

PROJECT MANAGEMENT PLAN
JOHN H. KERR DAM AND RESERVOIR
VIRGINIA AND NORTH CAROLINA
(SECTION 216)
FEASIBILITY STUDY



SEPTEMBER 2006



**US Army Corps
of Engineers**
Wilmington District

PROJECT MANAGEMENT PLAN
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VIRGINIA AND NORTH CAROLINA
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Prepared by:

US Army Corps of Engineers
Wilmington District

The State of North Carolina

The Commonwealth of Virginia



**US Army Corps
of Engineers**
Wilmington District



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Introduction

The Feasibility Study, authorized under Section 216 of Public Law 91-611, the River and Harbor and Flood Control Act of 1970, as amended, will review the operation of the John H. Kerr Dam and Reservoir and report recommendations to Congress on the advisability of modifying the structures or the structures' operation and for improving the quality of the environment in the overall public interest. Information developed during the Feasibility Study may become the basis for actions specifically authorized by Congress or by the legislatures of the Sponsors, the State of North Carolina, and the Commonwealth of Virginia; addressed by the existing continuing authorities of the US Army Corps of Engineers; and for actions by non-government organizations (NGO). The Study provides interested parties an opportunity to integrate multiple perspectives and assets to achieve the common goal. The parties commit to effective and efficient management of their responsibilities for the Study, and to the sharing of information about the Study.

Aprior to the initiation of this study, and Initial Appraisal was completed, with project funds, to determine in a preliminary way the subjects that needed addressed by a Section 216 Study. This lead to the reconnaissance study. In turn, approval of participation in this Feasibility Study by the US Army Corps of Engineers, Wilmington District, was based on the *Reconnaissance Phase Section 905(b) Analysis for John H. Kerr Dam and Reservoir, Virginia and North Carolina 216 and a Supplemental Sheet* prepared in response to comments on the 905(b) from the U.S. Army Corps of Engineers South Atlantic Division. These documents indicate that the Feasibility Study will address subjects determined in the Initial Appraisal Report for the Study, and identified by citizens during hearings held in the Study area. More than 40 topics were identified and categorized into 11 Study Subjects. These tasks have been modified by combining the Downstream Aquatic Habitat task with the Diadromous Fish task to form the Diadromous Fish and Downstream Riverine Aquatic Resources Task. The Applicable Laws and Regulations Task has been deferred until later in the Study process. There are 9 remaining study subjects to be addressed. Task implementation has been developed to consider each Study Subject. US Army Corps of Engineers Regulation 1105-2-100, Planning Guidance Notebook, provides full guidance regarding conduct of the study.

Study Area Description

The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952. John H. Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable

outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced farming and forestry opportunities. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl. The primary project purposes authorized by Congress were flood control and hydroelectric power generation.

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the Dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The Study Area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina. A Reconnaissance Phase feasibility study (Section 905(B)) analysis is currently underway for the Philpott Lake to determine if there is an interest in undertaking a Section 216 study for Philpott. If a 216 Study is undertaken at Philpott, the study teams will work closely together to assure that any changes are implemented system wide. The Philpott Lake study area includes Patrick, Franklin, Henry, and Pittsylvania Counties in Virginia, and Rockingham and Caswell Counties in North Carolina. The study area is located in the following Virginia and North Carolina, and is located in the 4th and 5th th Congressional District in North Carolina and the 1st and 3rd. Congressional Districts in Virginia.

The Phases of the Study

This Project Management Plan (PMP) will be prepared in three phases. The first phase details the plan for the Feasibility Study to the first major decision point, the first In-Progress Review (IPR). In the first phase of the Study, existing data about the Study Subjects will be gathered, and recommendations for further study will be developed. As the Study progresses, the PMP will be modified to detail the plans for Phases 2 and 3. The Sponsors may request changes in the PMP, which will be changed by the USACE as plans for the Study change.

In September 2005, a draft Project Management Plan (PMP) was prepared which captured all of the recommendation stemming from the completion of Phase I of the Study (except for the Water Supply Team). This PMP which described all of the proposed studies developed by the individual resource specific teams and contained all of the Scopes of Work for data collection for Phase II of the study. The individual resource specific team recommendations contained in the PMP intentionally were not constrained by either budget or scheduling realities. This unconstrained PMP was provided to the Executive Committee with a request for guidance on how best to adjust the budget and schedule. The EC agreed that the scope for the study needed to be reduced to fit within current budget constraints. The EC reiterated that the goal of the Kerr 216 Study is to recommend practical, implementable changes to the project that will maximize total project benefits. Data collection and analysis need to be crafted that supports this type of probable recommendation. “Nice-to-have” items that do not fit in the budget, should be eliminated. This guidance was provided to the Study Team Leaders for their consideration in their deliberations for prioritizing study components. The following actions were recommended.

a. **Work Group One—Downstream Flow Regime and Effects on Riparian Ecosystem:** The EC considered all of the elements of this task presented in the September 2005 PMP as high priority and recommended that they proceed. The EC directed the team to consider if any adjustments either to the work elements or, their means of accomplishment could be made that would reduce costs but not reduce effectiveness of the study tasks. This team was also directed to consider if the offer made by The Nature Conservancy (TNC) to produce the required vegetation map needed for this work group was acceptable.

b. **Work Group Two—Water Quality:** The budget for task two presented in the September 2005 PMP was the highest of all work elements and the time required to complete the Task was the longest. Budget and schedule constraints made it impossible to accomplish all of the detailed water quality model that was first envisioned. The EC pointed out that the purpose of the study was to evaluate reservoir operating policies and their effects on lake levels, hydroelectric power generation, and environmental quality downstream in the Roanoke River and the Roanoke floodplain. Only enough water quality information needed to be developed to allow these decisions to be made with confidence and with the knowledge that the effects on water quality were understood. It was recommended that studies which address issues beyond this are unnecessary and should be eliminated from the Kerr 216 Study.

c. **Work Group Three—Sedimentation and Channel Morphology:** The EC considered the central issue for this work group to be bank erosion, which adds sediment load to the river and also results in loss of riparian habitat. The Kerr 216 Study needs to determine to what extent the flow regime below the project contributes to bank erosion by scouring or by prolonged inundation of the river banks. The EC agreed that the work elements related to bank erosion should be accomplished, but does not agree that the sediment modeling work element was needed. The EC directed this work group to determine if the bank erosion element of its work could be added to Work Group One—Downstream Flow Regime and Effects on Riparian Ecosystem with any necessary adjustment of Group One's membership to provide the necessary expertise for this purpose. If this is possible, Work Group Three—Sedimentation and Channel Morphology should then cease independent operations, simplifying the administration of the overall study. The EC directed the Work Group to go as far as possible in coordinating and cooperating with the bank erosion studies being done by Dominion Resources as a result of relicensing and directed that all possible efforts be made toward one coordinated effort directed to address this important issue.

d. **Work Group Four-Reservoir Resources:** The scope of work for this task contains a number of items that while useful were not considered central to the Kerr 216 Study purpose. It was determined that this Work Group should cease to exist and the the impacts of any change in water management would be addressed during Phase III of the study.

e. **Work Group Five—Downstream Flow-Based Recreation:** The EC agreed that the likely effects of study recommendations on downstream recreation would be minor.

Therefore, due to budget constraints, downstream flow based recreation was eliminated as a study purpose and include it only in the review of the impacts of the study recommendations. Studies should be undertaken to the extent that they are required to accommodate review of the impacts of the study recommendations.

f. **Work Group Six—Salt Wedge:** The EC recognized that salt water intrusion at the lower end of the Roanoke River is a complex phenomenon affected by many variables not related to Kerr reservoir operations. Kerr Lake operations are not considered a major factor, except during droughts, in which case an excellent management and coordination process is already in place. The EC therefore agreed that study expenditures should not be made on this task. When study recommendations are developed, any changes recommended in project operations will be reviewed to determine if they affect the salt wedge issue.

g. **Work Group Seven—Diadromous Fish and Riverine Aquatic Resources:** The EC directed this team to review its study plan and select only those items for implementation that support the evaluation of the potential changes in the flow regime at Kerr Reservoir. The EC noted that Dominion Resources is studying fish passage as required by its new FERC license. They recommended that the Kerr 216 Study should defer any consideration of fish passage until the benefit of the work being done by Dominion is determined.

h. **Work Group Eight—Water Supply:** Representatives from Virginia and North Carolina stated that good planning is needed before new proposals for water allocations from Kerr Reservoir are considered. Virginia is undertaking a study of long-range state water supplies, which will be completed within five years. North Carolina is addressing this same long-range water supply planning issue on a river basin basis and will be completing its work on the Roanoke at about the same time. North Carolina and Virginia want to complete this state planning process before new long-range decisions are addressed about allocations of water from the reservoir. Making first come, first served water allocation decisions without a good understanding of long-range needs should be avoided. The USACE believes that some study is needed to determine how much storage allocation should be set aside at the project for water supply, which will require evaluating the value of water supply versus other project purposes such as flow augmentation, hydropower, and flood control. The USACE developed a scope of work for this part of the Kerr 216 Study. This Scope of Work was approved by the EC.

i. **Work Group Nine—Operating Policies and Administrative Procedures:** The intent of this task is to get an objective description of the policies guiding the operation of Kerr Lake, including those of the Corps of Engineers, the Southeast Power Administration, and those described in the FERC agreements with Dominion Resources. The review of these policies and the relationship among different policies should establish the range of project operational changes that are allowable under current rules and will identify which policies need to be changed if additional changes in project operations are desirable. The compilation of Corps of Engineers policy will be reviewed by the Wilmington District under the Operation and Maintenance. An outside consultant

will then review the policy and look at how similar issues are handled around the country. David Paylor pointed out that this task is essential because we can not make our study decisions until this information is available. Ben Wood said that the Corps can do some research on this issue in-house, funded by the operations and maintenance budget, which will provide a head start on developing a more comprehensive approach. The EC agreed to support this initial work by the Corps, including the suggestion that we develop some questions that need to be answered to focus the research that is needed. The EC recorded its support of the concept of an outside consultant contract to complete this task when funds can be budgeted for this purpose.

j. **Work Group Ten—Modeling Oversight:** No changes were recommended for this Work Group.

In Phase III of the Study, alternatives will be developed and evaluated to meet the goals and objectives identified in Phase II. Outputs and impacts of each alternative will be determined, trade-off analysis performed, and, if appropriate, actions selected for recommendation to Congress. A feasibility report and National Environmental Policy Act documentation will be prepared.

Within the first phase, the Project Management Plan requires the following tasks for each Study Subject.

- ❑ Gather and evaluate existing relevant data.
- ❑ Identify gaps in the existing relevant data.
- ❑ Develop recommendations to fill gaps in the existing relevant data.
- ❑ Identify and evaluate existing methods and tools for study of the subject.
- ❑ Develop a plan to keep models and data available to the public and in compatible formats.
- ❑ Develop an approach for combining individual models and investigations into an overall system evaluation.
- ❑ Develop a stepwise procedure to conceive and test alternatives to the existing condition.
- ❑ Complete a risk analysis evaluation associated with gaps in existing methods and tools necessary for study of the subject.
- ❑ Develop recommendations regarding further study of the subject.

The level of accuracy within the descriptions and the associated cost estimates depends upon the extent of uncertainties and the depth of investigations made in preparing them.

The detailed focus and scope of the entire Feasibility Study is incomplete. All investigations performed for the Study will, at a minimum, comply with legal obligations and administration policy and will not compromise professional standards. This will allow all the results of the Study, even parts not receiving detailed analysis, to be of use and value to the Sponsors and USACE. Requirements exceeding these minimum standards are presumed and will be negotiated by the Sponsors and the USACE, based on complexity, available resources, and associated risks.

For each Study Subject, adequate information will be developed in Phase I to produce a product allowing the Sponsors and USACE decision-makers to decide what additional investigation may be needed. Documentation and evaluation of existing data and study methods will be produced for use by the Sponsors and USACE regardless of whether it becomes incorporated as a Study Subject in the Feasibility Study. Initial goals of the IPR are to provide information for determining areas in need of further study and to provide information and to provide information regarding authorized operation of John H. Kerr Dam and Reservoir for environmental restoration considerations and for the Sponsors in the performance of their authorized functions.

Communication and Decision-making Processes

The Project Delivery Team (referred to as the Study Management Team in the Feasibility Cost Sharing Agreement) is committing to the detailed Task Outline described below, to ensure full communication and for identifying and resolving any concerns, problems, or disagreements. Resolutions shall be reached through discussion among employees in the study management level in which the issue arises and will be resolved at the earliest possible stage.

Examples of matters that may be discussed in these processes include coordination of USACE's requests for funds with the funding cycles of the Sponsors, a Sponsor's potential need to suspend the Study due to lack of funding, and identification of work which the Sponsors may propose for negotiation as work in-kind.

USACE and the Sponsors commit to appointing individuals with equivalent authority to act for them, to ensure constant representation is available during established time periods for these processes. Communication may include telephone and electronic communications and face-to-face discussions, as needed to keep each other timely informed on all matters related to the Study.

As the Feasibility Cost Sharing Agreement states, the John H. Kerr 216 Executive Committee is tasked with ensuring consistent and effective communication. The following individuals are designated to serve on the Executive Committee: Rick Weeks, Deputy Director for Operations, Virginia Department of Environmental Quality; John Morris, Director, North Carolina Division of Water Resources; and Christine Brayman, the Deputy District Engineer for Programs and Project Management of the Wilmington District Corps of Engineers. The Executive Committee will generally oversee the Study, consistent with this PMP, and will make recommendations deemed warranted to the District Engineer, including suggestions to avoid potential sources of dispute. The Executive Committee will meet at least quarterly until the end of the Study Period. Location and specific times will be determined during conduct of the study.

The Project Delivery Team will inform the Executive Committee of significant pending issues and actions and will prepare monthly written reports to the Executive Committee documenting the progress of the Study. Task expenditures will be documented in these monitoring reports to provide adequate time for full discussion of Study Costs escalation.

To ensure timely completion of the John H. Kerr 216 Feasibility Study, any member of the Executive Committee, the Project Delivery Team, or subject matter specialist employed by USACE may request immediate discussion of any arising issues affecting the Study.

Upon the conclusion of Phase I, the PDT will prepare and present recommendations for Phase II, to the Executive Committee. Recommendations from the PDT will include a proposed scope of work which will define tasks, costs, responsible parties, and cost sharing requirements. The Executive Committee will present the final recommendation to the USACE, Wilmington District Commander.

Prior to issuance of any order under the Study, the party issuing the order shall allow other involved parties a minimum of ten working days to review the order. Access to proposals for contract award will be limited to the individuals appointed to serve on the contract evaluation Team by the Contracting Officer, the Contracting Staff, and Contracting Officer of the party issuing the contract. Membership on the contract evaluation team should include staff members of the Wilmington District, the State of North Carolina, and the Commonwealth of Virginia.

Public Involvement, Collaboration, and Coordination with Other Agencies

As established by USACE Regulation 1105-2-100, Planning Guidance Notebook, Appendix B, the Feasibility Study will document substantial active involvement by interested government and non-governmental agencies and organizations. The goal of public involvement is to obtain information and views of those with an interest in the Study, so that their comments and concerns receive full consideration in the planning process. Significant public involvement has occurred and been acknowledged for a substantial period of time regarding Dominion Inc's application for a renewal of their license for the hydropower facilities downstream of the John H. Kerr Dam by the Federal Energy Regulatory Commission (FERC).

A Sponsors' Advisory Committee has been established by the sponsors, the states of Virginia and North Carolina, which includes many of those who participated in the FERC process. The Sponsors' Advisory Committee will provide input to the Sponsors for consideration during decision-making activities affecting the Study. The Sponsors' Advisory Committee includes representatives of federal, state, and local governments, and representatives of businesses and environmental organizations. Primary responsibility of the Sponsors' Advisory Committee, under the John H. Kerr Feasibility Study, is to avoid conflicting interests amongst involved parties, especially potential contractors.

Formal collaboration or coordination between USACE and other agencies is not anticipated during Phase I. However, during Phase I, subject matter specialists, many of whom participated in the FERC process and are members of the Sponsors' Advisory Committee, will be consulted regarding the Study Subjects. Other steps facilitating public involvement will be developed for Phases Two and Three.

Costs for attendance at the Sponsors' Advisory Committee Meetings by members of the Executive Committee, the Project Delivery Team, and individuals responsible for performing work for USACE or for performing in-kind work for the Sponsors shall be included in total project costs and cost shared. Other expenses of the Sponsors' Advisory Committee shall not be included in total project costs or cost shared.

For each of the 10 Study Subjects Tasks identified in the PMP for Phase I, subject matter experts are identified, including USACE employees, the Sponsors, and employees or representatives of other government and non-government organizations, and businesses. Many of these subject matter experts have participated in the Dominion's Inc. FERC license renewal process. The subject matter experts will be consulted for information and advice during the performance of each task. For the purpose of completing Phase I actions, the sponsors will contribute 50% of the total project cost in cash or a combination of cash and in-kind services. In-kind services will be limited to 50% of the sponsors portion of the cost share.

Tasks and Costs for Phase II

Phase II - Task 1: Downstream Flow Regime and Effects on Riparian Ecosystem

Phase II - Task 1: Subject Matter Specialists (PDT & ITR Members)

- ❑ Dominion Inc.
- ❑ The Nature Conservancy (TNC)
- ❑ NC Department of Environment and Natural Resources (NCDENR)
- ❑ Division of Water Resources (NCDWR)
- ❑ Division of Water Quality (NCDWQ)
- ❑ Natural Heritage Program (NCNHP)
- ❑ Roanoke River National Wildlife Refuge (RRNWR)
- ❑ US Fish and Wildlife Service (USFWS)
- ❑ US Army Corps of Engineers (USACE)
- ❑ International Paper (IP)
- ❑ US Geological Survey (USGS)

METHOD OF ACCOMPLISHMENT: This task should be undertaken by a private consultant.

TIME:

Downstream Flow Regime and Effects on Riparian Ecosystem Sub Tasks	
Flood Model Evaluation (Completed)	\$26,692
Baseline Information to Evaluate Impact of Downstream Flooding on Agriculture, Timber Operations, Recreation Access and Road Access	\$150,000
Geographic-based Evaluation of Flooding Impacts on Recreation Access and Immersion of Recreation Lands ¹	\$15,000
Update of Comprehensive Vegetation Map	\$0 ²
Bottomland Hardwood Productivity and Recruitment Study	\$30,000
Administer Contract/Work Order	\$6,378
Federal	\$114,035
Non-Federal	\$114,035
Non-Federal (Cash)	TBD
Non-Federal (In-Kind)	TBD
Total Cost Downstream Flow Regime and Effects on Downstream Riparian Ecosystem	\$228,070
<p><u>To view Scopes of Work See Attachment 7</u> <u>Downstream Flow Regime and Effects on Downstream Riparian Ecosystem Scope of Work</u> <u>Flood Mapping Model Scope of Work</u></p>	

¹ Collection of Baseline Information on Recreation Access was transferred to this Study Group by the Downstream Flow Based Recreation Study Team which has been disbanded.

² The update of the comprehensive vegetation map is being completed by the North Carolina Chapter of the Nature Conservancy (TNC). TNC has agreed to complete is update an provide this map for use in the John H. Kerr (Section 216) Feasibility Study with out change.

Phase II - Task 2: Water Quality

Phase II - Task 2: Subject Matter Specialists (PDT & ITR Members)

- ❑ Dominion Inc.
- ❑ NC Division of Water Quality (NCDWQ)
- ❑ NC Wildlife Resources Commission (NCWRC)
- ❑ Roanoke River National Wildlife Refuge (RRNWF)
- ❑ US Army Corps of Engineers Wilmington District (USACE)
- ❑ US Fish and Wildlife Service (USFWS)
- ❑ US Geological Survey (USGS)
- ❑ VA Department of Game and Inland Fisheries (VADGIF)
- ❑ VA Department of Environmental Quality (VADEQ)
- ❑ The Nature Conservancy (TNC)
- ❑ Weyerhaeuser
- ❑ Other agencies as appropriate

METHOD OF ACCOMPLISHMENT: Transfer Funding to USGS

TIME: (How much time in person days will task take.)

Water Quality Sub Tasks	
Modeling Strategy Development	\$45,000
Interim Modeling Letter Report	\$20,000
Field Monitoring	\$496,100
Hydrodynamic Modeling	\$249,000
Water Quality Monitoring	\$164,000
Management Scenario Analysis	\$56,000
Administer Contract/Work Order	\$75,900
Federal	\$553,000
Non-Federal	\$553,000
Non-Federal (Cash)	TBD
Non-Federal (In-Kind)	TBD
Total Cost Downstream Flow Regime and Effects on Downstream Riparian Ecosystem	\$1,106,000
<u>To view Scope of Work See Attachment 8 Water Quality Scope of Work</u>	

Phase II - Task 3: Sedimentation and Channel Morphology

Phase II - Task 3: Subject Matter Specialists (PDT & ITR Members)

- US Geological Survey (USGS)
 - Reston, Virginia
 - Raleigh, North Carolina
 - Baltimore, Maryland
- Roanoke River National Wildlife Refuge (RRNWR)
- US Army Corps of Engineers, Wilmington District (USACE)
- NC Division of Water Quality (NCDWQ)
- Dominion Inc.
- Riverine Geomorphologists, Sedimentation Expert (as needed)

METHOD OF ACCOMPLISHMENT: Transfer Funding to USGS

TIME: (How much time in person days will task take.)

Sedimentation and Channel Morphology Sub Tasks	
Virginia Tech/Dominion Bank Erosion Study	\$135,000
Establishment of Channel and Floodplain Cross-Section	\$17,012
Establishment of Channel and Floodplain Cross-Section	\$47,617
Monitoring Transects (Resurvey cross-sections/erosion pin measurement)	\$34,348
Suspended Sediment Sampling	\$8,500
Analysis and Report Writing	\$50,496
Administer Contract/Work Order	\$19,027
Federal	\$156,000
Non-Federal	\$156,000
Non-Federal (Cash)	\$21,000
Non-Federal (In-Kind)	\$135,000
Total Cost Downstream Flow Regime and Effects on Downstream Riparian Ecosystem	\$312,000
<u>Combined with Task 1 (See Above)</u>	

Phase II - Task 4: Reservoir Resources

Phase II - Task 4: Subject Matter Specialists (PDT & ITR Members)

- ❑ NC Department of Parks and Recreation (NCDPR)
- ❑ NC Wildlife Resources Commission (NCWRC)
- ❑ Regional Partnership of Local Government
- ❑ Roanoke River Basin Association (RRBA)
- ❑ Southeastern Power Administration (SEPA)
- ❑ US Army Corps of Engineers, Wilmington District (USACE)
- ❑ VA Department of Conservation & Recreation (VADCR)
- ❑ VA Department of Game and Inland Fisheries (VADGIF)

METHOD OF ACCOMPLISHMENT: All work on this Task was deferred until Phase III.

TIME:

The scope of work for this task, as originally envisioned, addressed a number of items that would be useful to do, but which are not central to the Kerr 216 Study purpose. The Executive Committee determined that once a recommended water management policy is determined, any impacts on issues such as fisheries and lake shore ecosystems should be evaluated during the analysis undertaken to prepare the Environmental Impact Statement for the project. There will be no data collection for this task during Phase II. Impact analysis will be conducted during Phase III.

Phase II - Task 5: Downstream Flow Based Recreation

Phase II - Task 5: Subject Matter Specialists (PDT & ITR Members)

- ❑ NC Division of Water Resources (NCDWR)
- ❑ NC Wildlife Resources Commission (NCWRC)
- ❑ The Nature Conservancy (TNC)
- ❑ US Army Corps of Engineers, Wilmington District (USACE)
- ❑ VA Department of Conservation & Recreation (VADCR)
- ❑ Roanoke River Partners (RRP)
- ❑ Roanoke River National Wildlife Refuge (RRNWR)

METHOD OF ACCOMPLISHMENT: All work on this Task was deferred until Phase III.

TIME: (How much time in person days will task take.)

The EC agreed that the likely effects of study recommendations on downstream recreation were minor. Therefore, due to budget constraints, downstream flow based recreation as a study purpose was eliminated. It was agreed that the impacts on Downstream Flow Based Recreation would be reviewed during Phase III of the study. Studies should be undertaken only to the extent that they are required for the review of the impacts during the analysis undertaken to prepare the Environmental Impact Statement for the project. There will be no data collection for this task during Phase II. Impact analysis will be conducted during Phase III.

Phase II - Task 6: Salt Wedge

Phase II - Task 6: Subject Matter Specialists (PDT & ITR Members)

- ❑ NC Division of Water Quality (NCDWQ)
- ❑ US Army Corps of Engineers, Wilmington District, (USACE)
- ❑ US Fish and Wildlife Service (USFWS)
- ❑ Weyerhaeuser Corporation

METHOD OF ACCOMPLISHMENT: All work on this Task was deferred until Phase III.

TIME: (How much time in person days will task take.)

