41.5333	-93.6667
IA	3	IRWIN 3 ESE	4174	41.7833	-95.15
IA	4	LARRABEE	4644	42.8667	-95.55
IA	5	LENOX	4746	40.8833	-94.5667
IA	6	MCGREGOR	5315	43.0167	-91.1833
IA	7	MOUNT PLEASANT 1 SSW	5796	40.95	-91.5667
IA	8	ST ANSGAR	7326	43.3833	-92.9167
IA	9	SIOUX CITY AP	7708	42.4	-96.3833
IA	10	WATERLOO WSO AP	8706	42.55	-92.4
ID	1	BOISE WSFO AIRPORT	1022	43.5667	-116.217
ID	2	CALDER	1370	47.2667	-116.183
ID	3	CASCADE 1 NW	1514	44.5333	-116.05
ID	4	FENN RANGER STATION	3143	46.1167	-115.567
ID	5	GOODING 1 S	3677	42.9167	-114.7
ID	6	GRASMERE 3 S	3811	42.3333	-115.883
ID	7	LEADORE	5169	44.6833	-113.367
ID	8	POCATELLO WSO AP	7211	42.9167	-112.6

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
ID	9	SANDPOINT EXP STATIO	8137	48.2833	-116.567
ID	10	TETONIA EXPERIMENT S	9065	43.85	-111.267
IL	1	AUGUSTA	330	40.2333	-90.95
IL	2	BELLEVILLE SIU RESEA	510	38.5167	-89.85
IL	3	CHICAGO MIDWAY AP 3	1577	41.7333	-87.7833
IL	4	MOLINE WSO AP	5751	41.4333	-90.5
IL	5	MURPHYSBORO 2 SW	5983	37.7667	-89.3667
IL	6	NEWTON 6 SSE	6159	38.9167	-88.1167
IL	7	PEORIA WSO AIRPORT	6711	40.6667	-89.6833
IL	8	PIPER CITY	6819	40.7	-88.1833
IL	9	ROCKFORD WSO AP	7382	42.2	-89.1
IL	10	SPRINGFIELD WSO AP	8179	39.85	-89.6833
IN	1	EVANSVILLE WSO AP	2738	38.05	-87.5333
IN	2	FORT WAYNE WSO AP	3037	41	-85.2
IN	3	INDIANAPOLIS WSFO AP	4259	39.7333	-86.2667
IN	4	PERU WASTE WATER PLA	6864	40.75	-86.0667
IN	5	RICHMOND WTR WKS	7370	39.8833	-84.8833
IN	6	SHOALS HIWAY 50 BRID	8036	38.6667	-86.8
IN	7	SOUTH BEND WSO AP	8187	41.75	-86.1667
IN	8	VALPARAISO WATERWORK	8999	41.5167	-87.0333
IN	9	VERSAILLES WATERWORK	9069	39.0667	-85.25
IN	10	WEST LAFAYETTE 6 NW	9430	40.4667	-87
KS	1	BIG BOW 4 WSW	802	37.55	-101.633
KS	2	COLLYER 10 S	1730	38.9	-100.117
KS	3	COLUMBUS 1 SW	1740	37.1667	-94.85
KS	4	CONCORDIA WSO ARPT	1767	39.55	-97.65
KS	5	DODGE CITY WFO AP	2164	37.7667	-99.9667
KS	6	FALL RIVER LAKE	2686	37.65	-96.0833
KS	7	GOODLAND WFO	3153	39.3667	-101.7
KS	8	PHILLIPSBURG 1 SSE	6374	39.7333	-99.3167
KS	9	TOPEKA WSFO AIRPORT	8167	39.0667	-95.6333
KS	10	WICHITA WSO ARPT	8830	37.65	-97.4333
KY	1	BUCKHORN LAKE	1080	37.35	-83.3833
KY	2	CLINTON 4 S	1631	36.6167	-88.9667
KY	3	COVINGTON WSO AIRPOR	1855	39.05	-84.6667
KY	4	HODGENVILLE-LINCOLN	3929	37.5333	-85.7333
KY	5	LEXINGTON WSO AIRPOR	4746	38.0333	-84.6
KY	6	LOUISA 2 S	4946	38.1167	-82.6