The EC recognized that salt water intrusion at the lower end of the Roanoke River is a complex phenomenon affected by many variables not related to Kerr reservoir operations. Kerr Lake operations are not a major factor, except during droughts, in which case an excellent management and coordination process is already in place. The EC therefore agreed that additional study expenditures do not need to be made on this task. When study recommendations are developed, any changes recommended in project operations will be reviewed to determine if they affect the salt wedge issue during the analysis undertaken to prepare the Environmental Impact Statement for the project. There will be no data collection for this task during Phase II. Impact analysis will be conducted during Phase III.

Phase II - Task 7 Diadromous Fish and Downstream Riverine Aquatic Resources

Phase II - Task 7: Subject Matter Specialists (PDT & ITR Members)

- ❑ Dominion Inc.
- ❑ National Marine Fisheries Service (NMFS)
- ❑ NC Division of Marine Fisheries (NCDMF)
- ❑ NC Division of Water Resources NCDWR)
- ❑ NC Wildlife Resources Commission (NCWRC)
- ❑ US Army Corps of Engineers, Wilmington District, (USACE)
- ❑ US Fish and Wildlife Service – South Atlantic Fisheries (USFWS-SAF)
- ❑ Virginia Department of Game and Inland Fisheries (VADGIF)

METHOD OF ACCOMPLISHMENT: This Task should be undertaken by a private consultant.

TIME:

Diadromous Fish and Riverine Aquatic Resources Sub Tasks	
Aerial Videography of Bankside Woody Debris	\$70,000
Finalize Roanoke River Diadromous Fish Plan	\$38,000
Administer Contract/Work Order	\$15,000
Federal	\$27,500
Non-Federal	\$27,500
Non-Federal (Cash)	TBD
Non-Federal (In-Kind)	TBD
Total Cost Reservoir Resources	\$55,000
To view Scope of Work See Attachment 9 Diadromous Fish and Riverine Aquatic Resources Scope of Work	

Phase II - Task 8: Water Supply

Phase II - Task 8: Subject Matter Specialists (PDT & ITR Members)

- ❑ City of Virginia Beach (CVB)
- ❑ Dominion Inc.
- ❑ NC Division of Water Resources (NCDWR)
- ❑ Roanoke River Basin Association (RRBA)
- ❑ Southeastern Power Administration (SEPA)
- ❑ US Army Corps of Engineers, Wilmington District (USACE)
- ❑ VA Department of Environmental Quality (VADEQ)

METHOD OF ACCOMPLISHMENT:

TIME: (How much time in person days will task take.)

Water Supply	
Total Cost Reservoir Resources	\$55,000
<u>To view Scope of Work See Attachment 10</u> <u>Water Supply Scope of Work</u>	

Phase II - Task 9. Operating Policies and Administrative Procedure

Phase II - Task 9: Subject Matter Specialists (PDT & ITR Members)

- ❑ City of Virginia Beach (CVB)
- ❑ Dominion Inc.
- ❑ Hydro Logics, Inc. (HLI)
- ❑ NC Division of Water Resources (NCDWR)
- ❑ Southeastern Power Administration (SEPA)
- ❑ US Army Corps of Engineers , Wilmington District (USACE)
- ❑ VA Department of Environmental Quality (VADEQ)

METHOD OF ACCOMPLISHMENT: This Task should be undertaken by a private consultant.

TIME:

Operating Policies and Administrative Procedure Sub Tasks	
USACE Assemble Existing Information	\$0 ³
Review Operating Policies and Administrative Procedures Contract	\$45,000
Administer Contract	\$5,000
Federal	\$0
Non-Federal	\$50,000
Non-Federal (Cash)	\$0
Non-Federal (In-Kind)	\$50,000
Total Cost Operating Policies and Administrative Procedures	\$50,000
To view Scope of Work See Attachment 11 Operating Policies and Administrative Procedure Scope of Work	

³ This task will be completed using existing O&M Funding and will not be completed using oh H. Kerr Section 216 Study funding.

Phase II - Task 10: Modeling Oversight

Subject Matter Specialist *Taken from Phase I. Change as required.*

- ❑ NC Division of Water Quality (NCDWQ)
- ❑ NC Division of Water Resources (NCDWR)
- ❑ The Nature Conservancy (TNC)
- ❑ Unidentified Stakeholder (To be Determined)
- ❑ US Army Corps of Engineers, Wilmington District (USACE)
- ❑ Virginia Department of Environmental Quality (VADEQ)

METHOD OF ACCOMPLISHMENT: This Task is being undertaken by HDR, Inc.

TIME: (How much time in person days will task take.)

Modeling Oversight Sub Tasks	
Roanoke River Basin Reservoir Operation Model (RRBROM) Update	\$85,000
Administer Contract	\$6,000
Model Oversight (Funded by Workgoup Requesting Review)	TBD
Model Certification	\$15,000
Federal	\$43,000
Non-Federal	\$43,000
Non-Federal (Cash)	\$43,000
Non-Federal (In-Kind)	\$0
Total Cost Modeling Oversights	\$106,000
<u>To view Scope of Work See Attachment 12</u>	
<u>RRBROM Update Scope of Work</u>	

Summary of Phase II Tasks, Costs, and Schedule

The total cost of Phase II is \$2,200,000. A detailed breakdown of costs can be found at the table at this link. (See Table 6)

TASKS AND COSTS FOR PHASE III

Phase III consists of plan formulation and evaluation and completion, processing and approval of the feasibility report and NEPA documentation. Output of this phase include: development of alternatives to meet objectives; determination of outputs and impacts of each alternative; a trade-off analysis; and recommendations for a selected plan(s).

The estimated cost for Phase III of the study is: \$\$1,000,000

During Phase III it will be necessary to integrate study elements and consider overall alternatives. The PDT in consultation with appropriate subject matter specialists will develop a process to formulate alternatives. The suggested approach is to make use of all of the interrelationships and feedback loops between the various components of the Roanoke River system. A diagram illustrating the linkages between the different study elements are shown on the following page.

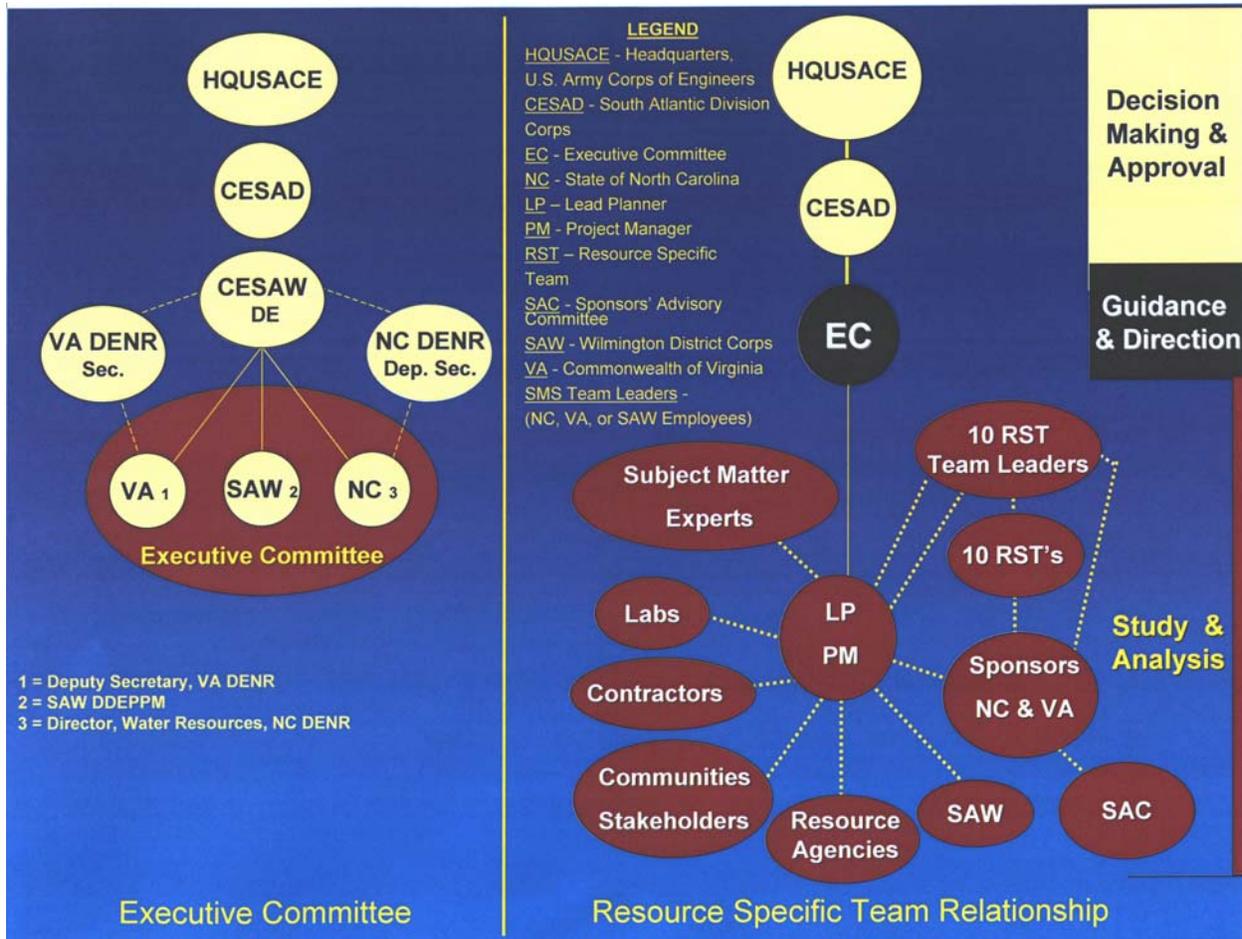
TOTAL STUDY COSTS

Based on the Phase II scopes of work developed by the working groups, an estimated feasibility study cost estimate of \$4,200,000, as follows was presented to and approved by the Executive Committee at the March 2006 meeting.

Phase I	\$800,000
Phase II	\$2,200,000
Phase III	\$1,000,000
Contingency	\$200,000
Estimated Feasibility Cost	\$4,200,000

This estimate was used for the Fiscal Year 2007 Federal budget submission.

John H. Kerr Dam and Reservoir
Virginia and North Carolina
(Section 216) Feasibility Study
Relationship Between Study Teams



REFERENCES CITED

REFERENCES CITED

Federal Energy Regulatory Commission

1995 Relicensing First Stage Consultation Package for Major Project - Roanoke Rapids Lake and Lake Gaston Hydropower Project. FERC Project No. 2009. North, Carolina Power.

1996 Relicensing Study Plans for Major Project - Roanoke Rapids Lake and Lake Gaston Hydropower Project. FERC Project No. 2009. North Carolina Power.

1997 Roanoke Rapids Lake and Lake Gaston Hydropower Project. Water Quality Year-End Report. North Carolina Power.

1997 Roanoke Rapids Lake and Lake Gaston Hydropower Project. Terrestrial Resources Year-End Report. North Carolina Power.

1997 Roanoke Rapids Lake and Lake Gaston Hydropower Project Recreational Resources Year-End Report. North Carolina Power.

1997 Roanoke Rapids Lake and Lake Gaston Hydropower Project Recreational Resources Year-End Report. North Carolina Power.

1997 Aquatic Resources of Lake Gaston and Roanoke Rapids Lake Updated Version of 1996 Year-End Report. Prepared for North Carolina Power.

1999 Draft Application for Licensing for Major Project-Existing Dam Roanoke Rapids Lake and Lake Gaston Hydropower Project. FERC Project No. 2009. North Carolina Power.

1999 Draft Applicant Prepared Environmental Assessment for Licensing for Major Project-Existing Dam Roanoke Rapids Lake and Lake Gaston Hydropower Project. FERC Project No. 2009.

1999 Appendices to the Draft Applicant Prepared Environmental Assessment for Licensing for Major Project-Existing Dam Roanoke Rapids Lake and Lake Gaston Hydropower Project. FERC Project No. 2009.

Finke, J. R. and S. Van Horn

1993. 1990 North Carolina Angler Opinion Survey. Federal Aid in Fish Restoration Project F-23-17. N.C. Wildlife Resources Commission, Division of Boating and Inland Fisheries, Raleigh, North Carolina.

HydroLogics, Inc.

n.d. Roanoke River Basin Reservoir Operations Model (RRBROM), Columbia, Maryland.

Kornegay, J. W.

2000. Roanoke River sport fishery creel survey, 1997-1999. Federal Aid in Fish Restoration Project F-22. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh, North Carolina.

Kornegay, J. W. and K. L. Nelson.

1997 Roanoke River sport fishery creel survey, 1994-1996. Federal Aid in Fish Restoration Project F-22. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh, North Carolina.

Schuhmann, P. W.

1999 Economic valuation of Roanoke River striped bass recreational fishery. Federal Aid in Fish Restoration Project F-22. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh, North Carolina.

U.S. Council on Environmental Quality

1978 *Regulations for Implementing National Environmental Policy Act*. 40 Code of Federal Regulations Parts 1500-1508, 43 Federal Register 55990, November 28, 1978.

U.S Army Corps of Engineers

2000 *Planning Guidance Note Book*. Engineering Regulation 1105-2-100, April 22, 2000, U.S. Army Corps of Engineers, Washington D.C.

U.S. Army Corps of Engineers, Wilmington District

1980 John H. Kerr dam and Reservoir, Master Plan Update (Design Memorandum Number 5), Wilmington, North Carolina.

1985 Reconnaissance Report on John H. Kerr Dam and Reservoir, Virginia and North Carolina (Section 216, Public Law 91-611). Wilmington District, Wilmington, North Carolina.

1992 Operational Management Plan, John H. Kerr Reservoir, Wilmington, North Carolina.

1995 Water Control Plan for John H. Kerr Dam and Reservoir, Wilmington, North Carolina.

1995 Shoreline Management Plan for John H. Kerr Reservoir, Virginia and North Carolina. Appendix VI of the Operational Management Plan. Wilmington, North Carolina.

1996 Initial Appraisal Report For the Lower Roanoke River Basin Study Below the John H. Kerr Dam and Reservoir, Virginia and North Carolina (216), Wilmington, North Carolina.

2001 Reconnaissance Report (905(b) Report) John H. Kerr Dam and Reservoir, Virginia and North Carolina (Section 216) Lower Roanoke River. Wilmington, North Carolina.

U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce

2001 U.S. Census Bureau. 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation.

U.S. Water Resources Council

1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. 8 July 1983, United States Water Resources Council, Washington DC.

ATTACHMENT 1
JOHN H. KERR DAM AND RESERVOIR SECTION 216 STUDY SCHEDULE

John H. Kerr Dam and Reservoir Section 216 Study Schedule

905(b) Report approved	May 2001
Sponsors' Advisory Committee formed	November 2001
PMP completed	January 2002
FCSA executed	June 2003
Technical work groups formed/Team leaders assigned	May 2004
Work groups complete Phase I scope of work (SOW)	March 2004
Begin Phase I – Prepare Scopes of Work	April 2004
Work groups complete SOW for Phase II (Except Water Supply)	July 2005
Work groups begin Phase II – Data Collection, Studies & Modeling	August 2005
Work groups complete Phase II (In-house Review and Executive Committee Approval)	September 2008
Work groups begin Phase III (Preliminary Plan Formulation)	May 2007
Independent Technical Review	April 2010
Feasibility Scoping Meeting (FSM) shouldn't this be done before the ITR and before this point?	June 2010
Work groups complete Phase III, ITR Complete	September 2010
Independent Technical Review	January 2011
Alternative Formulation Briefing (AFB)	February 2011
Draft Report to ITR	March 2011
Final Feasibility Report/EIS distributed for Public Review	April 2011
Final Report Complete and Submitted to Division/Headquarters	August 2011
Feasibility report approved by Division	September 2011
Civil Works Review Board	December 2011

**ATTACHMENT 2
EXECUTIVE COMMITTEE
AND PROJECT DELIVERY TEAM MEMBERS**

EXECUTIVE COMMITTEE MEMBERS:

<u>NAME</u>	<u>ORGANIZATION</u>	<u>E-MAIL ADDRESS</u>	<u>PHONE</u>
Christine Brayman	DDPM ⁴ , USACE, Wilmington USACE, Wilmington	christine.m.brayman@usace.army.mil	910-251-4478
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Richard F. Weeks	Deputy Director for Operations Virginia Department of Environmental Quality	rfweeks@deq.virginia.gov	(804) 698-4484

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Updated 1 September 2006

⁴ Deputy District Engineer for Programs and Project Management

STATE OF NORTH CAROLINA PROJECT DELIVERY TEAM MEMBERS:

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Adugna Kebede	NC Division of Water Quality	adugna.kebede@ncmail.net	919-733-5083 ext 515
Pete Kornegay	NC Wildlife Resources Commission	kornegayjw@mchsi.com	252-338-3607
Jim Mead	NC Division of Water Resources	jim.mead@ncmail.net	919-715-5428
Jim Mulligan	NC Division of Water Quality	Jim.Mulligan@ncmail.net	252-946-6481
Kent Nelson	NC Wildlife Resources Commission	nelsonk3@earthlink.net	252-752-5425
Linda Pearsall	NC Natural Heritage Program	Linda.pearsall@ncmail.net	919-715-8697
Dave Penrose	NC Division of Water Quality	Dave.Penrose@ncmail.net	919-715-3481
Brian Strong	NC State Parks/Resource Management	brian.strong@ncmail.net	919-715-8711
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COMMONWEALTH OF VIRGINIA PROJECT DELIVERY TEAM MEMBERS:

<u>NAME</u>	<u>ORGANIZATION</u>	<u>E-MAIL ADDRESS</u>	<u>PHONE</u>
Leon App	VA Dept. of Conservation & Recreation	leonapp@dcr.state.va.us	804-786-2093
John Davy	VA Dept. of Conservation & Recreation	jdavy@dcr.state.va.us	804-786-1119
Joe Hassell	VA Dept. of Environmental Quality	jphassell@deq.state.va.us	804-698-4072
Bud LaRoche	VA Dept of Game & Inland Fisheries	blaroche@dgif.state.va.us	434-525-7522
Robert Munson	VA Dept of Conservation & Recreation	rsmunson@dcr.state.va.us	804-786-6140
Tom Wilcox	VA Dept of Game & Inland Fisheries	twilcox@dgif.state.va.us	804-367-8998
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OTHER FEDERAL AGENCY PROJECT DELIVERY TEAM MEMBERS:

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Prescott Brownell	National Marine Fisheries Service	Prescott.Brownell@noaa.gov	843-762-8591
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Carter Edge	Southeastern Power Administration	cartere@sepa.doe.gov	06-213-3855
John Ellis	USFWS	john_ellis@fws.gov	919-856-4520 ext. 26
Bob Goss	Southeastern Power Administration	bobg@sepa.doe.gov	706-213-3860
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Harvey Hill	USFWS/Roanoke River Natl. Wildlife Refuge	harvey_hill@fws.gov	252-794-3808
Cliff Hupp	USGS	crhupp@usgs.gov	703-648-5207
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Jean Richter	USFWS/Roanoke River National Wildlife Refuge	jean_richter@fws.gov	252-794-3808 ext. 22
Jeanne Robbins	US Geological Survey	jrobbins@usgs.gov	919-571-4017
Ron Sechler	National Marine Fisheries Service	ron.sechler@noaa.gov	252-728-5090
Wayne Short	Natural Resource Conservation Service	wayne.short@nc.usda.gov	252-583-3481 ext. 3

LOCAL GOVERNMENT PROJECT DELIVERY TEAM MEMBERS:

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Thomas Leahy	City of Virginia Beach	tleahy@vbgov.com	757-427-8654
Gerry Lovelace	Halifax Co., VA	gvl@co.halifax.va.us	434-476-3310
Russell Slayton	Regional Partnership of Local Governments	sbclaw@telpage.net	434-848-3632
Nancy Wilson	Vance County Dept of Tourism	vctourism@gloryroad.net	252-438-2222

PRIVATE INDUSTRY PROJECT DELIVERY TEAM MEMBERS

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Wayne Dyok	Montgomery Watson & Harza Engineering	wayne.m.dyok@mwhglobal.com	916-921-1910 ext. 19
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Jack Hearne	Steele Creek Marina	marinajack@mindspring.com	252-213-1913
Martin Lebo	Weyerhaeuser Company	martin.lebo@weyerhaeuser.com	252-633-7511
Brian McCrodden	Hydro Logics, Inc.	bmccrodden@hydrologics.net	919-856-1288
Masato Miwa	International Paper Company	Masato.Miwa@ipaper.com	229-246-3642
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Updated 1 September 2006

INTERESTED PARTY PROJECT DELIVERY TEAM MEMBERS

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Jeff Horton	The Nature Conservancy	jhorton@tnc.org	252-794-1818
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Cindy Tripp	Roanoke River Partners	director@roanokeriverpartners.org	252-794-2793
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Richard Stimson		rstimson@schoolink.net	252-586-3304

Updated 1 September 2006

**ATTACHMENT 3
WORK GROUPS**

John H. Kerr Work Group Membership List

Downstream Flow and Riparian Ecosystem

Jim Mead, LEAD - NCDWR
Jerad Bales – USGS
John Dorney – NCDWQ
John Ellis – USFWS
Jennifer Everett – NCDWQ
Earl Gillis – NCWRC
Bob Graham – Dominion
John Hazelton – USACE
Harvey Hill – FWS - ref
Adugna Kebede – NCDWQ
Bob Lindsay – RRBA
Linda Pearsall – NCNHP
Sam Pearsall – TNC
Jean Richter – USFWS RRNWR
Jeff Richter – USACE

Water Quality

Norm Deaver, LEAD - NCDWQ
Frank Yelverton, LEAD – USACE
Tom Augsburg – USFWS
Jerad Bales – USGS
Bill Bolin – Dominion
Joe Hassell – VADEQ
Wayne Jones – NCWRC
Adugna Kebede – NCDWQ
Pete Kornegay – NCWRC
Bud LaRoche – VADGIF
Martin Lebo – Weyerhaeuser
Jim Mead – NCDWR
Jim Mulligan – NCDWQ
Jean Richter – USFWS RRNWR

Sedimentation & Channel

Morphology

Virginia Rynk, LEAD - USACE
Bill Bolin – Dominion
Jennifer Everett – NCDWQ
Cliff Hupp – USGS
Adugna Kebede – NCDWQ
Jean Richter – USFWS RRNWR
Virginia Rynk, USACE
Phil Townsend – TNC

Salt Wedge

John Hazelton, LEAD – USACE
Jerad Bales – USGS
Dan Emerson, USACE
Jennifer Everett – NCDWQ
Tom Fransen – NCDWR
Adugna Kebede – NCDWQ
Pete Kornegay – NCWRC
Martin Lebo – Weyerhaeuser
Jim Mulligan – NCDWQ
Jim Thorton – Dominion

Reservoir Resources

Tom Fransen, LEAD - NCDWR
Bud LaRoche, LEAD - VADGIF
Gene Adesso – RRBA
Leon App – VADCR
Robert Dennis, USACE
Jack Hearne – Steel Crk Marina
Wayne Jones – NCWRC
Bob Munson – VADCR
Herb Nadler – SEPA
Russel Slayton – RPLG
Frank Snipes – USACE
Brian Strong – NCDPR
Jim Thorton – Dominion
Scott VanHorn – NCWRC
Michael Womack, USACE

Downstream Flow-based Recreation

Jim Mead, LEAD – NCDWR
Leon App – VADCR
Jack Hearne – Steel Crk Marina
Harvey Hill – FWS - ref
Bob Munson – VADCR
Kent Nelson – NCWRC
Jean Richter – USFWS RRNWR f
Frank Snipes – USACE
Jim Thorton – Dominion
Cindy Tripp – RR Partners

Diadromous Fish & Downstream

Aquatic Habitat

Chuck Wilson, LEAD – USACE
Bennett Wynn, LEAD – NCWRC
Bill Bolin – Dominion
Pres Brownell – NMFS
Tom Fransen – NCDWR
Bob Graham – Dominion
Wilson Laney – USFWS
Bud LaRoche – VADGIF
Jim Mead – NCDWR
Dave Penrose – NCDWQ
Sara Winslow – NCDMF
Joe Hightower – USGS
Bob Graham – Dominion

Water Supply

Tom Fransen, LEAD -NCDWR
Terry Wagner, LEAD - VADEQ
Joe Hassell – VADEQ
Tom Leahy – VA Beach
Bob Lindsay – RRBA
John Morris – NCDWR
Herb Nadler – SEPA
Allen Piner – USACE
Bob Sattin USACE
Russell Slayton – RPLG
Jim Thorton – Dominion
Tony Young – USACE

Operating Policies and Administrative Procedures

Joe Hassell, LEAD – VADEQ
John Morris, LEAD – NCDWR
Terry Brown – USACE
Tom Fransen – NCDWR
Pete Kornegay – NCWRC
Tom Leahy – VA Beach
Bob Lindsay – RRBA
Jerry Lovelace – RPLG
Brian McCrodden – Hydrologics
Jim Mead – NCDWR
Herb Nadler – SEPA
Sam Pearsall – TNC
Richard Roos-Collins – TNC
Bob, Sattin, USACE
Jim Thorton – Dominion
Michael Womack, USACE

Modeling Oversight

Tony Young LEAD - USACE
Terry Brown - USACE
Tom Fransen - NCDWR
Joe Hassel - VADEQ
Adugna Kebede - NCDWQ
Jim Mead - NCDWR
Sam Pearsall - TNC
Jim Thorton – Dominion

Team Leaders

Norm Deaver, - NCDWQ
John Hazelton, – USACE
Pete Kornegay, – NCWRC
Bud LaRoche, - VADGIF
Jim Mead, – NCDWR
John Morris, – NCDWR
Virginia Rynk, – USACE
Terry Wagner, - VADEQ
Chuck Wilson, – USACE
Bennett Wynn, - NCWRC
Frank Yelverton, – USACE
Tony Young, - USACE

USACE Project Manager

Ben Lane

USACE Lead Planner

Richard Lewis

NC Project Manager

Jim Mead

VA Project Manager

Bud Laroche

Updated 23 August 2007

**John H. Kerr Dam and Reservoir, VA NC (Section 216) Feasibility Study
Estimate of Phase II Study Tasks -- Revised 12 Sep 2006**

Tasks	Costs	Method of Accomplishment	Approval Date/ Status of EC Review	FY 05 Actual Expenditures	FY 06 Recommended Expenditures	FY 07 Recommended Expenditures	FY 08 Recommended Expenditures
Work Group 1 - Downstream Flow Regime and Effects on Riparian Ecosystem							
Flood Model Evaluation	\$26,693	USACE Awarded Contract	13-Dec-2004		\$26,693		
Baseline Information to Evaluate Impacts of Downstream Flooding on Agriculture, Timber Operations and Road Access	\$150,000	State Awarded Contract Department of Water Resources will Administer as In-kind Service	13-Dec-2004		\$0		\$150,000
Geographic-based Evaluation of Flooding Impacts on Recreation Access and Immersion of Recreation Lands	\$15,000	As part of above \$150K baseline info contract = 150 + 15 = 165K	23-Mar-2006		\$0		\$15,000
Update Comprehensive Vegetation Map	\$0	\$50,000 to be completed by TNC at no cost to the Kerr	27-Sep-2004				
Bottomland Hardwood Productivity and Recruitment Study	\$30,000	State Awarded Contract Department of Water Resources will Administer as In-kind Service	27-Sep-2004		\$0		\$30,000
Administer Contract/Work Order	\$6,378	USACE	13-Dec-2004	\$2,148	\$4,230	\$0	\$0
Work Group 1 - Downstream Flow Regime and Effects on Riparian Ecosystem	\$228,071			\$2,148	\$30,923	\$0	\$195,000
Work Group 2 - Water Quality							
Monitoring Strategy Development	\$45,000	USGS	Look at ways to accelerate schedule	\$10,000	\$35,000		
Interim Modeling Letter Report	\$20,000	USGS		\$0	\$20,000		
Field Monitoring	\$496,100	USGS	Look at ways to accelerate schedule		\$182,900	\$283,600	\$29,600
Hydrodynamic Modeling	\$249,000	USGS	Look at ways to accelerate schedule		\$17,100	\$200,900	\$31,000
Water Quality Modeling	\$164,000	USGS	Look at ways to accelerate schedule			\$6,100	\$157,900
Management Scenario Analysis	\$56,000	USGS	Look at ways to accelerate schedule				\$56,000
Administer Contract/Work Order	\$75,900	USACE	Look at ways to accelerate schedule	\$1,224	\$9,471	\$34,000	\$31,205
Work Group 2 - Water Quality	\$1,106,000			\$11,224	\$264,471	\$524,600	\$305,705
Work Group 3 - Sedimentation and Channel Morphology							
VA. Tech/Dominion Bank Erosion Study	\$135,000	NC Fund - Work-In-Kind	23-Mar-2006		\$0	\$0	\$135,000
Establishment and Leveling of Bank, Channel & Floodplain Cross-Sections	\$17,012	USGS	13-Dec-2004	\$8,506	\$8,506		
Establishment and Leveling of Bank, Channel & Floodplain Cross-Sections	\$47,617	USGS	23-Mar-2006		\$27,056	\$20,561	
Transect Monitoring (Resurvey cross-sections/erosion pin measurement)	\$34,348	USGS	23-Mar-2006		\$17,174	\$17,174	\$0
Suspended Sediment Samplings	\$8,500	USGS	13-Dec-2004	\$4,250	\$4,250		\$0
Management, Analysis and Report Writing	\$50,496	USGS	23-Mar-2006		\$16,381	\$14,316	\$19,799
Administer Contract/Work Order	\$19,027	USACE	23-Mar-2006	\$1,714	\$6,253	\$4,000	\$7,059
Work Group 3 - Sedimentation and Channel Morphology	\$312,000			\$14,470	\$79,620	\$56,051	\$161,858
Work Group 4 - Reservoir Resources							
Establish Relationship Between Recreation Use and Water Management	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Fish Entrainment and Impingement Study	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Downstream Fish Passage	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Fish Spawning and Recruitment Study	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Recruitment of Ground Nesting Birds	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Spawning and Habbit Degradation and Shoreline Erosion Study	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Waterfowl Recruitment and Abundance Study	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Riparian Habitat Loss and Neotropical Birds	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Vernal Pond Study	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Work Group 4 - Reservoir Resources	\$0			\$0	\$0	\$0	\$0

**John H. Kerr Dam and Reservoir, VA NC (Section 216) Feasibility Study
Estimate of Phase II Study Tasks -- Revised 12 Sep 2006**

Tasks	Costs	Method of Accomplishment	Approval Date/ Status of EC Review	FY 05 Actual Expenditures	FY 06 Recommended Expenditures	FY 07 Recommended Expenditures	FY 08 Recommended Expenditures
Work Group 5 - Downstream Flow Based Recreation							
Geographic-based Evaluation of Flooding Impacts on Recreation Access and Immersion of Recreation Lands	\$0	Combined into WG 1 -DS Flow Regime as extra mapping & analysis for hunting, recreation	23-Mar-2006				\$0
Downstream Recreation Carrying Capacity	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Determination of How Recreation User Days are Influenced by John H. Kerr Operations	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				\$0
Work Group 5 - Downstream Flow Based Recreation	\$0			\$0	\$0	\$0	\$0
Work Group 6 - Salt Wedge							
Existing Salinity Data Collection and Organization	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Drought Data Collection Effort	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Evaluate and Modify hydrodynamic and Water Quality Model	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Run and Evaluate Scenarios	\$0	Work Deleted Per 21 Dec 05 EC	23-Mar-2006				
Work Group 6 - Salt Wedge	\$0			\$0	\$0	\$0	\$0
Work Group 7 - Diadromous Fish and Riverine Aquatic Resources							
Aerial Videography of Bankside Woody Debris	\$70,000	Private Contractor	23-Mar-2006		\$0	\$70,000	
Finalize Roanoke River Diadromous Fish Restoration Plan	\$38,000	USACE and State sponsors	23-Mar-2006		\$1,000	\$18,000	\$19,000
Administer Contract/Work Order	\$15,000	USACE	23-Mar-2006		\$9,000	\$6,000	
Work Group 7 - Diadromous Fish and Riverine Aquatic Resources	\$123,000			\$0	\$10,000	\$94,000	\$19,000
Work Group 8 - Water Supply							
Determine Economic Value of Water Supply At JH Kerr	\$50,000	USACE contract	23-Mar-2006	\$0			\$50,000
Administer Contract/Work Order	\$5,000	USACE,NC, VA	23-Mar-2006			\$1,000	\$4,000
Work Group 8 - Water Supply	\$55,000			\$0	\$0	\$1,000	\$54,000
Work Group 9 - Operating Policies and Administrative Procedures							
Review Operating Policies and Administrative Procedures	\$0	USACE assemble existing information(O&M funds)	21-Dec-2005				
Review Operating Policies and Administrative Procedures	\$45,000	State of NC Awarded Contract--Work-In-Kind--3 partners m	23-Mar-2006	\$0	\$0	\$0	\$45,000
Administer Contract/Work Order	\$5,000	USACE,NC, VA	23-Mar-2006			\$1,000	\$4,000
Work Group 9 - Operating Policies and Administrative Procedures	\$50,000			\$0	\$0	\$1,000	\$49,000
Work Group 10 - Modeling Oversight, RRBROM Upgrades							
Certify RRBROM, Flood Mapping Models	\$15,000	USACE		\$0	\$15,000		
RRBORM Upgrades	\$84,903	Private Contractor		\$37,717	\$47,186		
Administer Contract/Work Order	\$5,575	USACE		\$4,451	\$1,124		
Work Group 10 - Modeling Oversight, RRBROM Upgrades	\$105,478			\$42,169	\$63,309	\$0	\$0
Subtotal Phase 2 Data Collection Costs	\$1,979,549			\$70,011	\$448,323	\$676,651	\$784,563
Supervision and Administration, Coordination	\$212,451				\$36,637	\$80,400	\$95,414
Contingency	\$8,000						\$8,001
Total Phase 2 Costs	\$2,200,000			\$70,011	\$484,960	\$757,051	\$887,978

Notes: Work Group 8, Water Supply - \$50,000 place holder for contract will be replaced with SOW and estimated cost for Phase 2 data collection when Water Supply work group completes; \$10,000 - 46,000 estimated cost to prepare SOW (Phase 1 cost).

**John H. Kerr Dam and Reservoir, VA NC (Section 216) Feasibility Study
Estimate of Phase II Study Tasks -- Revised 12 Sep 2006**

EC Comment 22 Feb 2005	Total col G-J	Moved from schedule
Approved FY 06 Cost	\$26,693	
	\$150,000	
	\$15,000	
Deferred FY 06 Cost	\$0	\$50,000
	\$30,000	
	\$6,378	
	\$228,071	\$50,000
	\$0	
	\$0	
Approved	\$45,000	
Approved FY 07 Cost	\$20,000	
FY 08 Cost	\$496,100	
FY 08 Cost	\$249,000	
FY 08 Cost	\$164,000	
FY 08 Cost	\$56,000	
	\$75,900	
	\$1,106,000	\$0
	\$0	
	\$0	
	\$135,000	
	\$17,012	
	\$47,617	
	\$34,348	
	\$8,500	
	\$50,496	
	\$19,027	\$3,000
	\$0	\$312,000
	\$0	
	\$0	
	\$0	\$100,000
	\$0	\$50,000
	\$0	\$75,000
	\$0	\$35,000
	\$0	\$20,000
	\$0	\$20,000
	\$0	\$20,000
	\$0	\$20,000
	\$0	\$20,000
	\$0	\$360,000
	\$0	

**John H. Kerr Dam and Reservoir, VA NC (Section 216) Feasibility Study
Estimate of Phase II Study Tasks -- Revised 12 Sep 2006**

EC Comment 22 Feb 2005	Total col G-J	Moved from schedule
	\$0	
	\$0	\$15,000
	\$0	\$35,000
	\$0	\$60,000
	\$0	
	\$0	\$110,000
	\$0	
	\$0	\$25,000
	\$0	\$75,000
	\$0	\$75,000
	\$0	\$60,000
	\$0	\$235,000
	\$0	
0		
	\$70,000	\$110,000
	\$38,000	
	\$15,000	
	\$123,000	\$110,000
	\$0	
	\$0	
	\$50,000	
	\$5,000	
	\$55,000	\$0
	\$0	
	\$0	
	\$0	
	\$45,000	
	\$5,000	
	\$50,000	\$0
	\$0	
	\$15,000	
	\$84,903	
	\$5,575	
	\$105,478	\$0
	\$0	
	\$1,979,548	\$868,000
	\$0	
	\$212,451	
	\$8,001	
	\$0	
	\$2,200,000	\$868,000

ATTACHMENT 4
THREE PHASE STUDY APPROACH

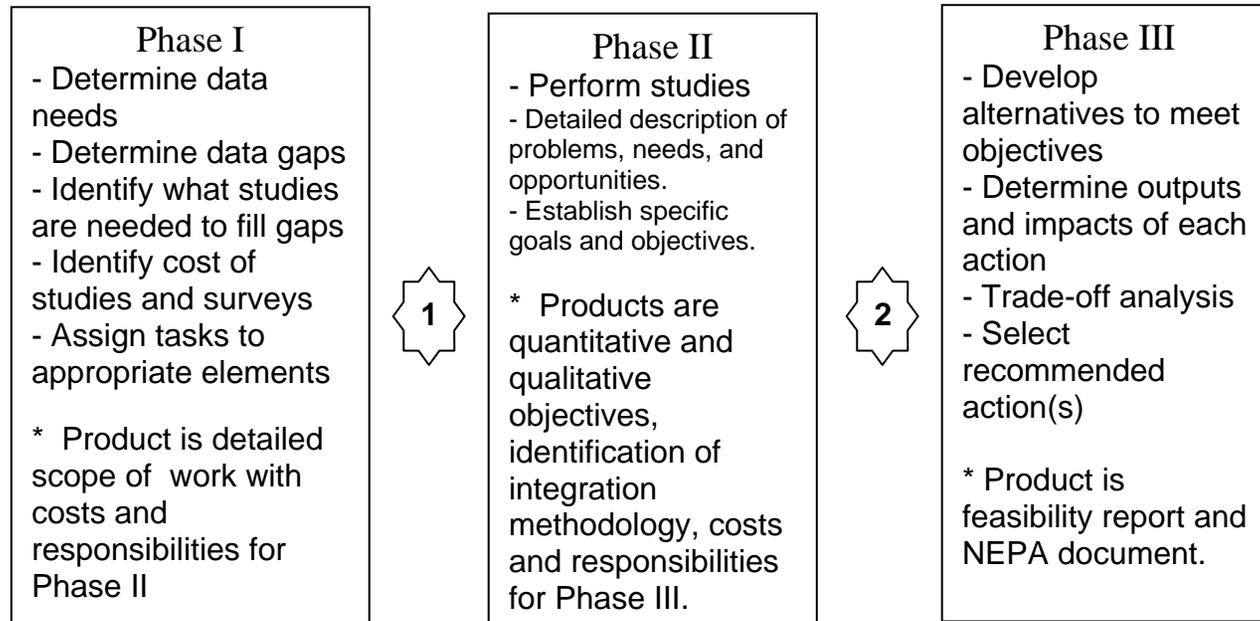
ATTACHMENT 4

THREE PHASE STUDY APPROACH

Corps Requirements: PMP and FCSA must identify full cost of feasibility study
FCSA must identify allocation of costs for each partner

Sponsor Requirements: PMP should be structured to be useful to project sponsor and beneficiaries.
PMP should identify stakeholder contributions
PMP should address tasks, methods, costs, and responsible parties

Actions: Project Management Plan will be structured to identify a 3-phase approach, identify Subject Matter Specialists for Phase I activities, and costs for each project phase. The three phases are described in the following table.



 **1** Decision Point 1 – what studies, surveys, etc. will be conducted in Phase II and how will the costs be allocated.

 **2** Decision Point 2 – what objectives will be addressed in Phase III and how will costs be allocated.

ATTACHMENT 5
FEASIBILITY COST SHARING AGREEMENT

AGREEMENT
BETWEEN THE DEPARTMENT OF THE ARMY
AND
THE COMMONWEALTH OF VIRGINIA
AND
THE STATE OF NORTH CAROLINA
FOR THE
JOHN H. KERR DAM AND RESERVOIR
SECTION 216 FEASIBILITY STUDY

THIS AGREEMENT is entered into this 17th day, of June, 2003, by and between the Department of the Army (hereinafter the "Government"), represented by the U.S. Army Engineer, Wilmington District (hereinafter the "District Engineer"), and the Commonwealth of Virginia, represented by the Deputy Secretary of Natural Resources and the State of North Carolina, represented by the Secretary, Department of Environment and Natural Resources (hereinafter the "Sponsors").

WITNESSETH, that

WHEREAS, the Congress has authorized the Secretary of the Army, acting through the Chief of Engineers, to review the operation of projects constructed by the Corps of Engineers for navigation, flood control, water supply, and related purposes when found advisable due to significantly changed physical, economic or environmental conditions, and to report to Congress with recommendations on the advisability of modifying the structures or their operation, pursuant to the authority provided by Section 216 of the River and Harbor and Flood Control Act of 1970, Public Law 91-611; and

WHEREAS, the Government has conducted a reconnaissance study of the operations of the John H. Kerr Dam and Reservoir and the effects to the Lower Roanoke River Basin pursuant to this authority, and has determined that further study in the nature of a "Feasibility Phase Study" (hereinafter the "Study") is required to fulfill the intent of the study authority and to assess the extent of the Federal interest in participating in a solution to the identified problems; and

WHEREAS, Section 105 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost sharing requirements applicable to the Study; and

WHEREAS, the Sponsors have the authority and capability to furnish the cooperation hereinafter set forth and are willing to participate in study cost sharing and financing in accordance with the terms of this Agreement; and

WHEREAS, the Sponsors and the Government understand that entering into this Agreement in no way obligates any party to implement a project and that whether the Government supports a project authorization and budgets it for implementation depends upon, among other things, the outcome of the Study and whether the proposed solution is consistent with the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and with the budget priorities of the Administration.

NOW THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For the purposes of this Agreement:

A. The term "Study Costs" shall mean all disbursements by the Government pursuant to this Agreement, from Federal appropriations or from funds made available to the Government by the Sponsors, and all negotiated costs of work performed by the Sponsors pursuant to this Agreement. Study Costs shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; the costs of participation in Study Management and Coordination in accordance with Article IV of this Agreement; the costs of contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement.

B. The term "estimated Study Costs" shall mean the estimated cost of performing the Study as of the effective date of this Agreement, as specified in Article III.A. of this Agreement.

C. The term "excess Study Costs" shall mean Study Costs that exceed the estimated Study Costs and that do not result from mutual agreement of the parties, a change in Federal law that increases the cost of the Study, or a change in the scope of the Study requested by the Sponsors.

D. The term "Study Period" shall mean the time period for conducting the Study, commencing with the release to the U.S. Army Corps of Engineers, Wilmington District of initial Federal feasibility funds following the execution of this Agreement and ending when the Assistant Secretary of the Army (Civil Works) submits the feasibility report to the Office of Management and Budget (OMB) for review for consistency with the policies and programs of the President.

E. The term "PMP" shall mean the Project Management Plan, which is attached to this Agreement and which shall not be considered binding on any party and is subject to change by the Government, in consultation with the Sponsors.

F. The term "negotiated costs" shall mean the costs of in-kind services to be provided by the Sponsors in accordance with the PMP.

G. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

ARTICLE II - OBLIGATIONS OF PARTIES

A. The Government, using funds and in-kind services provided by the Sponsors and funds appropriated by the Congress of the United States, shall expeditiously prosecute and complete the Study, in accordance with the provisions of this Agreement and Federal laws, regulations, and policies.

B. In accordance with this Article and Articles III.A., III.B. and III.C. of this Agreement, the Sponsors shall contribute cash and in-kind services equal to fifty (50) percent of Study Costs other than excess Study Costs. The Sponsors may, consistent with applicable law and regulations, contribute up to 50 percent of Study Costs through the provision of in-kind services. The in-kind services to be provided by the Sponsors, the estimated negotiated costs for those services, and the estimated schedule under which those services are to be provided are specified in the PMP. Negotiated costs shall be subject to an audit by the Government to determine reasonableness, allocability, and allowability.

C. The Sponsors shall pay a fifty (50) percent share of excess Study Costs in accordance with Article III.D. of this Agreement.

D. The Sponsors understand that the schedule of work may require the Sponsors to provide cash or in-kind services at a rate that may result in the Sponsors temporarily diverging from the obligations concerning cash and in-kind services specified in paragraph B. of this Article. Such temporary divergences shall be identified in the quarterly reports provided for in Article III.A. of this Agreement and shall not alter the obligations concerning costs and services specified in paragraph B. of this Article or the obligations concerning payment specified in Article III of this Agreement.

E. If, upon the award of any contract or the performance of any in-house work for the Study by the Government or the Sponsors, cumulative financial obligations of the Government and the Sponsors would result in excess Study Costs, the Government and the Sponsors agree to defer award of that and all subsequent contracts, and performance of that and all subsequent in-house work, for the Study until the Government and the Sponsors agree to proceed. Should the Government and the Sponsors require time to arrive at a decision, this Agreement shall be suspended in accordance with Article X of this Agreement, for a period of not to exceed six months. In the event the Government and the Sponsors have not reached an agreement to proceed by the end of their 6 month period, this Agreement may be subject to termination in accordance with Article X of this Agreement.

F. No Federal funds may be used to meet the Sponsors' share of Study Costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

G. The award and management of any contract with a third party in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within the control of the Government. The award and management of any contract by the Sponsors with a third party in furtherance of this Agreement which obligates funds of the Sponsors and does not obligate Federal appropriations shall be exclusively within the control of the Sponsors, but shall be subject to applicable Federal laws and regulations.

ARTICLE III - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties, current projections of Study Costs, current projections of each party's share of Study Costs, and current projections of the amount of Study Costs that will result in excess Study Costs. At least quarterly, the Government shall provide the Sponsors a report setting forth this information. As of the effective date of this Agreement,

estimated Study Costs are \$3,000,000 and the Sponsors' share of estimated Study Costs is \$1,500,000. The dollar amounts set forth in this Article are based upon the Government's best estimates, which reflect the scope of the study described in the PMP, projected costs, price-level changes, and anticipated inflation. Such cost estimates are subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Sponsors.

B. The Sponsors shall provide their cash contribution required under Article II.B. of this Agreement in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the Sponsors by August 1 of each year of the estimated funds that will be required from the Sponsors to meet the Sponsors' share of Study Costs for the upcoming fiscal year.

2. No later than 30 calendar days prior to the scheduled date for the Government's issuance of the solicitation for the first contract for the Study or for the Government's anticipated first significant in-house expenditure for the Study, the Government shall notify the Sponsors in writing of the funds the Government determines to be required from the Sponsors to meet their share of Study Costs for the remainder of the first fiscal year. No later than 15 calendar days thereafter, the Sponsors shall provide the Government the full amount of the required funds by delivering a check payable to "FAO, USAED, Wilmington " to the District Engineer or verifying to the satisfaction of the Government that the Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Sponsors or presenting the Government with an irrevocable letter of credit acceptable to the Government for the required funds or providing an Electronic Funds Transfer in accordance with procedures established by the Government.

3. For the second and subsequent fiscal years of the Study, the Government shall, no later than 60 calendar days prior to the beginning of such fiscal year, notify the Sponsors in writing of the funds the Government determines to be required from the Sponsors to meet their required share of Study Costs for that fiscal year, taking into account any temporary divergences identified under Article II.D. of this Agreement. No later than 30 calendar days prior to the beginning of such fiscal year, the Sponsors shall make the full amount of the required funds available to the Government through any of the payment mechanisms specified in paragraph B.2. of this Article.

4. The Government shall draw from the funds provided by the Sponsors such sums as the Government deems necessary to cover the Sponsors' share of contractual and in-house financial obligations attributable to the Study as they are incurred.

5. In the event the Government determines that the Sponsors must provide additional funds to meet their share of Study Costs, the Government shall so notify the Sponsors in writing. No later than 60 calendar days after receipt of such notice, the Sponsors shall make the full amount of the additional required funds available through any of the payment mechanisms specified in paragraph B.2. of this Article.

C. Within ninety (90) days after the conclusion of the Study Period or termination of this Agreement, the Government shall conduct a final accounting of Study Costs, including disbursements by the Government of Federal funds, cash contributions by the Sponsors, the amount of any excess Study Costs, and credits for the negotiated

costs of the Sponsors, and shall furnish the Sponsors with the results of this accounting. Within thirty (30) days thereafter, the Government, subject to the availability of funds, shall reimburse the Sponsors for the excess, if any, of cash contributions and credits given over their required share of Study Costs, other than excess Study Costs, or the Sponsors shall provide the Government any cash contributions required for the Sponsors to meet their required share of Study Costs other than excess Study Costs.

D. The Sponsors shall provide their cash contribution for excess Study Costs as required under Article II.C. of this Agreement by either: delivering a check payable to "FAO, USAED, Wilmington" to the District Engineer; or providing an Electronic Funds Transfer in accordance with procedures established by the Government; as follows:

1. After the project that is the subject of this Study has been authorized for construction, no later than the date on which a Project Cooperation Agreement is entered into for the project; or

2. In the event the project that is the subject of this Study is not authorized for construction by a date that is no later than 5 years after the date of the final report of the Chief of Engineers concerning the project, or by a date that is no later than 2 years after the date of the termination of the Study, the Sponsors shall pay their share of excess Study Costs on such date either 5 years after the date of the final report of the Chief of Engineers or 2 years after the date of the termination of the study.

ARTICLE IV - STUDY MANAGEMENT AND COORDINATION

A. To provide for consistent and effective communication, the Sponsors and the Government shall appoint named senior representatives to an Executive Committee. Thereafter, the Executive Committee shall meet regularly until the end of the Study Period.

B. Until the end of the Study Period, the Executive Committee shall generally oversee the Study consistently with the PMP.