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
KY	7	LOUISVILLE WSFO AP	4954	38.1833	-85.7333
KY	8	PADUCAH WALKER BOAT	6117	37.05	-88.55
KY	9	SOMERSET 2 NE	7508	37.1167	-84.6
KY	10	WOODBURY	8824	37.1833	-86.6333
LA	1	ALEXANDRIA	98	31.3167	-92.4667
LA	2	BATON ROUGE WSO AP	549	30.5333	-91.1333
LA	3	CALHOUN RESEARCH STN	1411	32.5167	-92.3333
LA	4	LAFAYETTE	5021	30.2167	-92.0667
LA	5	LAKE CHARLES AP	5078	30.1333	-93.2167
LA	6	MORGAN CITY	6394	29.6833	-91.1833
LA	7	NATCHITOCHES	6582	31.7667	-93.1
LA	8	NEW ORLEANS WSCMO AR	6660	29.9833	-90.25
LA	9	SHREVEPORT AP	8440	32.45	-93.8167
LA	10	WINNSBORO 5 SSE	9806	32.1	-91.7167
MA	1	BIRCH HILL DAM	666	42.6333	-72.1167
MA	2	BOSTON LOGAN INTL AP	770	42.3667	-71.0333
MA	3	BRIDGEWATER	840	41.95	-70.95
MA	4	HYANNIS	3821	41.6667	-70.3
MA	5	KNIGHTVILLE DAM	3985	42.2833	-72.8667
MA	6	NEW BEDFORD	5246	41.6333	-70.9333
MA	7	PROVINCETOWN	6681	42.05	-70.1833
MA	8	WORCESTER MUNI AP	9923	42.2667	-71.8667
MD	1	BALT-WASHGTN INTL AP	465	39.1833	-76.6667
MD	2	BELTSVILLE	700	39.0333	-76.8833
MD	3	HANCOCK	4030	39.7	-78.1833
MD	4	SAVAGE RIVER DAM	8065	39.5167	-79.1333
MD	5	UNIONVILLE	9030	39.45	-77.1833
ME	1	AUGUSTA	273	44.3	-69.7833
ME	2	CARIBOU MUNI ARPT	1175	46.8667	-68.0167
ME	3	CLAYTON LAKE	1472	46.6167	-69.5333
ME	4	EASTPORT	2426	44.9167	-67
ME	5	GRAND LAKE STREAM	3261	45.1833	-67.7833
ME	6	MILLINOCKET	5304	45.65	-68.7
ME	7	ORONO 2	6435	44.8833	-68.6667
ME	8	PORTLAND INTL JETPRT	6905	43.65	-70.3
ME	9	ROCKLAND 1 W	7255	44.1	-69.1167
ME	10	SKOWHEGAN	7827	44.7667	-69.7167
MI	1	ALPENA WSO AIRPORT	164	45.0667	-83.5667