C. The Executive Committee may make recommendations that it deems warranted to the District Engineer on matters that it oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider such recommendations. The Government has the discretion to accept, reject, or modify the Executive Committee's recommendations.

D. The Executive Committee shall appoint representatives to serve on a Study Management Team. The Study Management Team shall keep the Executive Committee informed of the progress of the Study and of significant pending issues and actions, and shall prepare periodic reports on the progress of all work items identified in the PMP.

E. The costs of participation in the Executive Committee (including the cost to serve on the Study Management Team) shall be included in Study Costs and shared in accordance with the provisions of this Agreement.

ARTICLE V – DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other parties in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to all parties. The parties participating in the non-binding alternative dispute resolution shall each pay an equal share of any costs for the services provided by such a third party as such costs are incurred. Such costs shall not be included in Study Costs. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VI - MAINTENANCE OF RECORDS

A. Within 60 days of the effective date of this Agreement, the Government and the Sponsors shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect Study Costs. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Sponsors shall maintain such books, records, documents, and other evidence in accordance with these procedures for a minimum of three years after completion of the Study and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Sponsors shall each allow the other to inspect such books, documents, records, and other evidence.

B. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Sponsors are required to conduct under the Single Audit Act Amendments of 1996, 31 U.S.C. Sections 7501-7507. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits shall be included in Study Costs and shared in accordance with the provisions of this Agreement.

ARTICLE VII - RELATIONSHIP OF PARTIES

The Government and the Sponsors act in independent capacities in the performance of their respective rights and obligations under this Agreement, and neither is to be considered the officer, agent, or employee of the other.

ARTICLE VIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE IX - FEDERAL AND STATE LAWS

In the exercise of the Sponsors' rights and obligations under this Agreement, the Sponsors agree to comply with all applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in 32 C.F.R. Part 195, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE X - TERMINATION OR SUSPENSION

A. This Agreement shall terminate at the conclusion of the Study Period, and neither the Government nor the Sponsors shall have any further obligations hereunder, except as provided in Article III.C. of this Agreement; provided, that prior to such time and upon thirty (30) days written notice, any party may terminate or suspend this Agreement. In addition, the Government shall terminate this Agreement immediately upon any failure of the parties to agree to extend the study under Article II.E. of this Agreement, or upon the failure of the Sponsors to fulfill their obligation under Article III of this Agreement. In the event that any party elects to terminate this Agreement, the parties shall conclude their activities relating to the Study and proceed to a final accounting in accordance with Article III.C. and III.D. of this Agreement. Upon termination of this Agreement, all data and information generated as part of the Study shall be made available to all parties.

B. Any termination of this Agreement shall not relieve the parties of liability for any obligations previously incurred, including the costs of closing out or transferring any existing contracts.

C. In the event that either of the Sponsors elect to terminate its own responsibilities under this Agreement, and the remaining Sponsor elects to continue to participate in the Study, the Government shall negotiate in good faith with the remaining Sponsor to effect a timely and productive conclusion to that portion of the Study pertaining to the remaining Sponsor's area of statutory authority. The Government shall prepare a revised PMP and revised estimated Study Costs, including the remaining Sponsor's share, to complete that portion of the Study of interest to the remaining Sponsor. If the remaining Sponsor elects to complete the Study, this Agreement shall be amended to reflect the negotiated revisions to the PMP and Study Costs. Cost amendments to this Agreement made pursuant to this paragraph shall reflect credits for the previous cash and in-kind contributions of all Study Sponsors and shall reflect task reductions made as a result of withdrawal of any Study Sponsor.

ARTICLE XI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or by telegram or mailed by first-class, registered, or certified mail, as follows:

If to the Commonwealth of Virginia: David K. Paylor, Deputy Secretary
of Natural Resources
P.O. Box 1475
Richmond, Virginia 23218

If to the State of North Carolina: John N. Morris, Director
NC Division of Water Resources
1611 Mail Service Center
Raleigh, NC 27699-1611

If to the Government: Charles R. Alexander, Colonel
U.S. Army Corps of Engineers
P.O. Box 1890
Wilmington, NC 28402-1890

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XII – OBLIGATION OF FUTURE APPROPRIATIONS

A. Nothing herein shall constitute, nor be deemed to constitute, an obligation of future appropriations by the General Assembly of the Commonwealth of Virginia, where creating such an obligation would be inconsistent with the Constitution or the statutory limitations of the Commonwealth of Virginia.

B. Nothing herein shall constitute, nor be deemed to constitute, an obligation of future appropriations by the General Assembly of the State of North Carolina, where creating such an obligation would be inconsistent with the Constitution of the State of North Carolina.

C. The Sponsors intend to satisfy their obligations under this Agreement. The Sponsors shall include in their budget requests or otherwise propose, for each fiscal period, appropriations sufficient to cover the Sponsors' obligations under this Agreement for each year, and will use all reasonable and lawful means to secure the appropriations for that year sufficient to make the payments necessary to fulfill their obligations hereunder. The Sponsors reasonably believe that funds in amounts sufficient to discharge these obligations can and will lawfully be appropriated and made available for this purpose. In the event the budget or other means of appropriations does not provide funds in sufficient amounts to discharge these obligations, the Sponsors shall use their best efforts to satisfy any requirements for payments under this Agreement from any other source of funds legally available for this purpose. Further, if the Sponsors are unable to satisfy their obligations hereunder, the Government may exercise any legal rights it has to protect the Government's interests related to this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the District Engineer.

DEPARTMENT OF THE ARMY

COMMONWEALTH OF VIRGINIA

BY: *Charles R. Alexander, Jr.*
Charles R. Alexander, Jr.
Colonel, Corps of Engineers
District Engineer
Wilmington District

BY: *David K. Paylor*
David K. Paylor
Deputy Secretary of Natural Resources

DATE: 6/17/03

DATE: 6-10-2003

STATE OF NORTH CAROLINA

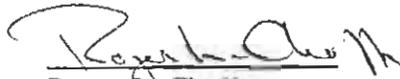
BY: *William G. Ross, Jr.*
William G. Ross, Jr.
Secretary, Department of Environment
and Natural Resources

DATE: 5-22-03

CERTIFICATE OF AUTHORITY

I, Roger L. Chaffe, do hereby certify that I am authorized by the principal legal officer of the Commonwealth of Virginia to make this certification; that the Commonwealth of Virginia is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army, the Commonwealth of Virginia, and the State of North Carolina in connection with a study of the John H. Kerr Dam and Reservoir; and that the persons who have executed this Agreement on behalf of the Commonwealth of Virginia have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this
9th day of June, 2003.

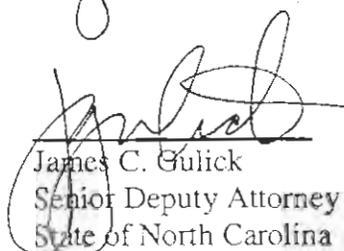


Roger L. Chaffe
Senior Assistant Attorney General
Commonwealth of Virginia

CERTIFICATE OF AUTHORITY

I, James C. Gulick, do hereby certify that I am authorized by the principal legal officer of the State of North Carolina to make this certification; that the State of North Carolina is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army, the Commonwealth of Virginia, and the State of North Carolina in connection with a study of the John H. Kerr Dam and Reservoir; and that the persons who have executed this Agreement on behalf of the State of North Carolina have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this
22^d day of May, 2003.


James C. Gulick
Senior Deputy Attorney General
State of North Carolina

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.



David K. Paylor
Commonwealth of Virginia
Deputy Secretary of Natural Resources

DATE: 6-10-03

CERTIFICATION REGARDING LOBBYING

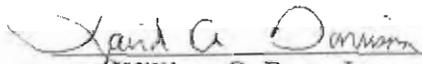
The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

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This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.


DIRECTOR
DIV. OF PURCHASE AND SERVICES
/ William G. Ross, Jr.
State of North Carolina
Secretary, Department of Environment and Natural Resources

DATE: 5-22-03

ATTACHMENT 6
SUMMARY OF PHASE II COSTS

Scope of Work for John H. Kerr Section 216 Feasibility Study Roanoke River Hydrodynamic and Water Quality Monitoring and Modeling Description of Existing And Future Without Project Conditions

1. Introduction: The U.S Army Corps of Engineers, Wilmington District (Wilmington District) in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for of improving the quality of the environment in the overall public interest. Public, stakeholder, and local, State, and Federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis *is* being done in accordance with U.S. Water Resources Council 's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website: http://www.saw.usace.army.mil/Authorized_Projects/Main.htm. The purpose of this contract is to inventory the existing conditions and to forecast future conditions for water quality if no operational changes are implemented at John H. Kerr Dam. Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of *implementation* of various modifications to the operation or structure at John H. Kerr Dam.

2. Technical Proposal: The Contractor shall prepare a Technical Proposal to be submitted along with the required Cost Proposal. The Technical Proposal will consist of a detailed description of the methods the Contractor proposes to use to collect the data requested by this Scope of Work. In addition to demonstrating a clear understanding of the technical requirements of this Scope of Work, the Contractor must demonstrate a clear understanding of: (1) current operation of the John H. Kerr Reservoir; (2) the relationship between John H. Kerr and the two downstream dams operated by Dominion Power; and (3) the Corps of

Engineers Planning process and how the future without project conditions analysis will influence future analysis of alternatives resulting from the John H. Kerr 216 Study.

3. Study Area Description: *(The following discussion is based on material contained in the John H. Kerr 216 Feasibility Study Project Management Plan, PMP.)* The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952.

Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced farming and forestry opportunities. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl and *provide quality seasonal recreational opportunities.*

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the Dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The Study Area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina.

4. Relevant Operational Guidance and FERC Settlement Agreement: John H. Kerr Reservoir is operated in accordance with the “*Water Control Plan for John H. Kerr Dam and Reservoir.*” which was updated in February 1995. A copy of this plan is attached (Attachment 1). The Contractor shall become familiar with this plan and shall use it as the basis for the future without conditions analysis.

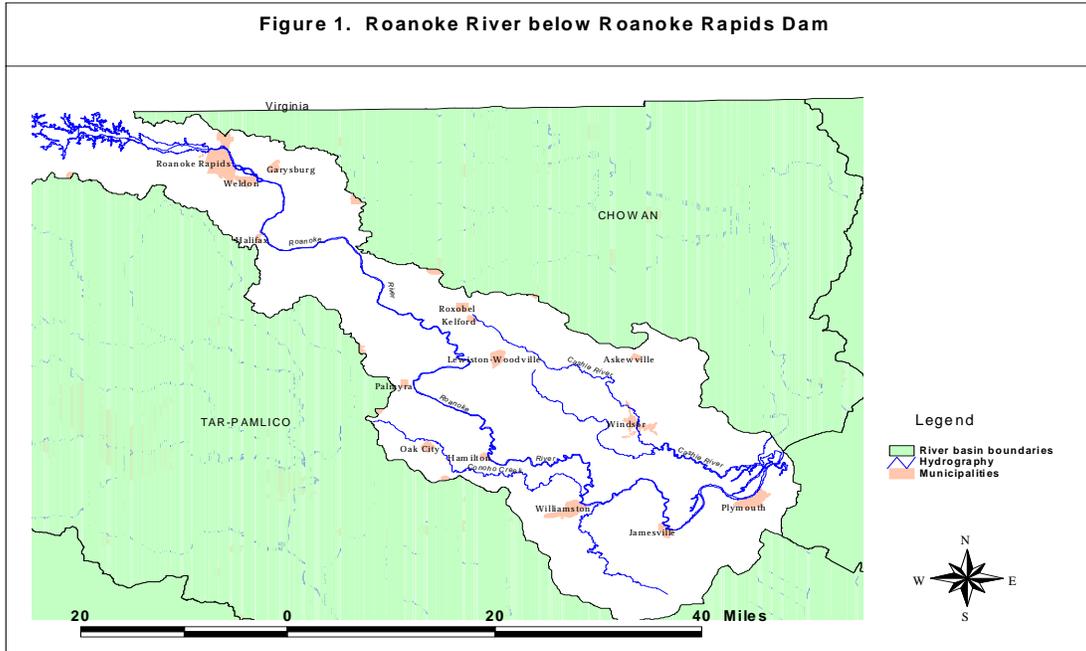
While the operation of John H. Kerr Reservoir under the terms of the 1995 Water Control Plan has a significant influence on the Lower Roanoke River Basin, the lower basin is also influenced by the downstream Roanoke Rapids and Lake Gaston Reservoirs, which are operated by Dominion Power. Roanoke Rapids and Lake Gaston are operated under the terms of the 2003 “*Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project*” (Attachment 2) that resulted from the Federal Energy Regulatory Commission (FERC) relicensing process. The Contractor shall be come familiar with this settlement agreement and shall use it to help distinguish between downstream influences on sedimentation, erosion, and channel morphology caused by the operation of John H. Kerr and the downstream influences caused by the operation of Roanoke Rapids and Lake Gaston.

5. Purpose: The purpose of this water quality contract is to inventory the existing conditions and to forecast future conditions for providing recommendations to address

several main issues regarding flow releases from John H. Kerr Dam to the Roanoke River. Such issues are:

- How do releases at Kerr Dam translate to changes into water quality in the Roanoke River?
- What is the effect of riparian swamp water drainage on the Roanoke River oxygen levels?
- What is the oxygen related assimilative capacity of the Roanoke River associated with different flow regimes and management operations at the dam?

Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of implement of various modifications to the operation or structure at John H. Kerr Dam. Monitoring and modeling should be one combined task where it will be sent out as two separate proposals, but for the same *award*. Also, nutrients and eutrophication are not considered major issues. The Roanoke River from the Roanoke Rapids Dam to the mouth below Plymouth is shown in Figure 1.



6. Background: Under Water Quality tasks in the PMP (USACE 2004) there are three objectives labeled A, B and C:

- A. “How does flow regime affect downstream water quality in floodplain areas, tributaries, and the main river channel”.
- B. “How do downstream flows maintained by releases from Kerr Reservoir affect water quality in the river channel between Roanoke Rapids and the mouth of the river?”
- C. “Evaluate the water quality of the release from the Kerr Dam impoundment through the Roanoke Rapids tailrace.”

This scope of work primarily addresses objective B and secondarily, objective A. Objective C is not included in this scope of work.

The water quality issues highlighted by the Water Quality Task Group (Task Group) include those related to dissolved oxygen levels in the water column.

The monitoring and modeling effort should include the Roanoke River and adjacent swamp lands from the Roanoke Rapids Dam to the mouth at the Albemarle Sound. Several stretches of the river are braided or diverted to side channels. The flow in these channels (not reflected in Figure 1) can be substantial, thus special considerations should be given to characterizing water movement and quality in these areas. For example, below Jamesville the Roanoke and Cashie Rivers have in common *one* natural and man-made channel through which water can flow from one system to another. With the added tidal influence, water movement in this area has the potential to change direction frequently.

At this time, the Task Group anticipates the need for about 28 months (Section 8. Timeline) of monitoring throughout all seasons. ***Four months of this time period will include quality assurance and control of collected and processed data as well as data management.*** Thus multiple seasons, meteorology and hydrologic conditions can be captured through both monitoring and modeling. Typically, high temperature, low flow situations are associated with low dissolved oxygen levels in riverine systems. However, the changes in flow regime due to dam releases, the influence of adjacent swamps, and the relative natural contributions from rainfall need to be characterized in a manner that will allow appropriate management actions.

The proposed monitoring period could be shortened depending on the environmental conditions that occur naturally or if releases from the reservoirs would be adjusted to meet requirements. ***By the current Water Control Plan, if the Kerr Reservoir pool elevation is in the range indicated below, releases at Roanoke Rapids Dam up to the corresponding maximum shown below can be made. Releases above the maximums indicated would require approval of a deviation request by the Corps of Engineers Division office in Atlanta. Minor deviations can be approved within a few days, but major deviations may require NEPA documentation which could take several months. Even though low releases do not require Division approval, there are limitations. Sustained low releases can not be made during flood conditions, and releases must be sufficient to meet the power house station needs and contract power requirements.***

<i>Elevation feet mean sea level (msl)</i>	<i>Maximum release cubic feet/sec (cfs)</i>
<i>< 300</i>	<i>8,000</i>
<i>300-312</i>	<i>20,000</i>
<i>312-315</i>	<i>25,000</i>
<i>315-320</i>	<i>35,000</i>
<i>>320</i>	<i>>35,000</i>

These specific flow requirements would range from extreme high flows of **35,000** cfs to low flows of 1,500 cfs. In addition, these ranges should be met for each of the four seasons in a year, given the availability of inflows to J.H. Kerr Reservoir.

Swamp drainage. The majority of the land on both sides of the Roanoke River downstream of Weldon is comprised of extensive wetlands and swamps that are subject to frequent flooding. This flooding often results from high flow releases from Roanoke Rapids dam. Flooding in response to heavy rainfall is less frequent. Since the swamps have naturally occurring low dissolved oxygen levels and depending on the season, have higher temperature values, the water quality model of the river will need to consider the oxygen consuming loads from the adjacent wetlands and swamps as it relates to water quality in the main channel of the Roanoke River. The impacts of industrial and domestic discharges on DO depletion also needs to be assessed along with the relative contribution to DO depletion by swamp drainage and industrial discharges. The monitoring to address these issues (as well as the modeling) will be directly relevant to Objective A described above.

Flow regime. The quantity of water in the Lower Roanoke River is dependent upon operation of the three reservoirs (J.H. Kerr, Gaston and Roanoke Rapids). Gaston and Roanoke Rapids are owned and operated by a public utility company. The J.H. Kerr dam is owned and operated by the USACE and is located upstream from the Roanoke Rapids dam. USACE gives weekly flow declarations to the public utility company to inform them of anticipated quantity amounts to be received. Under *various* conditions large water outflows are released from Roanoke Rapids dam and *if quantities and duration are sufficient*, subsequent flooding of the swamps *occurs*. Under drought conditions, a minimum flow requirement is established per the power company's Federal Energy Regulatory Commission license to avoid mass deterioration of downstream aquatic ecosystems.

Diurnal variation. The water quality model will need to consider changes to dissolved oxygen through a daily cycle, for all seasons and flow releases.

Salt wedge. The mouth of the Roanoke River drains into the Albemarle Sound, which is an estuarine system. During times of low flow and drought conditions salt has been observed to move into the Roanoke River. The change in density and saturation associated with salt water affect the levels of oxygen in the water column. The water quality model will need to simulate the movement of the salt wedge and its impacts on dissolved oxygen values.

Determination of saltwater movement in Albemarle Sound is covered by the salt wedge task area. Within the sound, saltwater movement is driven by river flow over the prior weeks to months and wind conditions. Operations at Kerr Reservoir may affect river flows and hence salt water movement in the sound. In the absence of predictions or downstream boundary monitoring data, model input data on salt water at the mouth of the Roanoke River will need to be developed making assumptions about the relationship between salt water movement and river flow.

7.0 Technical Services: This scope of work requests services related to objectives A and B described in Section 6.

7.1 Monitoring Strategy Development (Task 1): The Contractor will develop a monitoring strategy to support hydrodynamic and water quality modeling of the Roanoke River from Roanoke Rapids Dam to the mouth at the Albemarle Sound. In order to develop a successful monitoring strategy, the Contractor should have ready access to hydrodynamic and water quality modeling staff to provide expertise regarding the usefulness of the existing

monitoring networks and the additional needs for modeling purposes. Actual monitoring will be carried out in Task 2. The Task Group is expecting data needs to include geomorphology/bathymetry, discharge and velocity, dye studies, vertical water level and water quality parameters for water quality modeling as well as parameters for hydrodynamic modeling.

Several scientific and water quality issues have been identified that will need to be addressed as part of this project including strategies related to low dissolved oxygen values for J.H. Kerr Reservoir. This also includes the influence of swamp drainage including adjacent flooding, the influence of controlled releases from Roanoke Rapids dam, the diurnal variation in water quality, and the movement of the salt wedge in response to changes in flow regimes. These should all be addressed in the monitoring strategy. Issues of hypothetical effects at J.H. Kerr Reservoir is important to address; however, Task C from the draft PMP was identified as low priority. Therefore, theoretical DO values will be assumed regarding flows from J.H. Kerr Reservoir dam.

As previously stated, the Water Quality Task Group feels that monitoring and modeling should occur over a period of 28 months. Although actual monitoring takes place in Task 2, the Quality Assurance Project Plan (QAPP) and budget should reflect a 28 month time period. If supported by scientific data and analysis, the Contractor may suggest an alternate time period by *using adaptive management or other techniques* to meet the project goals.

- Prepare a data review document. The Task Group has prepared a summary of the sources of data, however a summary of the data has not been prepared. The Contractor will prepare a data review that includes descriptions of physical characteristics, previous water quality investigations by any agency, a review of existing modeling frameworks, an existing data compilation, exploratory data analysis, identification of data gaps and recommendations for monitoring. The data review should address the differences in analytical methods and precision among existing monitoring networks and highlight incompatible data. This document will be prepared in draft and final form and should be presented to the Task Group for consideration prior to the development of the Quality Assurance Project Plan (QAPP).
- The Contractor will prepare a combined monitoring strategy and a QAPP according to EPA guidance (EPA 240/R-02/009). A NC certified laboratory should be utilized for chemical parameter analysis. Monitoring frequency and location should be specified in the QAPP and a contingency procedure should be provided in case of extreme weather during the monitoring period. A draft QAPP, with a preliminary budget, will be provided to the Task Group for review and comment. Comments related to the QAPP and a final budget should be addressed in the final document. Approvals, in the form of signatures, should be obtained from both the USACE and DWQ.

In summary, the deliverables for this task are:

1. Roanoke River Data Review Document.
2. Draft and final Quality Assurance Project Plans (QAPP) for monitoring strategy.
3. QAPP meeting and presentation to Task Group.

7.2 Field Monitoring (Task 2): The Contractor will implement the monitoring strategy described in the QAPP developed for Task 1. Along with brief monthly updates, at a midpoint during the field study, the Contractor will provide a detailed memorandum to the Task Group to describe the progress with monitoring and expenditures. All quality assurance and control procedures outlined in the QAPP will be followed.

The following information should be included in the MS Access compatible database:

Station information: Station ID
Description
Latitude
Longitude
County
USGS Station Number (if applicable)

Chemical analysis information:
Parameter
Media
Analytical method
Reporting limit

Chemical monitoring information:
Station ID
Date
Time
Depth
Parameter
Result
Data qualifier

Hydrologic and hydraulic data should be provided in an ASCII file (or files). The format for hydrologic and hydraulic data should be similar to the chemical monitoring information.

With the midpoint progress memorandum, the Contractor will provide the USACE and DWQ with an ArcView shape file mapping all monitoring locations. The metadata should include the station ID, type of monitoring that occurs at that station (e.g., temperature only, chemical, hydrologic/hydraulic), and the agency or group responsible for data collected at that station. The submittal should include an interactive website with a map linked to real-time data.

The Contractor will also provide a brief summary report of the data collected for this effort. This will include graphical representations of conditions during the study and data summaries. The monitoring report should also compare the data collected for this effort to the historical record to determine if the monitoring period was particularly wet or dry.

Deliverables:

1. Monthly reports and Midpoint progress memorandum.
2. MS Access compatible database with all project chemical data. ASCII database with all project hydrologic/hydraulic data.
3. ArcView shape file *projected for NC&VA state plane* describing all monitoring stations and including metadata.
4. Draft and Final Monitoring Report, including graphs and tables.

7.3 Hydrodynamic Modeling (Task 3): The Contractor will develop a hydrodynamic model of the Roanoke River from the Roanoke Rapids Dam to the mouth at the Albemarle Sound. The hydrodynamic model should be capable of simulating rapid changes in the flow regime due to changes in dam releases. The hydrodynamic model should also be capable of simulating, to some extent, flooding of adjacent wetlands and forests and subsequent drainage back to the river. At this time, the Task Group believes that several lateral cells should be included in the modeling framework in order to describe the wetting and drying that occurs in riparian areas. These lateral wetting and drying cells will be repeated in the water quality model.

At this time, the Task Group feels that an existing modeling framework should be utilized to construct the Roanoke River hydrodynamic model. Examples of existing frameworks include CE-QUAL-RIV1, CE-QUAL-IMP, RMA2 and EFDC. The Contractor shall seek permission from both the USACE and DWQ if a proprietary code or model is preferred.

The treatment of braided channels is an important consideration in the Roanoke River model. This is particularly important in the lower portion of the Roanoke River near the mouth of the Cashie River where many channels are present and where tidally influenced movement is likely to be greatest.

The Contractor should provide a written and oral description of the modeling approach to the Task Group for review. The technical memorandum and presentation should include a description of the model selection procedure, calibration goals and methods, and the approach to characterizing model uncertainty. (The Contractor may prepare a combined hydrodynamic and water quality modeling approach document and presentation.)

Deliverables:

1. Modeling approach presentation and technical memorandum.
2. Calibrated hydrodynamic model compatible with MS Windows NT.
3. Graphical representations of water movement and temperature changes in the system including movies.
4. Draft and final hydrodynamic model technical reports (can be included in a combined hydrodynamic and water quality modeling report).
5. Presentation of results (see Section 7.4).

7.4 Water Quality Modeling (Task 4): The Contractor will develop a dynamic water quality model of the Roanoke River from the Roanoke Rapids Dam to the mouth below the Cashie River at the Albemarle Sound. The water quality model should be capable of simulating rapid changes in dissolved oxygen due to changes in Roanoke Rapids dam releases and to swamp water inputs. The water quality model should also be capable of simulating, to some extent, the oxygen consuming properties of riparian swamp water inflow after a flooding event. Sediment oxygen demand should be explicitly included in the model.

At this time, the Task Group feels that an existing modeling framework should be utilized to construct the Roanoke River water quality model. Examples of existing frameworks include CE-QUAL-RIV1, CE-QUAL-ICM, EFDC, and WASP. The Contractor shall seek permission from both the USACE and DWQ if a proprietary code or model is preferred. The Task

Group also feels that a minimum of a 2-dimensional water quality model is needed in order to address issues with swamp drainage, tidal influences, and the salt wedge.

The Contractor should provide a written and oral description of the modeling approach to the Task Group for review. The technical memorandum and presentation should include a description of the model selection procedure, model linkage, calibration goals and methods, and the approach to characterizing model uncertainty. (The Contractor may prepare a combined hydrodynamic and water quality modeling approach document and presentation.)

Deliverables:

1. Modeling approach presentation and technical memorandum. (Can be included in a combined hydrodynamic and water quality modeling report.)
2. Calibrated water quality model compatible with MS Windows NT
3. Graphical representations of dissolved oxygen in the system including movies.
4. Draft and final water quality model technical reports (can be included in a combined hydrodynamic and water quality modeling report).
5. Presentation of results to the Task Group.

7.5 Management Scenario Analysis(Task 5): In addition to providing modeling output describing water movement and dissolved oxygen levels by segment on a daily basis, the Contractor will evaluate several other management scenarios in order to guide management of water releases from Kerr Reservoir. These additional management scenarios include the following:

- Evaluate mainstem water quality conditions with minimum release flows at the Roanoke Rapids Dam that vary monthly.
- Evaluate mainstem water quality conditions with minimum release flows at the Roanoke Rapids Dam and permitted effluent loads of oxygen consuming wastes.
- Evaluate mainstem water quality conditions under flood control scenarios as defined by the USACE for Kerr Reservoir.
- Evaluate mainstem water quality conditions following high flow pulse releases from the Roanoke Rapids Dam.
- Evaluate mainstem water quality conditions following sustained releases of flood-level flows. (See example Figures 2 and 3)
- Evaluate riparian swamp area water quality conditions following sustained releases of flood-level flows.
- Evaluate riparian swamp area water quality conditions following high flow pulse releases from Roanoke Rapids Dam.
- Evaluate response of downstream DO to hypothetical management alterations of DO improvements at J.H. Kerr Dam. (The Contractor will have to make assumptions regarding the effects of changes at J.H. Kerr Dam to releases at Roanoke Rapids Dam. Reservoir modeling is not included in this project).

The Contractor should convene a conference call with the Task Group following the completion of the water quality model. This conference call will be held to discuss these management scenarios and any other scenarios that may arise. The Task Group anticipates that batch runs of the water quality and/or hydrodynamic model will be required to answer these management questions.

Figure 2. Example management scenario result: Percent of River Violating Standards

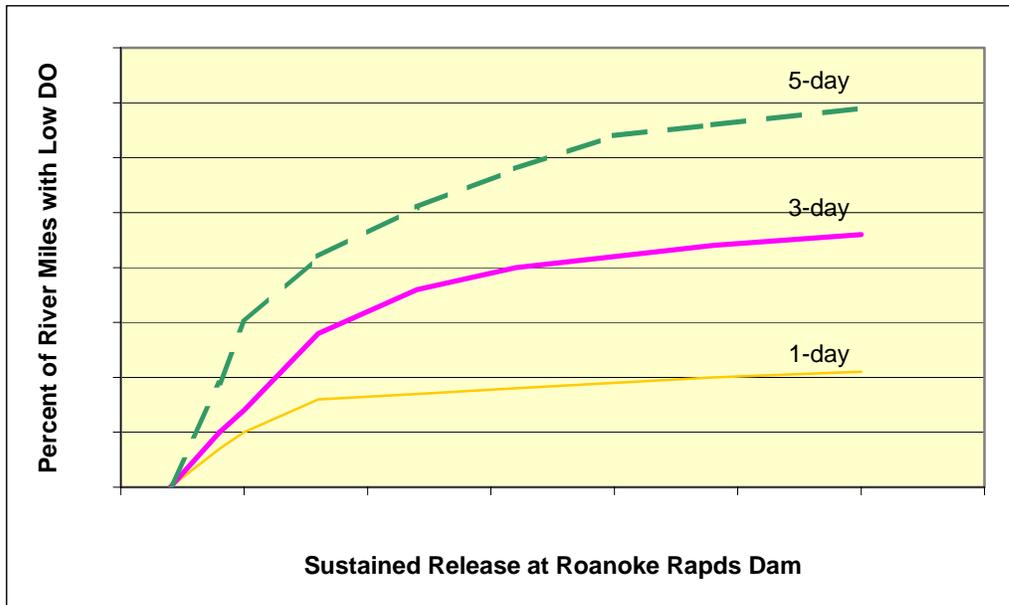
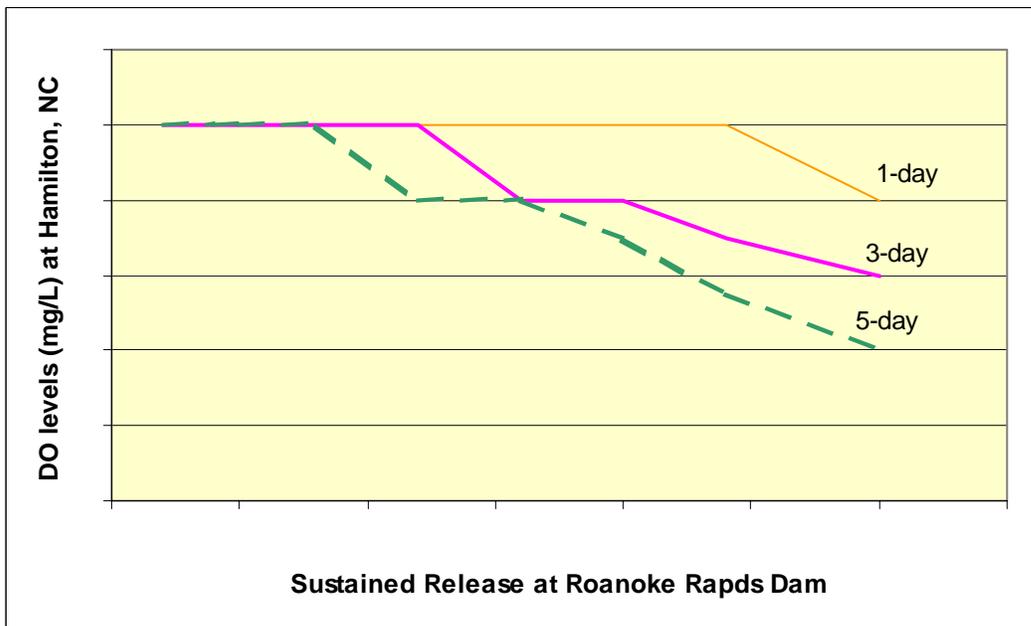


Figure 3. Example management scenario result: Water Quality Impacts at Hamilton, NC



Deliverables:

1. Presentation of results to the Task Group
2. Draft and final scenario analysis reports (can be included in a combined hydrodynamic and water quality modeling report.)

8. Timeline:

The timeline *indicated* for each task of this project is *based on timing of previous similar projects. However as indicated in section 13, proposals that provide justification for an accelerated schedule by using adaptive management or other techniques will be given a higher ranking.*

Task	Scheduled completion
Award contract	
Task 1. Monitoring Strategy Development	6 months after contract award
Task 2. Field Monitoring	28 months after QAPP and budget approval, assuming same contractor performs Task 1 and 2.
Task 3. Hydrodynamic Modeling	8 months after contract award or receipt of all monitoring data
Task 4. Water Quality Modeling	8 months after completion of hydrodynamic modeling
Task 5. Management scenario analysis	2 months after completion of water quality modeling

9. Monthly Status Reports: The Contractor shall submit written monthly status reports by the 5th day of each month the contract is in force. A Monthly Status Report must accompany all requests for payment. These reports may be in brief letter format and should summarize work performed and problems encountered. A concise statement and/or graphic presentation of estimated work progress (incremental and cumulative percentage completed), by task, shall be included in each report. The report should also note difficulties, if any, in meeting the work schedule. The Contractor shall be responsive to verbal requests from the Contracting Officer for specific information to be included in the monthly reports. Any matters requiring an immediate action or decision by the Contracting Officer shall be identified by expeditious telephone contact with the Contracting Officer’s Representative (COR).

10. Project Reports: Upon completion of all work under the five tasks under the terms of this contract, the Contractor shall submit a draft report for review. The report and findings shall be objective and fully substantiated by documentation. The appendices will contain tabulations of all physical, biological, and statistical data and a list of all participating technical staff and their respective responsibilities on the project. The report shall contain appropriate summary tables and figures. Text material shall be printed on 8-1/2" by 11" bond paper with 1-1/2" margins on the left for binding. All pages must be consecutively numbered. Drawings or plates bound in the report shall be no larger than 11" by 17" and shall include a graphic bar scale for control during reduction or enlargement. Additional larger maps or drawings shall be provided on standard 30" by 42" sheets, unless the Contracting Officer and the Contractor agree otherwise. **Draft reports requiring extensive proofreading or incomplete draft reports are unacceptable and will be returned to the Contractor.** The Contracting Officer will provide written comments on the accepted draft report. The Contractor will revise the report in accordance with these comments and, then, submit the report as final. In some instances a revised draft report to assure that all agency

requirements are properly addressed prior to release of the report for agency or public review may be required.

- (1) Electronic copies of each report will be delivered to the USACE and DWQ and should be compatible with Adobe Acrobat and MS Word 2000. In addition, 15 hard copies of each report will be required. This requirement includes the following documents:
 1. Roanoke River Data Review Document
 2. Draft and final Quality Assurance Project Plans (QAPPs)
 3. Monitoring Data Report
 4. Draft and final Hydrodynamic and Water Quality Modeling Report
 5. Various technical memoranda.
- (2) Monitoring database including hydrologic, hydraulic and water quality data. All files must be compatible with MS Access 2000 or ASCII as specified in Section 7.2.
- (3) All input and output modeling files with, if necessary, a copy of an executable version of the model. All files will be compatible with Windows operating systems (prefer 2000) and/or ArcView version 9.0.
- (4) Shape files with locations of all monitoring stations and metadata. These shape files will be compatible with ArcView 9.0 and projected for NC & VA state planes.
- (5) Stakeholder presentations. The Contractor shall provide, in advance, copies of the presentations and any handouts to be provided to the Task Group. Electronic copies of presentations should be compatible with Adobe Acrobat and MS PowerPoint.

11. Report Title Page: The title page of the project report(s) will bear an inscription that indicates the source of funding for the particular item of work covered by the report. This inscription will reference the Contract Number. In addition, the title page shall bear the following inscription: “Project Manager: (Name).” If someone other than the Project Manager has prepared the document, this inscription will, instead, state Prepared Under the Supervision of (Name), Project Manager.

12. Instructions for Proposals: To expedite the review and selection process, the Letter of Interest, Statement of Qualifications, and Cost Proposal shall not be in excess of 50 pages, including appendices. The document shall be formatted as follows:

Part I. Letter of Interest (1 page)

Part II. Table of Contents

Part III. Technical Approach

Part IV. Project Team (1 page maximum)

This section should identify the lead firm that will have total responsibility for coordination with the USACE. Describe lead firm’s and any sub-contractors’ responsibilities and anticipated percentage of total work for each team participant. Identify project work location(s) and describe how coordination and communication will be conducted. Provide a brief summary of past joint work with each sub-contractor, if applicable.

Part V. Organization Chart (1 page maximum)

Identify the Project Manager (that person responsible for day-to-day communication with the USACE contract) and all personnel contributing to the contract. Indicate the firm with which the individual works.

Part VI. Qualifications, Experience and References

This Section must include the following information:

- A. Description of the Proposer's most significant qualifications for this project;
- B. Summary of the Proposer's experience with similar projects, highlighting projects completed in the Carolinas (include client's name, brief description of project, project contract period, contract amount, and names of the Proposer's key personnel who worked on the project);
- C. References concerning the Proposer's qualifications, experience, and performance on prior and current assignments that are similar to the proposed project (name, title, organization, address, phone number, etc.)

Part VII. Resumes

Provide resumes to present the credentials and experience of each team member identified in the proposal. Each resume should be limited to one page or less.

13. Proposal Evaluation and Contractor Selection: The Task Group will consider numerous criteria to evaluate proposals received in response to this Request for Qualifications. Criteria include, but are not limited to:

1. Technical approach *including justification for accelerating the timeline by using adaptive management or other techniques indicated in section 8.*
2. Technical qualifications and competence of the contractor, including applicable subcontractors *especially related to field monitoring, water quality and hydrodynamic modeling,*
3. Experience and qualifications of key staff assigned to this project *especially related to field monitoring, water quality and hydrodynamic modeling,*
4. Organization of the proposal, and
5. Costs

14. Contractor Obligations:

a. Permits, Licenses, And Approvals: The Contractor shall obtain all necessary permits, licenses, and approvals required by Federal, State, or local authorities for conducting work under this contract. Personnel conducting work on endangered and threatened species must have demonstrable knowledge of the biology and current conservation practices for the species in the work area, and they must have, or be able to demonstrate the ability to obtain, all necessary permits required to survey and monitor listed species. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress to perform any of the work required under this contract on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event all efforts by the Contractor fail to gain permission from the property owner(s) for entry to the property for performing the required work, the Contractor shall contact the Contracting Officer to obtain instructions for further action. In the event that the Contracting Officer must take action to obtain right-of-entry for the Contractor, the Contractor will be entitled to an equitable extension of time for the period required to obtain said right-of-entry. The Contractor shall assume all responsibility for and take all precautions to prevent damage to private and Government-owned property. The

Contractor shall be responsible for any claims covering actions not approved by the Contracting Officer.

b. Project Management: The Project Manager shall be the individual responsible for the validity of the material in all reports and shall have recognized expertise in the appropriate field. During execution of the work, the Project Manager shall provide adequate professional supervision to assure timeliness, accuracy, quality, and completeness. In the event of controversy or court challenge, the Project Manager may be called upon, under separate contract, to testify on behalf of the Government in support of the Contractor's findings.

c. Product Quality: The Contractor shall be responsible for accomplishing all work in an accurate and professional manner. Any work deemed inadequate or nonconforming by the Contracting Officer shall be re-done by the Contractor, as necessary, to comply with the contract requirements at no additional cost to the Government.

15. Personnel Qualifications: All professional persons employed under the terms of this contract must meet the minimum qualifications for their profession as established by the United States Office of Personnel Management. The duties and basic qualifications of key staff are as follows:

a. Project Manager/Principal Investigator.

(1) **Duties.** The Project Manager or Principal Investigator is the individual identified in the contract as being authorized to act for the Contractor and is responsible for contract administrative actions and research formulation for the contract firm. This individual usually selects the Technical Director and appropriate work crews, determines appropriate level of investigation and analysis, coordinates activities with the Contracting Officer's Representative, and performs other administrative functions. This individual is responsible for overall contract quality control.

(2) **Qualifications.** Persons in charge of a project or research investigation, in addition to meeting the appropriate standards for their respective profession, must have a doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in project formulation, execution, and technical monograph reporting. If prior projects were of a sort not ordinarily resulting in a publishable report, a narrative should be included, detailing the proposed Project Manager/Principal Investigator's previous experience along with references suitable to obtain opinions regarding the adequacy of this earlier work.

b. Technical Director.

(1) **Duties.** The Technical Director is the individual in charge of accomplishing specific scientific data collection, analysis, evaluation, and reporting. This individual follows work from initiation to completion and

provides technical support to the Project Manager/Principal Investigator utilizing a basic understanding of scientific methods and procedures. The Technical Director is responsible for conducting literature reviews; office, field, and laboratory research; field surveys; site testing; and scientific analyses using various reference materials, maps, interviews with knowledgeable individuals, scientific instruments, and aerial photographs and other remotely-sensed data. The Technical Director is the individual who authors reports under the supervision of the Project Manager/Principal Investigator. Under the guidance of the Project Manager/Principal Investigator, this individual is responsible for making day-to-day decisions regarding the data collection, testing and analysis, and evaluations. The Technical Director is responsible for the accuracy of the information collected and for the scientific validity of recommendations made in draft and final reports. Technical Directors oversee and supervise the crewmembers assigned to their projects. The Technical Director assures that assignments are carried out in a safe and timely manner according to procedures established by the Project Manager/Principal Investigator.

(2) **Qualifications.** Individuals in this job category must hold a Master's or higher degree in the field of their work assignment, or possess an equivalent level of professional experience.

c. Scientist.

(1) **Duties.** Personnel in this category must carry academic and experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if this person has not been retained at the time of proposal.

(2) **Qualifications.** Individuals in this job category must hold a Bachelor's or higher degree in the field of their work assignment and must possess at least 12 month combined field and laboratory experience.

d. Technician.

(1) **Duties.** Technicians work under the direction of the Technical Director. Technicians conduct a variety of tasks, including locating field sites by using maps and instruments, conducting scientific data collection, performing analytical procedures and techniques, and performing accurate record-keeping. Technicians may be required to calibrate and operate various types of analytical instruments. Technicians may also be required to perform preliminary treatments on samples or specimens requiring later detailed analyses.

(2) **Qualifications.** Technicians must possess an Associate's or higher degree (except archaeological technicians, who must have a Bachelor's degree) in the field of their work assignment, or at least 12 months combined field and laboratory experience.

e. Consultant.

(1) **Duties.** Consultants are personnel subcontracted on a short-term basis for their special knowledge and expertise.

(2) **Qualifications.** Consultants must carry academic and/or experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if the consultant has not been retained at the time of proposal.

16. Equipment And Facilities: The Contractor must provide or demonstrate access to the following capabilities:

a. Adequate field and laboratory equipment necessary to conduct whatever operations are defined in this Scope of Work

b. Adequate facilities necessary for the proper treatment, analysis, and storage of samples and/or specimens likely to be obtained from a given project. This does not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but it does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis that may be required.

c. Adequate facilities for secure storage and efficient retrieval of data and records.

17. Release Of Information: Neither the Contractor nor the Contractor's representatives shall release any report, data, specification, drawing, rendering, perspective, sketch, photograph, cost estimate, or other material obtained or prepared under this contract without prior specific written approval of the Contracting Officer.

18. Inspection Of Services: The Government's rights regarding the inspection of services under the terms of a fixed-price services contract are explained in Section I "Contract Clauses." Generally, under this clause, the Government has the right to inspect all services called for by this contract and any Task Order issued under it. If any of the services do not conform with the contract and the Task Order requirements the Government may require the Contractor to perform the services again in conformity with the contract and Task Order requirements, **at no increase in the contract amount**. If the Contractor fails to promptly perform the services again in conformity with the contract and Task Order requirements, the Government may: perform the services (or have the services performed) and charge the Contractor any cost incurred by the Government; cancel the services required under terms of a specific Task Order; or in extreme case may **terminate the contract** for default.

19. Travel: All travel and per diem in connection with work performed under this contract will be at the Contractor's expense, including travel time to and from work sites.

20. Payment: Payments will be made based on documented progress. Evidence of progress (e.g. percentage of task complete) shall be documented in the monthly progress report that must accompany invoices.

21. Method Of Payment: Partial payments to the Contractor will be made through the end of each month, for work or services performed by the Contractor during that month, upon submission of a proper invoice on the submitted on corporate letterhead. In order to be considered a proper invoice each invoice must be accompanied by the monthly status report accepted by the COR clearly indicating what the work has been accomplished during the billing period. Partial payments will not be made in amounts less than \$1,000 (except for final submittals). Each invoice must identify the contract and indicate whether the payment is a partial billing (e.g. "partial #1") or a final bill (e.g. "#4, final"). For purposes of billing, the acceptance date of deliverables (not delivery date or date of invoice) will constitute the billing date for the purposes of all payments.

22. References Cited:

Federal Energy Regulatory Commission

2003 *Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project FERC Project No. P-2009*, June 2003

U.S. Army Corps of Engineers

1988 *Environmental Quality - Procedures for Implementing NEPA*. Publication Number: Engineering Regulation 200-2-24 March 1988, U.S. Army Corps of Engineers, Washington D.C.

1992 *Authorized and Operating Purposes of Corps of Engineers Reservoirs July 1992* U.S. Army Corps of Engineers, Washington D.C.

2000 *Planning Guidance Note Book*. Engineering Regulation 1105-2-100, April 22, 2000, U.S. Army Corps of Engineers, Washington D.C.

U.S. Army Corps of Engineers, Wilmington District

1995 *Water Control Plan For John H. Kerr Dam And Reservoir*, Wilmington, North Carolina.

2004 Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina, Wilmington North Carolina.

2004 Wilmington District Authorized Project Web Site

http://www.saw.usace.army.mil/Authorized_Projects/Main.htm

U.S. Council on Environmental Quality

1978 *Regulations for Implementing National Environmental Policy Act*. 40 Code of Federal Regulations Parts 1500-1508, 43 Federal Register 55990, November 28, 1978.

U.S. Water Resources Council

1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. 8 July 1983, United States Water Resources Council, Washington DC.

SCOPE OF WORK
JOHN H. KERR SECTION 216 FEASIBILITY STUDY
SEDIMENTATION, EROSION, AND CHANNEL MORPHOLOGY
COLLECTION OF DATA, DESCRIPTION OF EXISTING
AND
FUTURE WITHOUT THE PROJECT CONDITIONS

1. Introduction: The U.S Army Corps of Engineers, Wilmington District (Wilmington District) in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for improving the quality of the environment in the overall public interest. Public, stakeholder, and local, State, and Federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis being done in accordance with U.S. Water Resources Council 's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G)* as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website: http://www.saw.usace.army.mil/Authorized_Projects/Main.htm.. The purpose of this contract is to inventory the existing conditions and to forecast future conditions for sedimentation, erosion, and channel morphology, if no operational changes are implemented at John H. Kerr Dam. Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of implement of various modifications to the operation or structure at John H. Kerr Dam.

2. Technical Proposal: The Contractor shall prepare a Technical Proposal to be submitted along with the required Cost Proposal. The Technical Proposal will consist of a detailed description of the methods the Contractor proposes to use to collect the data requested by this Scope of Work. In addition to demonstrating a clear understanding of the technical requirements of this Scope of Work, the Contractor must demonstrate a clear understanding of: (1) current operation of the John H. Kerr Reservoir; and (2) the relationships among flow release operations variables including duration, frequency, seasonality, and management of flows, and detail (both spatial and temporal) observed erosion/deposition of channel bed, banks, and floodplain in the lower Roanoke River.

3. Study Area Description: *(The following discussion is based on material contained in the John H. Kerr 216 Feasibility Study Project Management Plan.)* The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg

County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952.

Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced farming and forestry opportunities. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl.

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the Dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The Study Area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina.

4. *Relevant Operational Guidance and FERC Settlement Agreement:* John H. Kerr Reservoir is operated in accordance with the “*Water Control Plan for John H. Kerr Dam and Reservoir.*” which was updated in February 1995. A copy of this plan is attached (Attachment 1). The Contractor shall become familiar with this plan and shall use it as the basis for the future without conditions analysis.

While the operation of John H. Kerr Reservoir under the terms of the 1995 Water Control Plan has a significant influence on the Lower Roanoke River Basin, the lower basin is also influenced by the downstream Roanoke Rapids and Lake Gaston Reservoirs, which are operated by Dominion. Roanoke Rapids and Lake Gaston are operated under the terms of the 2003 “*Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project*” (Attachment 2) that resulted from the Federal Energy Regulatory Commission (FERC) relicensing process. The Contractor shall become familiar with this settlement agreement and shall use it to help distinguish between downstream influences on sedimentation, erosion, and channel morphology caused by the operation of John H. Kerr and the downstream influences caused by the operation of Roanoke Rapids and Lake Gaston.

5. *Relevant Ongoing Studies:*

a. The U.S. Geological Survey (USGS) in cooperation with the University of Maryland (UM) and the University of North Carolina, under the auspices of a grant from the National Science Foundation, is investigating sediment and riparian ecological dynamics along the Lower Roanoke River. This study is being undertaken to: (1) determine past sedimentation/ecological dynamics and patterns both prior to European settlement and after dam closure; (2) quantify present dynamics/patterns; and (3) predict future dynamics/patterns. The group is currently collecting data on: (1) river bathymetry, (2) bank heights; (3) width/depth ratios, (4) detailed floodplain sediment deposition/erosion; and (5) riparian vegetation. The study includes analysis of floodplain soil stratigraphy (including pollen reconstruction, particle size analysis, organic matter assessment and radiocarbon dating), dendrochronological analysis, and measurement of current sedimentation rates on the levees, back swamps and intermediate environments using fixed silica disks.