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
MI	2	BERRIEN SPRINGS 5 W	735	41.9667	-86.4333
MI	3	DETROIT CITY AIRPORT	2102	42.4167	-83.0167
MI	4	FLINT WSCMO	2846	42.9667	-83.75
MI	5	GRAND RAPIDS WSFO	3333	42.8833	-85.5167
MI	6	HANCOCK MCLAIN ST PK	3551	47.2333	-88.6167
MI	7	LANSING WSO AIRPORT	4641	42.7667	-84.6
MI	8	MUSKEGON WSO AIRPORT	5712	43.1667	-86.25
MI	9	SAULT STE MARIE WSO	7366	46.4667	-84.35
MI	10	TRAVERSE CITY	8246	44.7667	-85.5667
MN	1	DULUTH WSO AP	2248	46.8333	-92.2167
MN	2	INT FALLS WSO AP	4026	48.5667	-93.3833
MN	3	MINNEAPOLIS WSFO AP	5435	44.8833	-93.2167
MN	4	ROCHESTER WSO AP	7004	43.9167	-92.5
MN	5	ST CLOUD WSO AP	7294	45.55	-94.0667
MN	6	SHERBURN 3 WSW	7602	43.6333	-94.7667
MN	7	THIEF LAKE REFUGE	8235	48.4833	-95.95
MN	8	TRACY	8323	44.2333	-95.6333
MN	9	WINNIBIGOSHISH DAM	9059	47.4333	-94.0667
MN	10	WINTON POWER PLANT	9101	47.9333	-91.7667
MO	1	COLUMBIA AIRPORT	1791	38.8167	-92.2167
MO	2	KANSAS CITY WSMO AP	4358	39.3167	-94.7167
MO	3	NEVADA WATER PLANT	5987	37.8333	-94.3667
MO	4	PATTONSBURG 2 S	6563	40.0333	-94.1333
MO	5	ROLLA UNI OF MISSOUR	7263	37.95	-91.7833
MO	6	ST LOUIS WSCMO AIRPO	7455	38.75	-90.3667
MO	7	SPRINGFIELD REG AP	7976	37.2333	-93.3833
MO	8	STEFFENVILLE	8051	39.9667	-91.8833
MO	9	WAPPAPELLO DAM	8700	36.9333	-90.2833
MO	10	WEST PLAINS	8880	36.75	-91.8333
MS	1	ARKABUTLA DAM	237	34.75	-90.1333
MS	2	BOONEVILLE	955	34.6667	-88.5667
MS	3	CALHOUN CITY 2 NW	1314	33.8667	-89.35
MS	4	CLEVELAND 3 N	1743	33.8	-90.7167
MS	5	JACKSON WSFO AIRPORT	4472	32.3167	-90.0833
MS	6	LEAKESVILLE	4966	31.15	-88.55
MS	7	LEXINGTON 2 NNW	5062	33.1333	-90.0667
MS	8	MERIDIAN WSO ARPT	5776	32.3333	-88.75
MS	9	RUTH 1 SE	7714	31.3667	-90.3

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
MS	10	SAUCIER EXP FOREST	7840	30.6333	-89.05
MT	1	BILLINGS WSO	807	45.8	-108.533
MT	2	CLARK CANYON DAM	1781	45	-112.867
MT	3	CUT BANK FCWOS	2173	48.6	-112.367
MT	4	GLASGOW WSO AIRPORT	3558	48.2167	-106.617
MT	5	GREAT FALLS WSCMO AI	3751	47.4833	-111.367
MT	6	HELENA WSO	4055	46.6	-112
MT	7	HILGER	4143	47.25	-109.35
MT	8	ISMAY	4442	46.5	-104.8
MT	9	KALISPELL WSO AIRPOR	4558	48.3	-114.267
MT	10	MISSOULA WSO AP	5745	46.9333	-114.1
NC	1	ASHEVILLE REGIONL AP	300	35.4333	-82.55
NC	2	CAPE HATTERAS NWS	1458	35.2667	-75.55
NC	3	CHARLOTTE DOUGLAS AP	1690	35.2167	-80.9333
NC	4	ELIZABETH CITY	2719	36.3167	-76.2
NC	5	GRNSBR,HGH PT,W-S AP	3630	36.0833	-79.95
NC	6	HELTON	3957	36.55	-81.5
NC	7	LAURINBURG	4860	34.75	-79.45
NC	8	MOREHEAD CITY 2 WNW	5830	34.7333	-76.7333
NC	9	RALEIGH DURHAM AP	7069	35.8667	-78.7833
NC	10	WILMINGTON NEW HANVR	9457	34.2667	-77.9
ND	1	ASHLEY	382	46.0333	-99.3667
ND	2	BALDHILL DAM	450	47.0333	-98.0833
ND	3	BISMARCK WSFO AP	819	46.7667	-100.75
ND	4	BOWMAN	995	46.1833	-103.4
ND	5	FARGO WSO AP	2859	46.9333	-96.8167
ND	6	MINOT EXPERIMENT STN	5993	48.1833	-101.3
ND	7	RICHARDTON ABBEY	7530	46.8833	-102.317
ND	8	ROLETTE	7655	48.6667	-99.8333
ND	9	TROTTERS 3 SSE	8812	47.2833	-103.9
ND	10	WILLISTON WSO	9425	48.1833	-103.633
NE	1	AMELIA 2 W	180	42.2333	-98.95
NE	2	EDISON	2560	40.2833	-99.7833
NE	3	GRAND ISLAND WSO AP	3395	40.9667	-98.3167
NE	4	HEBRON	3735	40.1667	-97.5833
NE	5	MALMO 3 E	5112	41.2667	-96.65
NE	6	NORFOLK AIRPORT	5995	41.9833	-97.4333
NE	7	NORTH PLATTE WSO ARP	6065	41.1333	-100.7