The Contractor shall review the work completed for the Lower Roanoke River by Cliff Huff with USGS and Phil Townsend with UM. The Contractor shall meet with Huff and Townsend before during and after data collection. The data resulting from Huff's and Townsend's work shall be considered when describing existing project conditions and when forecasting the future without project conditions required by P&G. The Contractor shall also provide recommendations on how the data resulting from this work would be used in developing adaptive management benchmarks involving sedimentation that would aid in the measurement of the long-term effectiveness of implemented alternatives.

b. During the Roanoke Rapids/Gaston Hydropower Project relicensing that lead to the FERC Settlement Agreement, nine erosion monitoring stations were established by Dominion. The U.S. Fish and Wildlife Service using the same research protocol has established 18 erosion monitoring stations. Since the 1990's, frequent bank failures were observed by staff from the U.S. Fish and Wildlife Service (USFWS), Roanoke River National Wildlife Refuge, in the middle reach of the river. There seemed to be a direct relationship of prolonged high flows to increased bank erosion. Staff believed the rate of erosion was accelerated due to the altered flow regime present on the river. Concerned about the loss of valuable levee and aquatic habitat, the USFWS committed to monitor erosion rates in the vicinity of refuge lands (HWY 11/42 to below Williamston). The objectives of the study initiated by Dominion and the USFWS were to: 1) estimate the rates of stream bank erosion relative to bank elevation and distance downstream from the Roanoke Rapids Dam, and, 2) determine the relative influence of different types of flow releases (i.e., flood control and peaking) on erosion rates. The data resulting from this erosion monitoring effort (Dominion 2002) were regarded as inconclusive by participants in the Roanoke Rapids/Gaston relicensing because it was difficult to match erosion patterns with discrete flood control or load following flow release patterns. However, the data provide baseline information that shall be included in the description of existing conditions regarding erosion and the forecast of future without the project conditions regarding erosion. The Contractor shall also provide recommendations on how the stations and methods used in the work by USFWS and Dominion could be modified to develop an adaptive management monitoring program for erosion that would aid in the measurement of the long-term effectiveness of implemented alternatives.

6. Review of Existing Literature: The Contractor shall review existing literature to determine if there is existing relevant information regarding sedimentation, erosion, and channel morphology in the Lower Roanoke River Basin. This literature review shall focus on historical conditions before 1950, current conditions, and the intervening rate of change in response to the last 50 years of reservoir operation. Information shall include, but not be limited to: (1) Hydraulic and Hydrologic Data (2) geomorphologic data for both river channel and adjacent floodplain; (3) 3.B.4.2.3-reservoir operational characteristic; (4) water quality-monitoring data with particular emphasis on, total suspended solids (TSS); and (5) information and documentation of relevant previous studies. Existing information resulting from the study described in paragraph 5a include: (1) surveyed (leveled) floodplain transects in which sediment deposition is being monitored and has been measured at time scales of 50-300 years; (2) channel width/depth measurements (two time steps) (3) vegetation data; (4) flood models (inundation extent and depth) of the Roanoke floodplain; and a comprehensive Geographic Information System (GIS) data base. Limited erosion data has been collected by USGS, USFWS, and Dominion.

7. Service to be Provided by the Contractor (Study Objectives and Purposes): The objective of this contract is to identify the relationships among flow release operations (hydrological variables) and observed erosion and deposition in the lower Roanoke River Basin. Information

gathered during this contract will be used to establish the without project conditions which will serve as the bench mark for evaluating alternatives resulting from the John H. Kerr 216 Study. The objectives of the study include determining the major forms of erosion on the Lower Roanoke River ranked in order of their contribution. The study should be completed in sufficient detail to determine the relative proportion and rate of channel erosion that is attributable to bank failure (mass wasting). The Contractor shall determine how these rates vary geographically and topographically based on factors such as: downstream distance from the dam, location of the area inside or outside of channel bends, bank soil characteristics and the local sinuosity of the channel reach. A second objective of the study is to determine which characteristics of the hydrologic regime contribute most to the major forms of erosion identified from Objective 1. From this, the contractor will determine the level of the contribution of select hydrologic variables to each identified form of erosion. The Study should focus on determining how the importance of those variables differ geographically with downstream distance from the dam, location of the area inside or outside of channel bends, bank soil characteristics and the local sinuosity of the channel reach. The third objective, which is crucial to the establishment of the future without project conditions, is to establish the predicted future patterns of erosion under current and recent past operational conditions.

a. Establishment of Channel and Floodplain Cross-Sections

The contractor shall judgmentally establish a series of channel and floodplain cross-sections along the entire Lower Roanoke River to evaluate bed, bank and floodplain sediment erosion and deposition. The locations of these cross sections will be surveyed (by GPS) and mapped using ARC GIS. At a minimum a cross section shall be placed in the same location as the existing and newly established erosion transects discussed below. Additional cross sections shall be placed judgmentally to assure that adequate data is collected to address sediment and erosion issues related to the morphology of the lower Roanoke River. The Contractor shall contact Phil Townsend, Cliff Hupp, Jean Richter, Bob Graham, and USACE and review existing data. The Contractor shall take advantage of existing data, and coordinate monitoring program with ongoing programs as much as possible.

b. Monitoring Transects:

(1) Erosion and deposition: Since the construction of the dams on the Roanoke River in the early 1950's, little material from upstream of John H. Kerr Dam has contributed to sedimentation in Lower Roanoke River. There is little evidence to show that tributaries of the Lower Roanoke River contribute a significant amount of sediment to the system. It is speculated that upstream bank erosion within the Lower Roanoke River contributes the bulk of the sedimentation within the system. A detailed investigation of bank form and stability along much of the lower river is required to determine the source and destination of transported sediment. Such a study would include several cross-sectional analyses (above and below water), as well as installation of erosion pins/chains. Frequent measurement of the installed equipment and surveys would be necessary to determine effects of specific flow regimes. Data from these studies should be linked to reach type analyses and channel conditions to extrapolate river wide trends and estimate the full impact of dam release scenarios. Objectives of this work are to evaluate bed, bank and floodplain sediment erosion and deposition in

relation to Roanoke Rapids operational flows including the USACE directive in flood operation. The Contractor will accomplish this task by:

(a) Enhancing the existing 27 (9 transects Dominion, 18 transects USFWS, a transect is defined as three sets of bank pins on one side of the river) transects established by Dominion Power and USFWS (See Attachments 4 and 5) by: (1) evaluating each transect to ensure the toe and the top of the levee are being adequately monitored (2) measure the slope of the bank at each transect; (3) take cross sectional measurements of the river channel at each transect.

(b) Evaluate the current transect locations to determine where additional effort is needed and establish new transects in those reaches of the river where monitoring gaps exist in order to more adequately determine the impacts of flood control operations. The Contractor shall determine the location and number of transects which will be required. The location and number of transects as well as the rationale for those choices shall be provided in the Technical Proposal.

(c) The Contractor shall measure pins after high flow (flood control) and peaking events. This may be required three-six times per year depending on flow conditions. After reviewing the erosion studies described in Section 5b the Contractor shall develop a rationale for erosion pin sampling that addresses gradually declining river stage following flood control events that leave some pins underwater for prolonged periods; effects of recent environmental history on erosion rates (e.g., how erosion rates may differ during a single short term flood control event versus repetitive short term events); and other factors likely to affect sampling efficiency and erosion rates.

(d). The Contractor shall determine erosion rates for each transect and relate these to hydrologic variables and patterns of flow releases.

(2) Channel dynamics: A detailed investigation of channel dynamics is needed, particularly downstream of eroding beds and banks. The frequency and intensity of bathymetric survey must be adequate to correlate channel erosion and filling with hydrological variables as detailed above. This study should include analyses of bank heights and width/depth ratios, which will help determine hydrological conditions for normally stable banks.

(3) Downstream trends in suspended sediment. Suspended sediment sampling should be conducted at selected locations along the lower river. This would provide information on potential sediment entrainment and trapping associated with dam release scenarios. Suspended sediment should be taken near gauging stations so that discharge data can be related to the sample and used to compute sediment load and perhaps sediment yield. Periodic and event sampling should occur.

(4) Floodplain trapping: Although the NSF study will be generating considerable data on this, it cannot in its present design assess dam release

scenarios in any detail. This would require the installation (along floodplain-flow paths) of single-stage suspended sediment samplers to measure changes in load across floodplain surfaces, detailed erosion chains where the floodplain may be eroding, and wells/stage recorders (determination of hydroperiod). This should be done on at least a few representative floodplain locations associated with different types of river channel reaches. These should be established along existing NSF transects to facilitate interpretation. NSF study scientists will consult on preferred locations.

(5) *Sediment transport simulation model:* The contractor will evaluate information assembled in paragraphs 1 - 4 to determine if the prototype data alone are adequate to develop relationships between flow release operations and observed erosion/sedimentation in the lower river. The Contractor will identify whether these relationships are suitable to extrapolate and forecast erosion rates over the 50 year period of analysis and establish the without project condition. If not, the contractor shall evaluate the relative trade-offs between additional field data collection and the implementation of a hydrodynamic and sediment transport model for the entire 125-mile length of the lower river. The proposed methodology to be employed shall be documented in the technical proposal required by paragraph 2.

(6) *Implementation of sediment transport modeling:* If modeling is determined to be necessary, the contractor shall outline the model to be used and data needed to parameterize said model for implementation. The contractor will fully detail the specific model to be used, its assumptions, its methods for initiation and implementation, and how model outputs will be evaluated. Then, the contractor will apply an available multi-dimensional hydrodynamic and sediment transport model to develop relationships between the hydrograph, the observed rates and forms of sedimentation and bank erosion, and the other specified variables (e.g., distance downstream, bank soil characteristics, position in the river bend, and local sinuosity). These results will be used to translate RRBROM flows to predicted rates and forms of deposition and erosion given any set of policy inputs for operations.

8. *Monthly Status Reports:* The Contractor shall submit written monthly status reports by the 5th day of each month the contract is in force. A Monthly Status Report must accompany all requests for payment. These reports may be in brief letter format and should summarize work performed and problems encountered. A concise statement and/or graphic presentation of estimated work progress (incremental and cumulative percentage completed), by task, shall be included in each report. The report should also note difficulties, if any, in meeting the work schedule. The Contractor shall be responsive to verbal requests from the Contracting Officer for specific information to be included in the monthly reports. Any matters requiring an immediate action or decision by the Contracting Officer shall be identified by expeditious telephone contact with the Contracting Officer's Representative (COR).

9. *Project Reports:* Upon completion of all work tasks under the terms of this contract, the Contractor shall submit a draft report for review. The report and findings shall be objective and fully substantiated by documentation. The report shall follow the format required by reputable scientific periodicals, including abstract, summary, introduction, methods, results, discussion, conclusions and recommendations, references, and appendices. The appendices will contain tabulations of all physical, biological, and statistical data and a list of all participating technical staff and their respective responsibilities on the project. The report shall contain appropriate summary tables and figures. Text material shall be printed on 8-1/2" by 11" bond paper with 1-

1/2" margins on the left for binding. All pages must be consecutively numbered. Drawings or plates bound in the report shall be no larger than 11" by 17" and shall include a graphic bar scale for control during reduction or enlargement. Additional larger maps or drawings shall be provided on standard 30" by 42" sheets, unless the Contracting Officer and the Contractor agree otherwise. **Draft reports requiring extensive proofreading or incomplete draft reports are unacceptable and will be returned to the Contractor.** The Contracting Officer will provide written comments on the accepted draft report. The Contractor will revise the report in accordance with these comments and, then, submit the report as final. In some instances a revised draft report to assure that all agency requirements are properly addressed prior to release of the report for agency or public review may be required.

10. Required Number Of Report Copies: (*Need Team recommendation on number of required copies.*).

11. Report Title Page: The title page of the project report(s) will bear an inscription that indicates the source of funding for the particular item of work covered by the report. This inscription will reference the Contract Number. In addition, the title page shall bear the following inscription: "Project Manager: (Name)." If someone other than the Project Manager has prepared the document, this inscription will, instead, state Prepared Under the Supervision of (Name), Project Manager.

12. Contractor Obligations:

a. Permits, Licenses, And Approvals: The Contractor shall obtain all necessary permits, licenses, and approvals required by Federal, State, or local authorities for conducting work under this contract. Personnel conducting work on endangered and threatened species must have demonstrable knowledge of the biology and current conservation practices for the species in the work area, and they must have, or be able to demonstrate the ability to obtain, all necessary permits required to survey and monitor listed species. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress to perform any of the work required under this contract on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event all efforts by the Contractor fail to gain permission from the property owner(s) for entry to the property for performing the required work, the Contractor shall contact the Contracting Officer to obtain instructions for further action. In the event that the Contracting Officer must take action to obtain right-of-entry for the Contractor, the Contractor will be entitled to an equitable extension of time for the period required to obtain said right-of-entry. The Contractor shall assume all responsibility for and take all precautions to prevent damage to private and Government-owned property. The Contractor shall be responsible for any claims covering actions not approved by the Contracting Officer.

b. Project Management: The Project Manager shall be the individual responsible for the validity of the material in all reports and shall have recognized expertise in the appropriate field. During execution of the work, the Project Manager shall provide adequate professional supervision to assure timeliness, accuracy, quality, and completeness. In the event of controversy or court challenge, the Project Manager may be called upon, under separate contract, to testify on behalf of the Government in support of the Contractor's findings.

c. Product Quality: The Contractor shall be responsible for accomplishing all work in an accurate and professional manner. Any work deemed inadequate or nonconforming by the Contracting Officer shall be re-done by the Contractor, as necessary, to comply with the contract requirements at no additional cost to the Government.

d. Digital Data Standards: U.S. Army Corps of Engineers, Wilmington District Digital Data Standards can be found in Attachment 6.

13. Personnel Qualifications: All professional persons employed under the terms of this contract must meet the minimum qualifications for their profession as established by the United States Office of Personnel Management. The duties and basic qualifications of key staff are as follows:

a. Project Manager/Principal Investigator.

(1) **Duties.** The Project Manager or Principal Investigator is the individual identified in the contract as being authorized to act for the Contractor and is responsible for contract administrative actions and research formulation for the contract firm. This individual usually selects the Technical Director and appropriate work crews, determines appropriate level of investigation and analysis, coordinates activities with the Contracting Officer's Representative, and performs other administrative functions. This individual is responsible for overall contract quality control.

(2) **Qualifications.** Persons in charge of a project or research investigation, in addition to meeting the appropriate standards for their respective profession, must have a doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in project formulation, execution, and technical monograph reporting. If prior projects were of a sort not ordinarily resulting in a publishable report, a narrative should be included, detailing the proposed Project Manager/Principal Investigator's previous experience along with references suitable to obtain opinions regarding the adequacy of this earlier work.

b. Technical Director.

(1) **Duties.** The Technical Director is the individual in charge of accomplishing specific scientific data collection, analysis, evaluation, and reporting. This individual follows work from initiation to completion and provides technical support to the Project Manager/Principal Investigator utilizing a basic understanding of scientific methods and procedures. The Technical Director is responsible for conducting literature reviews; office, field, and laboratory research; field surveys; site testing; and scientific analyses using various reference materials, maps, interviews with knowledgeable individuals, scientific instruments, and aerial photographs and other remotely-sensed data. The Technical Director is the individual who authors reports under the supervision of the Project Manager/Principal Investigator. Under the guidance of the Project Manager/Principal Investigator, this individual is responsible for making day-to-day decisions regarding the data collection, testing and analysis, and evaluations. The Technical Director is responsible for the accuracy of the information collected and for the scientific validity of recommendations made in draft and

final reports. Technical Directors oversee and supervise the crewmembers assigned to their projects. The Technical Director assures that assignments are carried out in a safe and timely manner according to procedures established by the Project Manager/Principal Investigator.

(2) **Qualifications.** Individuals in this job category must hold a Master's or higher degree in the field of their work assignment, or possess an equivalent level of professional experience.

c. Scientist.

(1) **Duties.** Personnel in this category must carry academic and experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if this person has not been retained at the time of proposal.

(2) **Qualifications.** Individuals in this job category must hold a Bachelor's or higher degree in the field of their work assignment and must possess at least 12 month combined field and laboratory experience.

d. Technician.

(1) **Duties.** Technicians work under the direction of the Technical Director. Technicians conduct a variety of tasks, including locating field sites by using maps and instruments, conducting scientific data collection, performing analytical procedures and techniques, and performing accurate record-keeping. Technicians may be required to calibrate and operate various types of analytical instruments. Technicians may also be required to perform preliminary treatments on samples or specimens requiring later detailed analyses.

(2) **Qualifications.** Technicians must possess an Associate's or higher degree (except archaeological technicians, who must have a Bachelor's degree) in the field of their work assignment, or at least 12 months combined field and laboratory experience.

e. Consultant.

(1) **Duties.** Consultants are personnel subcontracted on a short-term basis for their special knowledge and expertise.

(2) **Qualifications.** Consultants must carry academic and/or experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if the consultant has not been retained at the time of proposal.

14. Equipment And Facilities: The Contractor must provide or demonstrate access to the following capabilities:

a. Adequate field and laboratory equipment necessary to conduct whatever operations are defined in this Scope of Work

b. Adequate facilities necessary for the proper treatment, analysis, and storage of samples and/or specimens likely to be obtained from a given project. This does not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but it does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis that may be required.

c. Adequate facilities for secure storage and efficient retrieval of data and records.

15. Release Of Information: Neither the Contractor nor the Contractor's representatives shall release any report, data, specification, drawing, rendering, perspective, sketch, photograph, cost estimate, or other material obtained or prepared under this contract without prior specific written approval of the Contracting Officer.

16. Inspection Of Services: The Government's rights regarding the inspection of services under the terms of a fixed-price services contract are explained in Section I "Contract Clauses." Generally, under this clause, the Government has the right to inspect all services called for by this contract and any Task Order issued under it. If any of the services do not conform with the contract and the Task Order requirements the Government may require the Contractor to perform the services again in conformity with the contract and Task Order requirements, **at no increase in the contract amount**. If the Contractor fails to promptly perform the services again in conformity with the contract and Task Order requirements, the Government may: perform the services (or have the services performed) and charge the Contractor any cost incurred by the Government; cancel the services required under terms of a specific Task Order; or in extreme case may **terminate the contract** for default.

17. Period Of Services: The draft report required by paragraph 9 of this contract shall be delivered to the Contracting Officer 18 months from the date of contract award. 24 months.

18. Travel: All travel and per diem in connection with work performed under this contract will be at the Contractor's expense, including travel time to and from work sites.

19. Payment: Payments will be made based on documented progress. Evidence of progress (e.g. percentage of task complete) shall be documented in the monthly progress report that must accompany invoices.

20. Method Of Payment: Partial payments to the Contractor will be made through the end of each month, for work or services performed by the Contractor during that month, upon submission of a proper invoice on the submitted on corporate letterhead. In order to be considered a proper invoice each invoice must be accompanied by the monthly status report accepted by the COR clearly indicating what the work has been accomplished during the billing period. Partial payments will not be made in amounts less than \$1,000 (except for final submittals). Each invoice must identify the contract and indicate whether the payment is a partial billing (e.g. "partial #1") or a final bill (e.g. "#4, final"). For purposes of billing, the acceptance date of deliverables (not delivery date or date of invoice) will constitute the billing date for the purposes of all payments.

REFERENCES CITED

REFERENCES CITED

Dominion

2002 Roanoke Rapids and Gaston Hydropower Project FERC No. 2009 - *Cumulative impacts assessment studies - revised*. Dominion, Richmond, Virginia.

Federal Energy Regulatory Commission

2003 *Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project FERC Project No. P-2009*, June 2003

U.S. Army Corps of Engineers

1988 *Environmental Quality - Procedures for Implementing NEPA*. Publication Number: Engineering Regulation 200-2-24 March 1988, U.S. Army Corps of Engineers, Washington D.C.

1989 *Engineering and Design - Sedimentation Investigations of Rivers and Reservoirs* Engineering Manual EM 1110-2-4000 December 1989 (Change 1 October 1995), U.S. Army Corps of Engineers, Washington D.C.

<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-4000/toc.htm>

1994 *Cannel Stability Assessment for Flood Control Project*. Engineering Manual EM 1110-2-1418 October 1994, U.S. Army Corps of Engineers, Washington D.C.

<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-1418/entire.pdf>

2000 *Planning Guidance Note Book*. Engineering Regulation 1105-2-100, April 22, 2000, U.S. Army Corps of Engineers, Washington D.C.

U.S. Army Corps of Engineers, Wilmington District

1995 *Water Control Plan For John H. Kerr Dam And Reservoir*, Wilmington, North Carolina.

2004 Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina, Wilmington North Carolina.

2004 Wilmington District Authorized Project Web Site

http://www.saw.usace.army.mil/Authorized_Projects/Main.htm.)

U.S. Council on Environmental Quality

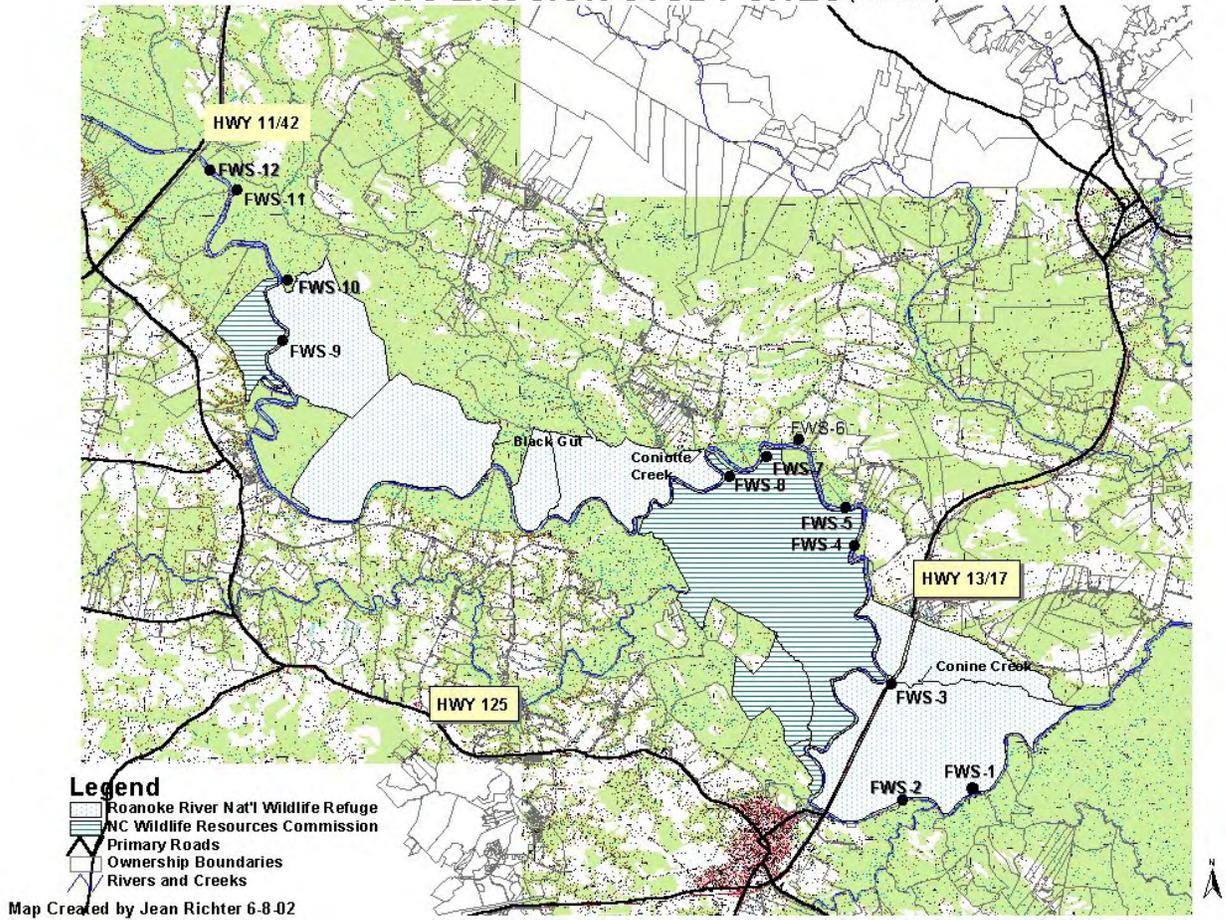
1978 *Regulations for Implementing National Environmental Policy Act*. 40 Code of Federal Regulations Parts 1500-1508, 43 Federal Register 55990, November 28, 1978.