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
NE	8	OSHKOSH 10 NE	6386	41.5	-102.183
NE	9	SCOTTSBLUFF AP	7665	41.8667	-103.6
NE	10	VALENTINE WSO AP	8760	42.8833	-100.55
NH	1	BRISTOL	998	43.6	-71.7167
NH	2	CONCORD MUNI AP	1683	43.2	-71.5
NH	3	DURHAM	2174	43.15	-70.95
NH	4	ERROL	2842	44.7833	-71.1333
NH	5	LINCOLN	4732	44.05	-71.6667
NH	6	MOUNT WASHINGTON	5639	44.2667	-71.3
NH	7	NEW DURHAM 3 NNW	5780	43.4833	-71.1833
NH	8	NORTH STRATFORD	6234	44.75	-71.6333
NH	9	PITTSBURG RESERVOIR	6856	45.05	-71.3833
NH	10	SURRY MOUNTAIN LAKE	8539	43	-72.3167
NJ	1	ATLANTIC CITY INT AP	311	39.45	-74.5667
NJ	2	CAPE MAY 2 NW	1351	38.95	-74.9333
NJ	3	CLINTON 2 N	1754	40.6667	-74.9167
NJ	4	GLASSBORO 2 W	3291	39.7	-75.1167
NJ	5	NEWARK INTL ARPT	6026	40.7	-74.1667
NJ	6	NEW BRUNSWICK 3 SE	6055	40.4667	-74.4333
NJ	7	SPRINGFIELD	8423	40.7167	-74.3167
NJ	8	WANAQUE RAYMOND DAM	9187	41.05	-74.3
NJ	9	WATCHUNG	9271	40.6667	-74.4167
NJ	10	WINDSOR	9761	40.25	-74.5833
NM	1	ALBUQUERQUE WSFO AIR	234	35.05	-106.617
NM	2	ANIMAS	417	31.95	-108.817
NM	3	AUGUSTINE 2 E	640	34.0833	-107.617
NM	4	CARLSBAD	1469	32.4333	-104.25
NM	5	CARRIZOZO 1 SW	1515	33.6333	-105.883
NM	6	CUBA	2241	36.0167	-106.967
NM	7	DURAN	2665	34.4667	-105.4
NM	8	JORNADA EXP RANGE	4426	32.6167	-106.733
NM	9	OCATE 2 NW	6275	36.2	-105.067
NM	10	TUCUMCARI 4 NE	9156	35.2	-103.683
NV	1	BEATTY 8 N	718	37	-116.717
NV	2	CONTACT	1905	41.7667	-114.75
NV	3	ELKO FCWOS	2573	40.8333	-115.8
NV	4	ELY ASOS	2631	39.2833	-114.85
NV	5	LAS VEGAS AP	4436	36.0833	-115.167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
NV	6	LEONARD CREEK RANCH	4527	41.5167	-118.717
NV	7	PAHRANAGAT W L REFUG	5880	37.2667	-115.117
NV	8	RENO AIRPORT	6779	39.5	-119.783
NV	9	SMOKEY VALLEY	7620	38.7833	-117.167
NV	10	WINNEMUCCA AIRPORT	9171	40.9	-117.8
NY	1	ALBANY COUNTY AP	42	42.75	-73.8
NY	2	BINGHAMTON LINK FLD	687	42.2167	-75.9833
NY	3	BUFFALO GR BUFFLO AP	1012	42.9333	-78.7333
NY	4	CANTON 4 SE	1185	44.5667	-75.1167
NY	5	NEW YORK CNTRL PARK	5801	40.7833	-73.9667
NY	6	OLD FORGE	6184	43.7167	-74.9833
NY	7	ROCHESTER INTL AP	7167	43.1333	-77.6667
NY	8	SYRACUSE HANCOCK AP	8383	43.1167	-76.1167
NY	9	WELLSVILLE	9072	42.1167	-77.95
NY	10	WHITEHALL	9389	43.55	-73.4
OH	1	AKRON CANTON WSO AP	58	40.9167	-81.4333
OH	2	CLEVELAND WSFO AP	1657	41.4167	-81.8667
OH	3	COLUMBUS WSO AIRPORT	1786	40	-82.8833
OH	4	DAYTON WSO AIRPORT	2075	39.9	-84.2
OH	5	MANSFIELD WSO AP	4865	40.8167	-82.5167
OH	6	PANDORA	6405	40.95	-83.9667
OH	7	PORTSMOUTH SCIOTOVIL	6781	38.75	-82.8833
OH	8	TOLEDO EXPRESS WSO A	8357	41.6	-83.8
OH	9	TOM JENKINS DAM-BURR	8378	39.55	-82.0667
OH	10	YOUNGSTOWN WSO AP	9406	41.25	-80.6667
OK	1	CARTER TOWER	1544	34.2667	-94.7833
OK	2	FORT SUPPLY DAM	3304	36.55	-99.5833
OK	3	GOODWELL RESEARCH ST	3628	36.6	-101.617
OK	4	GREAT SALT PLAINS DA	3740	36.75	-98.1333
OK	5	LEHIGH	5108	34.4667	-96.2167
OK	6	MAYFIELD	5648	35.3333	-99.8667
OK	7	OKLAHOMA CITY AIRPOR	6661	35.3833	-97.6
OK	8	TULSA INTL AIRPORT	8992	36.2	-95.8833
OK	9	WEBBERS FALLS DAM	9450	35.55	-95.1667
OK	10	WICHITA MTN WL REF	9629	34.7333	-98.7167
OR	1	ALLEGANY	126	43.4333	-124.033
OR	2	ASTORIA WSO AIRPORT	328	46.15	-123.883
OR	3	BEULAH	723	43.9167	-118.167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
OR	4	EUGENE WSO AIRPORT	2709	44.1167	-123.217
OR	5	LA GRANDE	4622	45.3167	-118.067
OR	6	MEDFORD WSO AP	5429	42.3833	-122.883
OR	7	OCHOCO DAM	6238	44.3	-120.733
OR	8	PENDLETON WSO AIRPOR	6546	45.6833	-118.85
OR	9	PORTLAND INTL AIRPOR	6751	45.6	-122.617
OR	10	SALEM WSO AIRPORT	7500	44.9167	-123
PA	1	ALLENTOWN A-B-E INTL	106	40.65	-75.4333
PA	2	ALVIN R BUSH DAM	147	41.3667	-77.9333
PA	3	ERIE INTL ARPT	2682	42.0833	-80.1833
PA	4	JOHNSTOWN 2	4390	40.3167	-78.9167
PA	5	KANE 1 NNE	4432	41.6833	-78.8
PA	6	PHILADELPHIA INTL AP	6889	39.8833	-75.25
PA	7	PITTSBURGH GR P'BURG	6993	40.5	-80.2167
PA	8	PUTNEYVILLE 2 SE DAM	7229	40.9333	-79.2833
PA	9	WILKES-BARRE SCRANTN	9705	41.3333	-75.7333
PA	10	YORK 1 S FILTER PLAN	9938	39.9333	-76.7333
PR	1	COROZAL SUBSTATION	2934	18.3333	-66.3667
PR	2	PONCE 4 E	7292	18.0167	-66.5333
PR	3	SAN JUAN ISLA VERDE	8812	18.4333	-66
PR	4	SAN SEBASTIAN 2 WNW	8881	18.35	-67.0167
PR	5	YABUCOA 1 NNE	9829	18.0667	-65.8667
RI	1	BLOCK IS STATE AP	896	41.1667	-71.5833
RI	2	NEWPORT ROSE	5215	41.5	-71.35
RI	3	PROVIDENCE GREEN ST	6698	41.7333	-71.4333
SC	1	BISHOPVILLE 8 NNW	736	34.3333	-80.3
SC	2	CHARLESTON INTL ARPT	1544	32.9	-80.0333
SC	3	CLARK HILL 1 W	1726	33.6667	-82.1833
SC	4	COLUMBIA METRO AP	1939	33.95	-81.1167
SC	5	GEORGETOWN 2 E	3468	33.35	-79.25
SC	6	GREER GREENV'L-SPART	3747	34.9	-82.2167
SC	7	JOCASSEE 8 WNW	4581	34.9833	-83.0667
SC	8	LAURENS	5017	34.5	-82.0333
SC	9	MULLINS 4 W	6114	34.2	-79.3167
SC	10	SANTEE COOP SPLWY	7712	33.45	-80.15
SD	1	BUFFALO	1114	45.6	-103.55
SD	2	EDGEMONT	2557	43.3	-103.833
SD	3	HURON AP	4127	44.4	-98.2167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
SD	4	ISABEL	4268	45.4	-101.433
SD	5	LA CREEK NATL WILDLI	4651	43.1	-101.567
SD	6	OAHE DAM	6170	44.45	-100.417
SD	7	PICKSTOWN	6574	43.0667	-98.5333
SD	8	RAPID CITY WSO AP	6937	44.05	-103.05
SD	9	SIOUX FALLS WSFO	7667	43.5667	-96.7333
SD	10	WAUBAY NATL WILDLIFE	8980	45.4333	-97.3333
TN	1	BRISTOL WSO AIRPORT	1094	36.4833	-82.4
TN	2	BROWNSVILLE SEWAGE P	1150	35.5833	-89.2667
TN	3	CHATTANOOGA WSO AP	1656	35.0167	-85.2
TN	4	KNOXVILLE WSO AIRPOR	4950	35.8333	-83.9833
TN	5	LEWISBURG EXP STN	5187	35.4167	-86.8
TN	6	MEMPHIS WSCMO AP	5954	35.05	-90