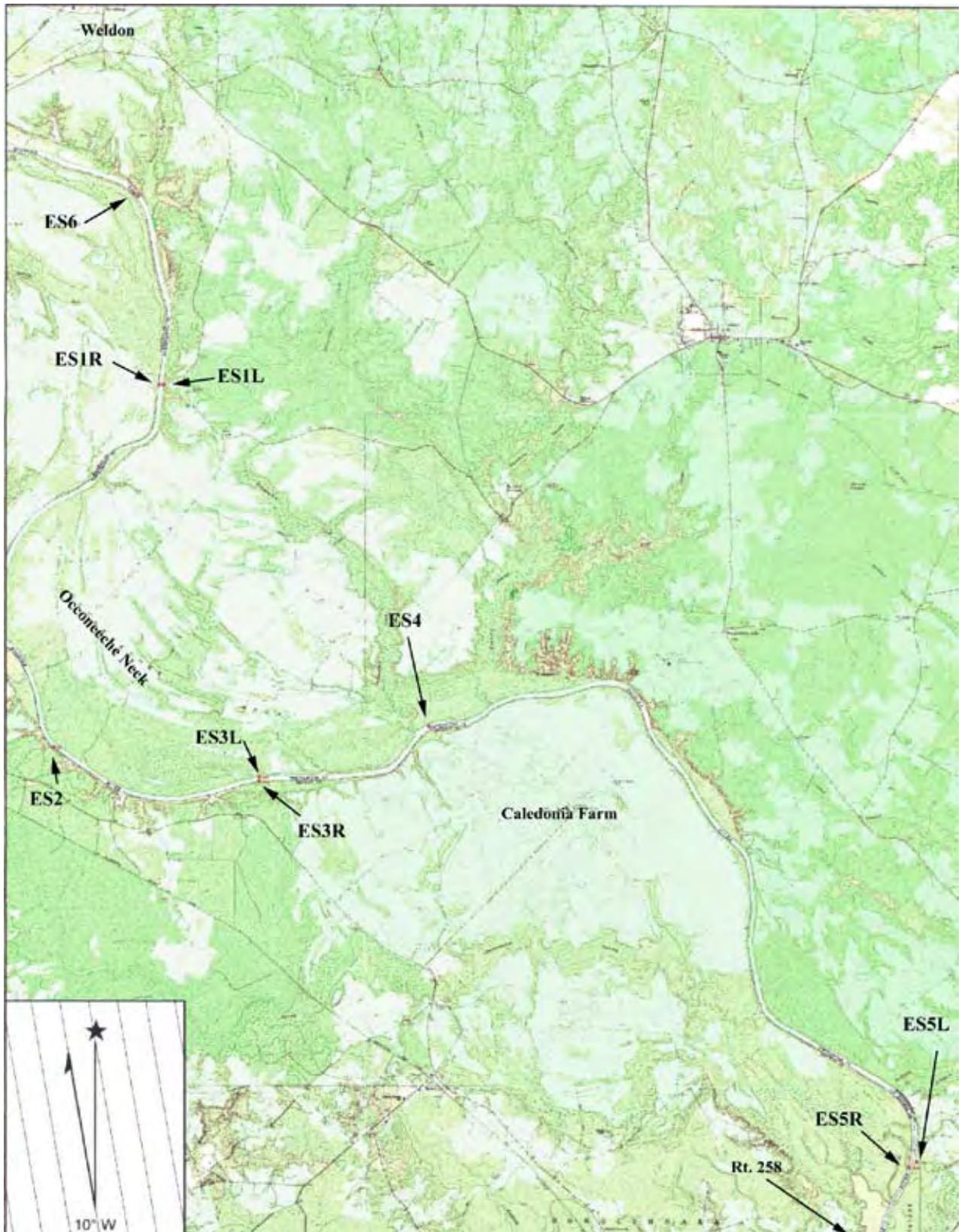
U.S. Water Resources Council

1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. 8 July 1983, United States Water Resources Council, Washington DC.

Planning Guidance Note Book. Engineering Regulation 1105-2-100

FWS EROSION STUDY SITES (1999-2002)





John H. Kerr 216 Study
Downstream Riparian Ecosystem Task Group
Flood Model Evaluation
Task 1.A.2 Phase II Scope of Work

1. Background

A. The Wilmington District is conducting a Feasibility Study under Section 216 of the River and Harbor Flood Control Act of 1970 in order to review the operation of the John H. Kerr Dam and Reservoir. The Wilmington District will then issue a report on the advisability of modifying the structure or operation of the dam in order to meet current and projected needs and for improving the quality of the environment in the overall public interest.

B. A Modeling Oversight Team for the Kerr 216 study has recently been established to oversee modeling data requirements and needed modeling outputs for the other resource specific study teams, including oversight of the flood model. The team leader is Tony Young, US Army Corps of Engineers (USACE), Wilmington District.

C. Having an acceptable flood mapping model is an integral part of the assigned tasks for the study teams. The Project Management Plan requires under Task 1.A.2 that a flood model be identified, reviewed, and selected. The PMP further specifies that a digital elevation model and associated flood depth mapping model developed by The Nature Conservancy (hereinafter, the “TNC flood model”) will be evaluated for use in the Section 216 study. The Task 1 Team is chaired by Jim Mead of NC Department of Environment and Natural Resources.

D. The TNC flood model requires the Roanoke River Basin Reservoir Operations Model (RRBROM) as a data-source on the front end, and it requires Arc GIS 9.n to generate flood depth maps as overlays on other geographic data sets.

E. The TNC flood model was developed by TNC over several years through contracts with the Universities of North Carolina and Maryland, HydroLogics, Inc., and Advanced Technology Solutions, Inc. This scope of work assumes that TNC will be the sole-source contractor for the purposes of the tasks and deliverables described below.

2. Tasks and Deliverables

A. The contractor will convene a one-day workshop in Raleigh, NC for the purposes of demonstrating and evaluating the TNC flood model. At the workshop, presentations will include explanations of the processes that were used to develop the following:

- (i) Digital elevation model;
- (ii) Regressions for correlating flows at the Roanoke Rapids tailrace with river stages downstream;
- (iii) Regressions for converting river stages to water depths in the floodplain;
- (iv) Strategies for converting floodplain water depths to GIS-maps; and
- (v) Rationale for selection and sources for other data layers in the TNC flood model.

Presentations will be made by the model developers and include, as appropriate, discussion of data sources, accuracy, and precision. Presentations will also include information about peer-review of the TNC flood model accomplished and pending.

B. The contractor will take reasonable steps to ensure that the workshop is attended by the members of the Modeling Oversight Team, all contributors to the model, the Team Leaders for Task 1 and other appropriate tasks, and at least three independent experts capable of assisting the other workshop participants with evaluating and commenting on the validity of the TNC flood model and considering alternatives to it. At least one of the independent experts invited to the workshop will be a USACE flood model expert.

C. The expected outcome from the workshop is:

- (i) An evaluation of the utility and acceptability of the TNC flood model; and
- (ii) If the TNC flood model is acceptable, revisions needed prior to its use for the purposes of the Section 216 study, if any; or
- (iii) If the TNC flood model is not acceptable, recommendations for an alternative model; or
- (iv) If the TNC flood model cannot be adequately evaluated on the basis of information presented, recommendations for going forward to resolve that issue.

D. The contractor will prepare a budget for the workshop to include meeting facilities and breaks, staff support, equipment, handouts, and participant expenses. The budget will also include a capped time-and-expenses sub-contract for installation support for the TNC flood model for up to five participants that request it.

E. At least 45 days prior to the workshop, the contractor will provide an installable copy of the TNC flood model to any invited participant who requests it and who

certifies that they have and are able to use the RRBROM and Arc GIS 9.n. The contractor will provide limited installation support for the flood model through a sub-contractor. Installation support and training for the RRBROM and Arc GIS 9.n will not be provided by the contractor.

- F. Following the workshop, the contractor will prepare and distribute:
- (i) a report from the workshop detailing its deliberations and conclusions; and
 - (ii) if appropriate and necessary, a draft scope of work for upgrading the TNC flood model to meet the workshop recommendations; or
 - (iii) a draft scope of work for acquiring or developing an alternative to the TNC flood model; or
 - (iv) a draft scope of work for completing evaluation of the TNC model to be followed by one of the steps above ((ii) or (iii)).

3. Point of Contact

The point of contract for this contract is:
Jim Mead
NC Division of Water Resources – DENR
1611 Mail Service Center
Raleigh, NC 27699-1611
919/715-5428
FAX 919/733-3558

John H. Kerr 216 Study
Downstream Riparian Ecosystem Task Group
Developing Baseline Information To Evaluate Impacts of
Downstream Flooding on Agriculture, Timber Operations, and Road Access
Task 1.B Phase II Scope of Work

BACKGROUND

Flood control is the original and primary authorized purpose of J.H. Kerr Reservoir, and this flood control storage has significantly modified downstream hydrology. While downstream flood damages and hazards have been reduced, concerns have been raised about the adverse impacts of extended growing season floods on the downstream riparian ecosystem. These concerns are a major reason behind the Feasibility Study being conducted by the Wilmington District of the US Army Corps of Engineers (USACE) under Section 216 of the River and Harbor Flood Control Act of 1970 in order to review the operation of the John H. Kerr Dam and Reservoir.

Flood control has the highest priority in determining flows downstream of Roanoke Rapids during high inflow periods at Kerr Reservoir. The 216 study will need to determine if the current flood damage curves and operating procedures during high inflows need to be updated in light of new information about downstream flood impacts and updated land use data. Any changes to flood control operations that might be proposed to benefit downstream ecosystems will need to be evaluated to determine the extent of flood control benefits under the proposed changes.

TASKS AND OUTPUT PRODUCTS

Mapping

All maps produced by the contractor must be in digital format using Arc Info version 9.n. The contractor will produce GIS layer maps for the following nine parameters:

1. Land Ownership – obtain the most current digital information compiled by the Nature Conservancy (TNC) and consult with TNC to determine if additional updates are needed.
2. Agricultural Land Use – consult with TNC, the Natural Resource Conservation Service (NRCS), and large agricultural operations.
3. Silviculture Land Use – consult with TNC, International Paper (IP), and the NC Division of Forest Resources. This layer will be limited to forested lands whose primary management focus is timber production.

4. Forested Lands Managed for Conservation Purposes – consult with TNC, IP, the NC Wildlife Resources Commission (NCWRC), and the US Fish and Wildlife Service (USFWS). The lands identified in this layer may be used for timber production, but conservation purposes play a large role in land management.
5. Structures – based on land use and tax maps

Roads and Bridges – subdivided into four types:

6. Publicly maintained – consult NCDOT mapping information
7. Forestry Operations – consult IP
8. Agriculture – consult NRCS and major agriculture operations
9. Hunting Access – consult NCWRC, USFWS, and the Roanoke Tar River Gun Club. This layer may include roads also included in the agriculture or forestry operations maps that are key for hunting access.

The contractor will consult with TNC, USFWS, NCWRC, NRCS, IP, the Roanoke Tar River Gun Club, and major agricultural operations to determine if updates or data gaps need to be addressed in creating the digital maps, and to identify important access roads for forestry, agriculture or hunting. If necessary, GIS information may be collected in the field, including information about road grade elevations.

The output products for the mapping tasks will include:

- A report documenting the sources of information used in assembling geographic information.
- Digital (Arc Info version 9.n) and hard copy maps showing the baseline information for each of the nine parameters separately.
- The same nine maps, overlaid with the maps showing the extent of inundation under different flood scenarios (produced by the flood model). At least two flood scenarios will be used: a.) five day release at 20,000 cfs; and b.) three day release at 35,000 cfs.
- A report summarizing the acreage, roads, and structures affected by the flood scenarios, and a comparison of scenarios.

Baseline Information for Flood Damage Assessment

This task may be performed by a separate contractor or sub-contractor, but will require familiarity with and ability to use the information produced in the mapping task.

The contractor will consult with the Wilmington District, USACE and prepare a report describing the flood damage and hazard assessment information on which the current flood control operation is based.

An initial task for the contractor will be to establish the estimated baseline value of the agricultural and forest crops in the lower Roanoke River floodplain. The contractor will then consult with TNC, NRCS, IP, and major agricultural interests to prepare a report on flood impacts on timber and crop production. During the consultation process, the land use GIS map layers and flood model will be used in an interactive manner to assess the effects of different flood scenarios. This assessment will reflect the season, duration and magnitude of flooding. Impacts evaluated will include both impaired access/operations and damage to agricultural crops and timber.

The contractor will consult with the Downstream Flow-based Recreation Task Group regarding their analysis of recreational carrying capacity and flooding impacts on recreational user days. An initial task for the contractor will be to establish a baseline value for the different recreational uses in the lower Roanoke River and floodplain. As needed the contractor will perform additional consultation with TNC, NCWRC, USFWS, and the Roanoke Tar River Gun Club to prepare a report on flood impacts on hunting and other recreational uses. This evaluation of impacts will consider both impaired access and flooded lands, and also estimate the number of users affected per day on a seasonal basis.

The critical output product from the contractor's analyses will be a method for calculating monetary damages for different flood scenarios. This algorithm will allow dollar estimates of agricultural, forestry, and recreational impacts based on a given simulation produced by RRBROM and the flood model developed in task 1.A.2.

The contractor will prepare a report summarizing the damages caused by flood events from 20,000 cfs to 50,000 cfs in 5,000 cfs increments, and for durations ranging from one to five days – a total of 35 flood scenarios. The summary will break down damages into cost estimates for agriculture, timber, and recreation. The report will also include maps showing flooded areas for each scenario, and a description of affected roads.

The contractor's final report will summarize any differences between the flood damage and hazard assessment information currently used by the USACE and the updated information on land use, ownership, and potential flood damages and hazards.

John H. Kerr 216 Study
Downstream Riparian Ecosystem Task Group
Comprehensive Vegetation Map
Task 1.C.1 Phase II Scope of Work

A vegetation and land-cover map for the Roanoke River Basin below Roanoke Rapids Dam was developed in 1997 from imagery and field data collected in 1993-1995:

Townsend, P. A. and S. J. Walsh. 1997. Landcover classification and flood inundation models of the lower Roanoke River basin through remote sensing and GIS. Component report from The Roanoke River Bioreserve: A preliminary assessment of flow modifications on hydrology, geomorphological processes, and vegetation. The Nature Conservancy North Carolina Chapter, Durham NC.

The contractor will be provided with an Arc-Info version of the 1997 map in digital form and copies of the associated vegetation sampling data. The contractor will develop an updated version of the map using appropriate current, remotely-sensed data supplemented by one field season (2005) of intensive ground sampling and verification. Data from the 2004 NC vegetation Pulse samples may also be made available to the contractor, in which case they should also be used for ground-truth. The revised vegetation map will be developed at the same horizontal resolution (25 meter grid) and using the same classification¹ as the 1997 map. The contractor will provide the resulting map in Arc-Info 9.n format.

The contractor will provide Arc-Info data sets and maps of vegetation and land-use change between 1997 and the present to quantify and map: a) any change from one class to another (two classes – changed and not changed); b) any change from forest to non-forest and from non-forest to forest classes; and c) all detected class-to-class changes comprehensively.

The contractor will provide a detailed account of the work done to develop the data and the final products. The contractor will fully characterize the resulting data and provide a written report with maps and tables summarizing the project and illustrating the maps developed.

¹ The classification can be finer than that developed in 1997. However, it must be possible to aggregate the new classes into the 1997 classes. In other words, the 1997 classes can be split into subclasses where it is appropriate and possible.

Data standards and meta-data requirements

The contractor will report all processing and evaluation steps undertaken. The report should document error levels associated with the analyses, including geo-registration and attribute/interpretation errors. In particular, the contractor will provide a detailed statistical analysis of the sources of error and uncertainty in the resulting maps and change analyses. All data should be provided in a standardized format with standardized map projections and a metadata documented in a common format (e.g., FGDC standards). Field data should also be provided in a standardized (spreadsheet format), with complete documentation, geo-coordinates, and biological information following established standards and nomenclature.

John H. Kerr 216 Study
Downstream Riparian Ecosystem Task Group
Bottomland Hardwood Productivity and Recruitment Study
Task 1.C.2 Phase II Scope of Work

This scope of work is limited to the bottomland hardwood forests found downstream of Roanoke Rapids dam. The purpose of the study is to determine the influence of John H. Kerr Reservoir operations on the incremental growth of mature bottomland hardwood trees in the canopy.

1. Identify areas and forest types throughout the floodplain that may be impacted by USACE flood control operations.
 - a) Use the existing GIS-based flood model and digital elevation map, cross-referenced to the GIS vegetation layer database already developed by Townsend, to identify bottomland hardwood forest stands and topographic areas that are subject to inundation.
 - b) For each area identified in 1a, use the flood model and the digital elevation map to model years when flooding did and did not occur during the growing season for each bottomland hardwood stand.
2. Investigate the relationship between tree growth and the downstream flooding regime.
 - a) Examine existing tree core specimens to determine coverage of the topographic areas and forest types identified in part 1.
 - b) Extract additional core samples from mature trees (trees present before the reservoir began operation in 1950) as needed to represent the different topographic areas and forest stands identified in part 1 above. Species to be examined will include *Quercus* spp., *Carya* spp. and *Ulmus* spp. Additional species may be considered depending on readability of growth rings. In planning any additional collection of tree core samples, the contractor will ensure that there are adequate numbers and geographic coverage of samples to allow the effects of flooding to be isolated from other factors such as climatic events, insect infestations, etc.
 - c) Conduct a dendrochronological analysis on suitable extracted cores stratified across the different areas identified in part 1. The contractor will consider other factors that can affect tree growth and discuss any major historic events that might influence growth patterns in the sampling areas. The analysis will be conducted to isolate the effects of flooding alone on tree growth and to investigate whether growth patterns have been altered by the operation of J.H. Kerr reservoir. Growth will be compared before

and after the reservoir began regulating downstream flows, and also between years with and without prolonged growing season floods.

3. Investigate the relationship between flooding and historic seedling recruitment

- a) Examine existing tree core specimens to determine coverage of the topographic areas and forest types identified in part 1.
- b) Extract additional core samples from younger trees (trees established after the reservoir began operation in 1950) as needed to represent the different topographic areas and forest stands identified in part 1 above. Species to be examined will include *Quercus* spp., *Carya* spp. and *Ulmus* spp. Additional species may be considered depending on readability of growth rings. In planning any additional collection of tree core samples, the contractor will ensure that there are adequate numbers and geographic coverage of samples to allow the effects of flooding to be isolated from other factors such as climatic events, insect infestations, etc.
- c) Conduct an age distribution analysis on suitable extracted cores – from both older and younger trees - stratified across the different areas identified in part 1. The contractor will consider other factors that can affect seedling survival and discuss any major historic events that might influence seedling recruitment in the sampling areas. The analysis will be conducted to isolate the effects of flooding alone on seedling survival and to investigate whether recruitment has been altered by the operation of J.H. Kerr reservoir. Dendrochronological analysis will evaluate age distribution, by species, to identify periods when there are either gaps or surges in recruitment of tree seedlings. Age distribution will be compared before and after the reservoir began regulating downstream flows, and also between years with and without prolonged growing season floods.

4. Provide a report describing the methods employed for data collection and data analysis, the results, an analysis of statistical value and probable error, and conclusions. The complete data set, copies of all model runs, and any new maps employed should be attached. Any new tree cores collected and any equipment purchased should be delivered for archival purposes to a suitable party identified by the study review team.

ATTACHMENT 8
SCOPE OF WORK – WATER QUALITY

Scope of Work for John H. Kerr Section 216 Feasibility Study Roanoke River Hydrodynamic and Water Quality Monitoring and Modeling Description of Existing And Future Without Project Conditions

1. Introduction: The U.S Army Corps of Engineers, Wilmington District (Wilmington District) in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for of improving the quality of the environment in the overall public interest. Public, stakeholder, and local, State, and Federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis *is* being done in accordance with U.S. Water Resources Council 's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website: http://www.saw.usace.army.mil/Authorized_Projects/Main.htm. The purpose of this contract is to inventory the existing conditions and to forecast future conditions for water quality if no operational changes are implemented at John H. Kerr Dam. Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of *implementation* of various modifications to the operation or structure at John H. Kerr Dam.

2. Technical Proposal: The Contractor shall prepare a Technical Proposal to be submitted along with the required Cost Proposal. The Technical Proposal will consist of a detailed description of the methods the Contractor proposes to use to collect the data requested by this Scope of Work. In addition to demonstrating a clear understanding of the technical requirements of this Scope of Work, the Contractor must demonstrate a clear understanding of: (1) current operation of the John H. Kerr Reservoir; (2) the relationship between John H. Kerr and the two downstream dams operated by Dominion Power; and (3) the Corps of

Engineers Planning process and how the future without project conditions analysis will influence future analysis of alternatives resulting from the John H. Kerr 216 Study.

3. Study Area Description: *(The following discussion is based on material contained in the John H. Kerr 216 Feasibility Study Project Management Plan, PMP.)* The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952.

Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced farming and forestry opportunities. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl and *provide quality seasonal recreational opportunities.*

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the Dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The Study Area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina.

4. Relevant Operational Guidance and FERC Settlement Agreement: John H. Kerr Reservoir is operated in accordance with the “*Water Control Plan for John H. Kerr Dam and Reservoir.*” which was updated in February 1995. A copy of this plan is attached (Attachment 1). The Contractor shall become familiar with this plan and shall use it as the basis for the future without conditions analysis.

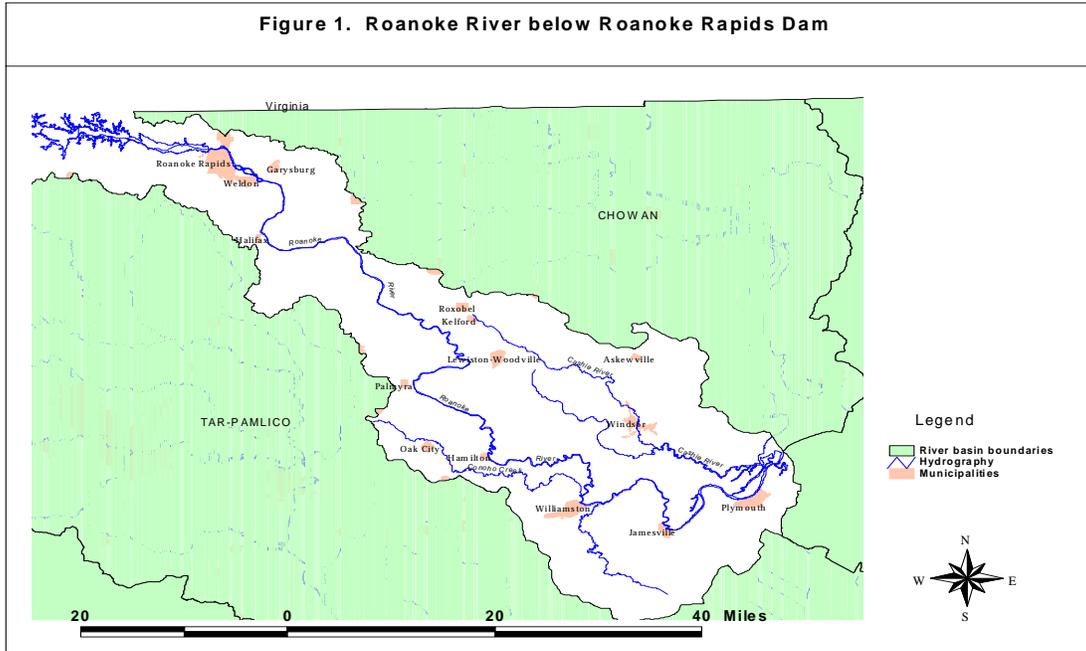
While the operation of John H. Kerr Reservoir under the terms of the 1995 Water Control Plan has a significant influence on the Lower Roanoke River Basin, the lower basin is also influenced by the downstream Roanoke Rapids and Lake Gaston Reservoirs, which are operated by Dominion Power. Roanoke Rapids and Lake Gaston are operated under the terms of the 2003 “*Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project*” (Attachment 2) that resulted from the Federal Energy Regulatory Commission (FERC) relicensing process. The Contractor shall be come familiar with this settlement agreement and shall use it to help distinguish between downstream influences on sedimentation, erosion, and channel morphology caused by the operation of John H. Kerr and the downstream influences caused by the operation of Roanoke Rapids and Lake Gaston.

5. Purpose: The purpose of this water quality contract is to inventory the existing conditions and to forecast future conditions for providing recommendations to address

several main issues regarding flow releases from John H. Kerr Dam to the Roanoke River. Such issues are:

- How do releases at Kerr Dam translate to changes into water quality in the Roanoke River?
- What is the effect of riparian swamp water drainage on the Roanoke River oxygen levels?
- What is the oxygen related assimilative capacity of the Roanoke River associated with different flow regimes and management operations at the dam?

Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of implement of various modifications to the operation or structure at John H. Kerr Dam. Monitoring and modeling should be one combined task where it will be sent out as two separate proposals, but for the same *award*. Also, nutrients and eutrophication are not considered major issues. The Roanoke River from the Roanoke Rapids Dam to the mouth below Plymouth is shown in Figure 1.