TN	7	MONTEREY	6170	36.15	-85.2667
TN	8	NASHVILLE NWSCMO AP	6402	36.1167	-86.6833
TN	9	PORTLAND SEWAGE PLAN	7359	36.5833	-86.5333
TN	10	SAMBURG WILDLIFE REF	8065	36.45	-89.3167
TX	1	ABILENE WSO AIRPORT	16	32.4167	-99.6833
TX	2	AMARILLO WSO AIRPORT	211	35.2333	-101.7
TX	3	BROWNSVILLE WSO AP	1136	25.9	-97.4333
TX	4	CORPUS CHRISTI WSFO	2015	27.7667	-97.5
TX	5	EL PASO AP	2797	31.8	-106.4
TX	6	HOUSTON WSCMO AP	4300	29.9667	-95.35
TX	7	SAN ANGELO WSO AP	7943	31.3667	-100.483
TX	8	SAN ANTONIO INTL AP	7945	29.5333	-98.4667
TX	9	WACO WSO AP	9419	31.6167	-97.2167
TX	10	WICHITA FALLS WSO AP	9729	33.9833	-98.5
UT	1	BLANDING	738	37.6167	-109.483
UT	2	DUGWAY	2257	40.1833	-112.917
UT	3	EPHRAIM SORENSENS FL	2578	39.3667	-111.583
UT	4	HANKSVILLE	3611	38.3667	-110.717
UT	5	LOGAN UTAH STATE UNI	5186	41.75	-111.8
UT	6	MILFORD	5654	38.4	-113.017
UT	7	OGDEN PIONEER P H	6404	41.25	-111.95
UT	8	ROOSEVELT RADIO	7395	40.2833	-109.967
UT	9	ST GEORGE	7516	37.1167	-113.567
UT	10	SALT LAKE CITY NWSFO	7598	40.7667	-111.95
VA	1	HURLEY	4180	37.4167	-82.0167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
VA	2	JOHN H KERR DAM	4414	36.6	-78.2833
VA	3	LYNCHBURG MUNI AP	5120	37.3333	-79.2
VA	4	NORFOLK INTL ARPT	6139	36.9	-76.2
VA	5	PIEDMONT RESEARCH ST	6712	38.2167	-78.1167
VA	6	RICHMOND BYRD AP	7201	37.5167	-77.3333
VA	7	ROANOKE WOODRUM AP	7285	37.3167	-79.9667
VA	8	THE PLAINS 2 NNE	8396	38.9	-77.75
VA	9	WASHINGTN DC NATL AP	8906	38.85	-77.0333
VA	10	WYTHEVILLE 1 S	9301	36.9333	-81.0833
VI	1	BETH UPPER NEW WORKS	480	17.7167	-64.8
VI	2	CANEEL BAY PLANTATIO	1316	18.35	-64.7833
VT	1	BALL MOUNTAIN LAKE	277	43.1167	-72.8
VT	2	BURLINGTON INTL AP	1081	44.4667	-73.15
VT	3	CORINTH	1565	44.0167	-72.2833
VT	4	HIGHGATE FALLS	3914	44.9333	-73.05
VT	5	MORRISVILLE	5366	44.5667	-72.6
VT	6	NEWPORT	5542	44.9333	-72.2
VT	7	NORTH HARTLAND LAKE	5768	43.6	-72.35
VT	8	NORTH SPRINGFIELD LA	5982	43.3333	-72.5
VT	9	SAINT JOHNSBURY	7054	44.4167	-72.0167
VT	10	SEARSBURG STATION	7152	42.8667	-72.9167
WA	1	COUGAR 4 SW	1759	46.0167	-122.35
WA	2	FRANCES	2984	46.55	-123.5
WA	3	MARBLEMOUNT RANGER S	4999	48.5333	-121.45
WA	4	OLYMPIA AIRPORT	6114	46.9667	-122.9
WA	5	QUILLAYUTE WSCMO AP	6858	47.95	-124.55
WA	6	SEATTLE TACOMA AIRPO	7473	47.45	-122.3
WA	7	SNOQUALMIE PASS	7781	47.4167	-121.417
WA	8	SPOKANE WSO AIRPORT	7938	47.6333	-117.533
WA	9	WHITMAN MISSION	9200	46.05	-118.45
WA	10	YAKIMA WSO AP	9465	46.5667	-120.533
WI	1	ASHLAND EXP FARM	349	46.5667	-90.9667
WI	2	CHIPPEWA FALLS	1578	44.9333	-91.3833
WI	3	GREEN BAY WSO	3269	44.5	-88.1167
WI	4	LA FARGE	4404	43.5667	-90.6333
WI	5	LANCASTER 4 WSW	4546	42.8333	-90.7833
WI	6	MADISON WSO AIRPORT	4961	43.1333	-89.3333
WI	7	MARSHFIELD EXP FARM	5120	44.6333	-90.1333

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
WI	8	MILWAUKEE WSO AIRPOR	5479	42.95	-87.9
WI	9	PHELPS	6518	46.0667	-89.0667
WI	10	SPOONER EXPERMNT FAR	8027	45.8167	-91.8833
WV	1	BECKLEY WSO AP	582	37.7833	-81.1167
WV	2	CHARLESTON AP	1570	38.3667	-81.6
WV	3	ELKINS WSO AIRPORT	2718	38.8833	-79.85
WV	4	HUNTINGTON WSO AP	4393	38.3667	-82.55
WV	5	LAKE LYNN	5002	39.7167	-79.85
WV	6	LIVERPOOL	5323	38.9	-81.5333
WV	7	MOOREFIELD 2 SSE	6163	39.0333	-78.9667
WV	8	TERRA ALTA NO 1	8777	39.45	-79.55
WV	9	TYGART DAM	8986	39.3167	-80.0333
WV	10	VALLEY HEAD	9086	38.5333	-80.0333
WY	1	CASPER WSCMO	1570	42.9	-106.467
WY	2	CHEYENNE WSFO AP	1675	41.15	-104.817
WY	3	MORAN 5 WNW	6440	43.85	-110.583
WY	4	ENCAMPMENT	3050	41.2167	-106.783
WY	5	JACKSON	4910	43.4833	-110.767
WY	6	LAKE YELLOWSTONE	5345	44.55	-110.4
WY	7	LANDER AP	5390	42.8167	-108.733
WY	8	MOUNTAIN VIEW	6555	41.2833	-110.317
WY	9	OSAGE	6935	43.9833	-104.417
WY	10	SHERIDAN AP	8155	44.7667	-106.967

NEDVIID	EPA design year category VIID needs
NEDVIIE	EPA design year category VIIE needs
NEDVIIF	EPA design year category VIIF needs
NEDVIIG	EPA design year category VIIG needs
DISCHRG	identifies facility FACID number which presently or eventually will receive flow from FACID number
CSOIAM	CSO indicator flag
FLAG_LL	indicates how coordinates were obtained
CSAREA	combined sewer system collection area
CSPOP	combined sewer system population
LAT	latitude
LONG	longitude

WATERSHED FUNCTIONS

FUNCTIONS AND SUB-FUNCTIONS

*Watershed Features can include intact wetlands, streams, riparian buffer areas, and existing Best Management Practices (BMPs) and Restoration & Rehabilitation Practices (R&R).

1. **WATER QUALITY FUNCTION**

   "Water quality improvement, nutrient cycling and supply"

   A. **NON-POINT SOURCE** – as water flows over the land surface (during rain events and storms) water quality degradation can occur as water picks up particulates (such as sediment) and nutrients ultimately flowing into our creeks, streams and rivers. Improvement of water quality can mean removal of particulates and nutrients as water flows over the land surface.

      1. **Nutrients –** Addition of nutrients as water moves across land into a water body.

      2. **Sedimentation** – Addition of sediment as water moves across land and into a water body.

   B. **POINT SOURCE** – as water enters a water body from a distinct source degradation can occur. Addressing this degradation may indicate the need to address the point source. Addressing, evaluating, and monitoring point source discharges is a regulatory function of the NC Division of Water Quality. The NC Wetlands Restoration Program (NCWRP) is a non-regulatory program of the NC Department of Environment and Natural Resources. Although the NCWRP will work with the stakeholder team to identify and generally assess these problems, the NCWRP cannot address these issues with program resources.

   C. **FLOODWATER CLEANSING –** ability of a watershed feature (i.e. wetland, BMP, etc.) to remove sediments, nutrients, and toxins, which have already entered surface water. These pollutants may have entered the feature by overbank flow from a flooding stream. Size of a watershed feature and surrounding land use type (i.e. urban / rural) could influence this subfunction.

2. **HYDROLOGICAL FUNCTION**

   "Flood attenuation and moderation of hydrologic flow"

   A. **SURFACE RUNOFF STORAGE –** Ability of an existing wetland / BMP to reduce peak high and low stream flows due to storage and slow release of water.

   B. **FLOODWATER STORAGE** – Ability of a watershed feature (i.e. wetland or BMP) to temporarily store floodwater to alleviate downstream flooding.

   C. **SHORELINE STABLIZATION –** Ability of a shoreline (river bank) to stabilize sediments or dissipate erosive forces.

3. **HABITAT FUNCTION**

   "Support for wildlife and fish, including food, shelter and breeding sites"

   A. **TERRESTRIAL –** Ability of a watershed feature (i.e. riparian corridor, wetland, etc.) to provide habitat for terrestrial wildlife species in relationship to its surrounding landscape.

   B. **AQUATIC –** Ability to provide in stream and in water habitat for spawning, feeding or predator avoidance for aquatic life in relationship to its surrounding landscape. y