6. Background: Under Water Quality tasks in the PMP (USACE 2004) there are three objectives labeled A, B and C:

- A. “How does flow regime affect downstream water quality in floodplain areas, tributaries, and the main river channel”.
- B. “How do downstream flows maintained by releases from Kerr Reservoir affect water quality in the river channel between Roanoke Rapids and the mouth of the river?”
- C. “Evaluate the water quality of the release from the Kerr Dam impoundment through the Roanoke Rapids tailrace.”

This scope of work primarily addresses objective B and secondarily, objective A. Objective C is not included in this scope of work.

The water quality issues highlighted by the Water Quality Task Group (Task Group) include those related to dissolved oxygen levels in the water column.

The monitoring and modeling effort should include the Roanoke River and adjacent swamp lands from the Roanoke Rapids Dam to the mouth at the Albemarle Sound. Several stretches of the river are braided or diverted to side channels. The flow in these channels (not reflected in Figure 1) can be substantial, thus special considerations should be given to characterizing water movement and quality in these areas. For example, below Jamesville the Roanoke and Cashie Rivers have in common *one* natural and man-made channel through which water can flow from one system to another. With the added tidal influence, water movement in this area has the potential to change direction frequently.

At this time, the Task Group anticipates the need for about 28 months (Section 8. Timeline) of monitoring throughout all seasons. ***Four months of this time period will include quality assurance and control of collected and processed data as well as data management.*** Thus multiple seasons, meteorology and hydrologic conditions can be captured through both monitoring and modeling. Typically, high temperature, low flow situations are associated with low dissolved oxygen levels in riverine systems. However, the changes in flow regime due to dam releases, the influence of adjacent swamps, and the relative natural contributions from rainfall need to be characterized in a manner that will allow appropriate management actions.

The proposed monitoring period could be shortened depending on the environmental conditions that occur naturally or if releases from the reservoirs would be adjusted to meet requirements. ***By the current Water Control Plan, if the Kerr Reservoir pool elevation is in the range indicated below, releases at Roanoke Rapids Dam up to the corresponding maximum shown below can be made. Releases above the maximums indicated would require approval of a deviation request by the Corps of Engineers Division office in Atlanta. Minor deviations can be approved within a few days, but major deviations may require NEPA documentation which could take several months. Even though low releases do not require Division approval, there are limitations. Sustained low releases can not be made during flood conditions, and releases must be sufficient to meet the power house station needs and contract power requirements.***

<i>Elevation feet mean sea level (msl)</i>	<i>Maximum release cubic feet/sec (cfs)</i>
<i>< 300</i>	<i>8,000</i>
<i>300-312</i>	<i>20,000</i>
<i>312-315</i>	<i>25,000</i>
<i>315-320</i>	<i>35,000</i>
<i>>320</i>	<i>>35,000</i>

These specific flow requirements would range from extreme high flows of **35,000** cfs to low flows of 1,500 cfs. In addition, these ranges should be met for each of the four seasons in a year, given the availability of inflows to J.H. Kerr Reservoir.

Swamp drainage. The majority of the land on both sides of the Roanoke River downstream of Weldon is comprised of extensive wetlands and swamps that are subject to frequent flooding. This flooding often results from high flow releases from Roanoke Rapids dam. Flooding in response to heavy rainfall is less frequent. Since the swamps have naturally occurring low dissolved oxygen levels and depending on the season, have higher temperature values, the water quality model of the river will need to consider the oxygen consuming loads from the adjacent wetlands and swamps as it relates to water quality in the main channel of the Roanoke River. The impacts of industrial and domestic discharges on DO depletion also needs to be assessed along with the relative contribution to DO depletion by swamp drainage and industrial discharges. The monitoring to address these issues (as well as the modeling) will be directly relevant to Objective A described above.

Flow regime. The quantity of water in the Lower Roanoke River is dependent upon operation of the three reservoirs (J.H. Kerr, Gaston and Roanoke Rapids). Gaston and Roanoke Rapids are owned and operated by a public utility company. The J.H. Kerr dam is owned and operated by the USACE and is located upstream from the Roanoke Rapids dam. USACE gives weekly flow declarations to the public utility company to inform them of anticipated quantity amounts to be received. Under *various* conditions large water outflows are released from Roanoke Rapids dam and *if quantities and duration are sufficient*, subsequent flooding of the swamps *occurs*. Under drought conditions, a minimum flow requirement is established per the power company's Federal Energy Regulatory Commission license to avoid mass deterioration of downstream aquatic ecosystems.

Diurnal variation. The water quality model will need to consider changes to dissolved oxygen through a daily cycle, for all seasons and flow releases.

Salt wedge. The mouth of the Roanoke River drains into the Albemarle Sound, which is an estuarine system. During times of low flow and drought conditions salt has been observed to move into the Roanoke River. The change in density and saturation associated with salt water affect the levels of oxygen in the water column. The water quality model will need to simulate the movement of the salt wedge and its impacts on dissolved oxygen values.

Determination of saltwater movement in Albemarle Sound is covered by the salt wedge task area. Within the sound, saltwater movement is driven by river flow over the prior weeks to months and wind conditions. Operations at Kerr Reservoir may affect river flows and hence salt water movement in the sound. In the absence of predictions or downstream boundary monitoring data, model input data on salt water at the mouth of the Roanoke River will need to be developed making assumptions about the relationship between salt water movement and river flow.

7.0 Technical Services: This scope of work requests services related to objectives A and B described in Section 6.

7.1 Monitoring Strategy Development (Task 1): The Contractor will develop a monitoring strategy to support hydrodynamic and water quality modeling of the Roanoke River from Roanoke Rapids Dam to the mouth at the Albemarle Sound. In order to develop a successful monitoring strategy, the Contractor should have ready access to hydrodynamic and water quality modeling staff to provide expertise regarding the usefulness of the existing

monitoring networks and the additional needs for modeling purposes. Actual monitoring will be carried out in Task 2. The Task Group is expecting data needs to include geomorphology/bathymetry, discharge and velocity, dye studies, vertical water level and water quality parameters for water quality modeling as well as parameters for hydrodynamic modeling.

Several scientific and water quality issues have been identified that will need to be addressed as part of this project including strategies related to low dissolved oxygen values for J.H. Kerr Reservoir. This also includes the influence of swamp drainage including adjacent flooding, the influence of controlled releases from Roanoke Rapids dam, the diurnal variation in water quality, and the movement of the salt wedge in response to changes in flow regimes. These should all be addressed in the monitoring strategy. Issues of hypothetical effects at J.H. Kerr Reservoir is important to address; however, Task C from the draft PMP was identified as low priority. Therefore, theoretical DO values will be assumed regarding flows from J.H. Kerr Reservoir dam.

As previously stated, the Water Quality Task Group feels that monitoring and modeling should occur over a period of 28 months. Although actual monitoring takes place in Task 2, the Quality Assurance Project Plan (QAPP) and budget should reflect a 28 month time period. If supported by scientific data and analysis, the Contractor may suggest an alternate time period by *using adaptive management or other techniques* to meet the project goals.

- Prepare a data review document. The Task Group has prepared a summary of the sources of data, however a summary of the data has not been prepared. The Contractor will prepare a data review that includes descriptions of physical characteristics, previous water quality investigations by any agency, a review of existing modeling frameworks, an existing data compilation, exploratory data analysis, identification of data gaps and recommendations for monitoring. The data review should address the differences in analytical methods and precision among existing monitoring networks and highlight incompatible data. This document will be prepared in draft and final form and should be presented to the Task Group for consideration prior to the development of the Quality Assurance Project Plan (QAPP).
- The Contractor will prepare a combined monitoring strategy and a QAPP according to EPA guidance (EPA 240/R-02/009). A NC certified laboratory should be utilized for chemical parameter analysis. Monitoring frequency and location should be specified in the QAPP and a contingency procedure should be provided in case of extreme weather during the monitoring period. A draft QAPP, with a preliminary budget, will be provided to the Task Group for review and comment. Comments related to the QAPP and a final budget should be addressed in the final document. Approvals, in the form of signatures, should be obtained from both the USACE and DWQ.

In summary, the deliverables for this task are:

1. Roanoke River Data Review Document.
2. Draft and final Quality Assurance Project Plans (QAPP) for monitoring strategy.
3. QAPP meeting and presentation to Task Group.

7.2 Field Monitoring (Task 2): The Contractor will implement the monitoring strategy described in the QAPP developed for Task 1. Along with brief monthly updates, at a midpoint during the field study, the Contractor will provide a detailed memorandum to the Task Group to describe the progress with monitoring and expenditures. All quality assurance and control procedures outlined in the QAPP will be followed.

The following information should be included in the MS Access compatible database:

Station information: Station ID
Description
Latitude
Longitude
County
USGS Station Number (if applicable)

Chemical analysis information:
Parameter
Media
Analytical method
Reporting limit

Chemical monitoring information:
Station ID
Date
Time
Depth
Parameter
Result
Data qualifier

Hydrologic and hydraulic data should be provided in an ASCII file (or files). The format for hydrologic and hydraulic data should be similar to the chemical monitoring information.

With the midpoint progress memorandum, the Contractor will provide the USACE and DWQ with an ArcView shape file mapping all monitoring locations. The metadata should include the station ID, type of monitoring that occurs at that station (e.g., temperature only, chemical, hydrologic/hydraulic), and the agency or group responsible for data collected at that station. The submittal should include an interactive website with a map linked to real-time data.

The Contractor will also provide a brief summary report of the data collected for this effort. This will include graphical representations of conditions during the study and data summaries. The monitoring report should also compare the data collected for this effort to the historical record to determine if the monitoring period was particularly wet or dry.

Deliverables:

1. Monthly reports and Midpoint progress memorandum.
2. MS Access compatible database with all project chemical data. ASCII database with all project hydrologic/hydraulic data.
3. ArcView shape file *projected for NC&VA state plane* describing all monitoring stations and including metadata.
4. Draft and Final Monitoring Report, including graphs and tables.

7.3 Hydrodynamic Modeling (Task 3): The Contractor will develop a hydrodynamic model of the Roanoke River from the Roanoke Rapids Dam to the mouth at the Albemarle Sound. The hydrodynamic model should be capable of simulating rapid changes in the flow regime due to changes in dam releases. The hydrodynamic model should also be capable of simulating, to some extent, flooding of adjacent wetlands and forests and subsequent drainage back to the river. At this time, the Task Group believes that several lateral cells should be included in the modeling framework in order to describe the wetting and drying that occurs in riparian areas. These lateral wetting and drying cells will be repeated in the water quality model.

At this time, the Task Group feels that an existing modeling framework should be utilized to construct the Roanoke River hydrodynamic model. Examples of existing frameworks include CE-QUAL-RIV1, CE-QUAL-IMP, RMA2 and EFDC. The Contractor shall seek permission from both the USACE and DWQ if a proprietary code or model is preferred.

The treatment of braided channels is an important consideration in the Roanoke River model. This is particularly important in the lower portion of the Roanoke River near the mouth of the Cashie River where many channels are present and where tidally influenced movement is likely to be greatest.

The Contractor should provide a written and oral description of the modeling approach to the Task Group for review. The technical memorandum and presentation should include a description of the model selection procedure, calibration goals and methods, and the approach to characterizing model uncertainty. (The Contractor may prepare a combined hydrodynamic and water quality modeling approach document and presentation.)

Deliverables:

1. Modeling approach presentation and technical memorandum.
2. Calibrated hydrodynamic model compatible with MS Windows NT.
3. Graphical representations of water movement and temperature changes in the system including movies.
4. Draft and final hydrodynamic model technical reports (can be included in a combined hydrodynamic and water quality modeling report).
5. Presentation of results (see Section 7.4).

7.4 Water Quality Modeling (Task 4): The Contractor will develop a dynamic water quality model of the Roanoke River from the Roanoke Rapids Dam to the mouth below the Cashie River at the Albemarle Sound. The water quality model should be capable of simulating rapid changes in dissolved oxygen due to changes in Roanoke Rapids dam releases and to swamp water inputs. The water quality model should also be capable of simulating, to some extent, the oxygen consuming properties of riparian swamp water inflow after a flooding event. Sediment oxygen demand should be explicitly included in the model.

At this time, the Task Group feels that an existing modeling framework should be utilized to construct the Roanoke River water quality model. Examples of existing frameworks include CE-QUAL-RIV1, CE-QUAL-ICM, EFDC, and WASP. The Contractor shall seek permission from both the USACE and DWQ if a proprietary code or model is preferred. The Task

Group also feels that a minimum of a 2-dimensional water quality model is needed in order to address issues with swamp drainage, tidal influences, and the salt wedge.

The Contractor should provide a written and oral description of the modeling approach to the Task Group for review. The technical memorandum and presentation should include a description of the model selection procedure, model linkage, calibration goals and methods, and the approach to characterizing model uncertainty. (The Contractor may prepare a combined hydrodynamic and water quality modeling approach document and presentation.)

Deliverables:

1. Modeling approach presentation and technical memorandum. (Can be included in a combined hydrodynamic and water quality modeling report.)
2. Calibrated water quality model compatible with MS Windows NT
3. Graphical representations of dissolved oxygen in the system including movies.
4. Draft and final water quality model technical reports (can be included in a combined hydrodynamic and water quality modeling report).
5. Presentation of results to the Task Group.

7.5 Management Scenario Analysis(Task 5): In addition to providing modeling output describing water movement and dissolved oxygen levels by segment on a daily basis, the Contractor will evaluate several other management scenarios in order to guide management of water releases from Kerr Reservoir. These additional management scenarios include the following:

- Evaluate mainstem water quality conditions with minimum release flows at the Roanoke Rapids Dam that vary monthly.
- Evaluate mainstem water quality conditions with minimum release flows at the Roanoke Rapids Dam and permitted effluent loads of oxygen consuming wastes.
- Evaluate mainstem water quality conditions under flood control scenarios as defined by the USACE for Kerr Reservoir.
- Evaluate mainstem water quality conditions following high flow pulse releases from the Roanoke Rapids Dam.
- Evaluate mainstem water quality conditions following sustained releases of flood-level flows. (See example Figures 2 and 3)
- Evaluate riparian swamp area water quality conditions following sustained releases of flood-level flows.
- Evaluate riparian swamp area water quality conditions following high flow pulse releases from Roanoke Rapids Dam.
- Evaluate response of downstream DO to hypothetical management alterations of DO improvements at J.H. Kerr Dam. (The Contractor will have to make assumptions regarding the effects of changes at J.H. Kerr Dam to releases at Roanoke Rapids Dam. Reservoir modeling is not included in this project).

The Contractor should convene a conference call with the Task Group following the completion of the water quality model. This conference call will be held to discuss these management scenarios and any other scenarios that may arise. The Task Group anticipates that batch runs of the water quality and/or hydrodynamic model will be required to answer these management questions.

Figure 2. Example management scenario result: Percent of River Violating Standards

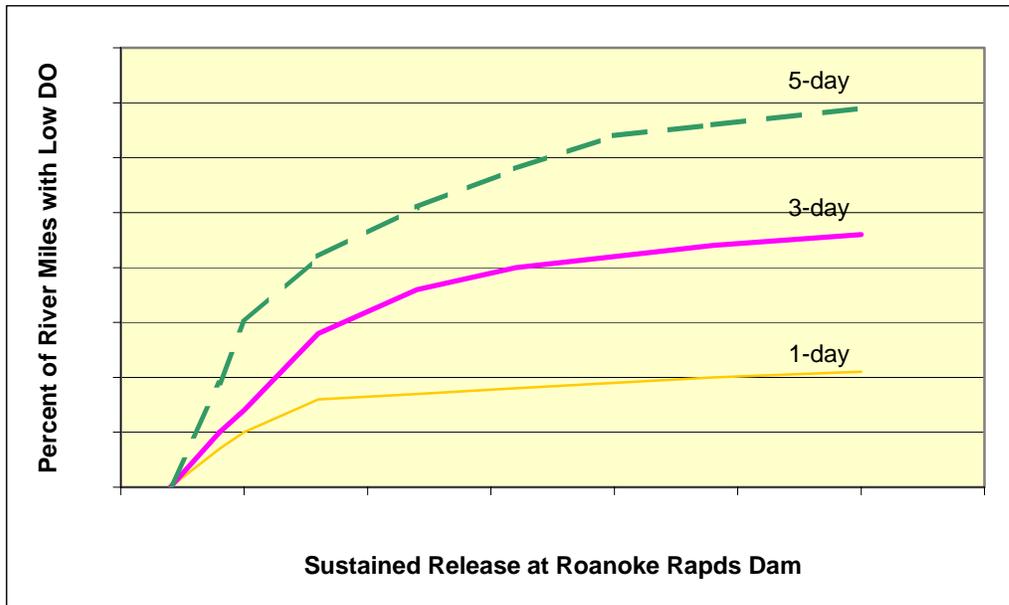
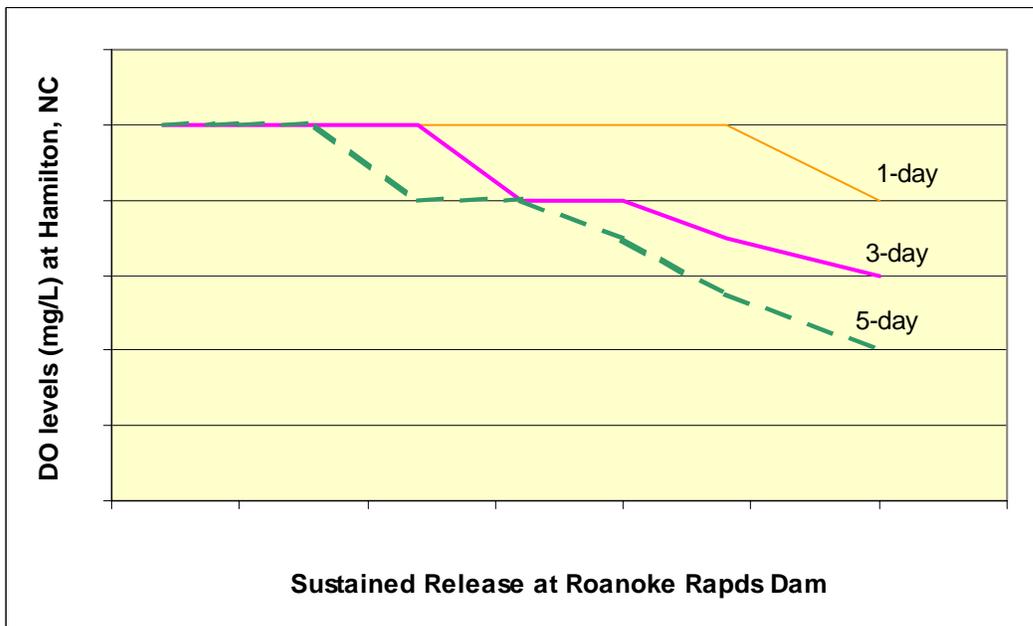


Figure 3. Example management scenario result: Water Quality Impacts at Hamilton, NC



Deliverables:

1. Presentation of results to the Task Group
2. Draft and final scenario analysis reports (can be included in a combined hydrodynamic and water quality modeling report.)

8. Timeline:

The timeline *indicated* for each task of this project is *based on timing of previous similar projects. However as indicated in section 13, proposals that provide justification for an accelerated schedule by using adaptive management or other techniques will be given a higher ranking.*

Task	Scheduled completion
Award contract	
Task 1. Monitoring Strategy Development	6 months after contract award
Task 2. Field Monitoring	28 months after QAPP and budget approval, assuming same contractor performs Task 1 and 2.
Task 3. Hydrodynamic Modeling	8 months after contract award or receipt of all monitoring data
Task 4. Water Quality Modeling	8 months after completion of hydrodynamic modeling
Task 5. Management scenario analysis	2 months after completion of water quality modeling

9. Monthly Status Reports: The Contractor shall submit written monthly status reports by the 5th day of each month the contract is in force. A Monthly Status Report must accompany all requests for payment. These reports may be in brief letter format and should summarize work performed and problems encountered. A concise statement and/or graphic presentation of estimated work progress (incremental and cumulative percentage completed), by task, shall be included in each report. The report should also note difficulties, if any, in meeting the work schedule. The Contractor shall be responsive to verbal requests from the Contracting Officer for specific information to be included in the monthly reports. Any matters requiring an immediate action or decision by the Contracting Officer shall be identified by expeditious telephone contact with the Contracting Officer’s Representative (COR).

10. Project Reports: Upon completion of all work under the five tasks under the terms of this contract, the Contractor shall submit a draft report for review. The report and findings shall be objective and fully substantiated by documentation. The appendices will contain tabulations of all physical, biological, and statistical data and a list of all participating technical staff and their respective responsibilities on the project. The report shall contain appropriate summary tables and figures. Text material shall be printed on 8-1/2" by 11" bond paper with 1-1/2" margins on the left for binding. All pages must be consecutively numbered. Drawings or plates bound in the report shall be no larger than 11" by 17" and shall include a graphic bar scale for control during reduction or enlargement. Additional larger maps or drawings shall be provided on standard 30" by 42" sheets, unless the Contracting Officer and the Contractor agree otherwise. **Draft reports requiring extensive proofreading or incomplete draft reports are unacceptable and will be returned to the Contractor.** The Contracting Officer will provide written comments on the accepted draft report. The Contractor will revise the report in accordance with these comments and, then, submit the report as final. In some instances a revised draft report to assure that all agency

requirements are properly addressed prior to release of the report for agency or public review may be required.

- (1) Electronic copies of each report will be delivered to the USACE and DWQ and should be compatible with Adobe Acrobat and MS Word 2000. In addition, 15 hard copies of each report will be required. This requirement includes the following documents:
 1. Roanoke River Data Review Document
 2. Draft and final Quality Assurance Project Plans (QAPPs)
 3. Monitoring Data Report
 4. Draft and final Hydrodynamic and Water Quality Modeling Report
 5. Various technical memoranda.
- (2) Monitoring database including hydrologic, hydraulic and water quality data. All files must be compatible with MS Access 2000 or ASCII as specified in Section 7.2.
- (3) All input and output modeling files with, if necessary, a copy of an executable version of the model. All files will be compatible with Windows operating systems (prefer 2000) and/or ArcView version 9.0.
- (4) Shape files with locations of all monitoring stations and metadata. These shape files will be compatible with ArcView 9.0 and projected for NC & VA state planes.
- (5) Stakeholder presentations. The Contractor shall provide, in advance, copies of the presentations and any handouts to be provided to the Task Group. Electronic copies of presentations should be compatible with Adobe Acrobat and MS PowerPoint.

11. Report Title Page: The title page of the project report(s) will bear an inscription that indicates the source of funding for the particular item of work covered by the report. This inscription will reference the Contract Number. In addition, the title page shall bear the following inscription: “Project Manager: (Name).” If someone other than the Project Manager has prepared the document, this inscription will, instead, state Prepared Under the Supervision of (Name), Project Manager.

12. Instructions for Proposals: To expedite the review and selection process, the Letter of Interest, Statement of Qualifications, and Cost Proposal shall not be in excess of 50 pages, including appendices. The document shall be formatted as follows:

Part I. Letter of Interest (1 page)

Part II. Table of Contents

Part III. Technical Approach

Part IV. Project Team (1 page maximum)

This section should identify the lead firm that will have total responsibility for coordination with the USACE. Describe lead firm’s and any sub-contractors’ responsibilities and anticipated percentage of total work for each team participant. Identify project work location(s) and describe how coordination and communication will be conducted. Provide a brief summary of past joint work with each sub-contractor, if applicable.

Part V. Organization Chart (1 page maximum)

Identify the Project Manager (that person responsible for day-to-day communication with the USACE contract) and all personnel contributing to the contract. Indicate the firm with which the individual works.

Part VI. Qualifications, Experience and References

This Section must include the following information:

- A. Description of the Proposer's most significant qualifications for this project;
- B. Summary of the Proposer's experience with similar projects, highlighting projects completed in the Carolinas (include client's name, brief description of project, project contract period, contract amount, and names of the Proposer's key personnel who worked on the project);
- C. References concerning the Proposer's qualifications, experience, and performance on prior and current assignments that are similar to the proposed project (name, title, organization, address, phone number, etc.)

Part VII. Resumes

Provide resumes to present the credentials and experience of each team member identified in the proposal. Each resume should be limited to one page or less.

13. Proposal Evaluation and Contractor Selection: The Task Group will consider numerous criteria to evaluate proposals received in response to this Request for Qualifications. Criteria include, but are not limited to:

1. Technical approach *including justification for accelerating the timeline by using adaptive management or other techniques indicated in section 8.*
2. Technical qualifications and competence of the contractor, including applicable subcontractors *especially related to field monitoring, water quality and hydrodynamic modeling,*
3. Experience and qualifications of key staff assigned to this project *especially related to field monitoring, water quality and hydrodynamic modeling,*
4. Organization of the proposal, and
5. Costs

14. Contractor Obligations:

a. Permits, Licenses, And Approvals: The Contractor shall obtain all necessary permits, licenses, and approvals required by Federal, State, or local authorities for conducting work under this contract. Personnel conducting work on endangered and threatened species must have demonstrable knowledge of the biology and current conservation practices for the species in the work area, and they must have, or be able to demonstrate the ability to obtain, all necessary permits required to survey and monitor listed species. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress to perform any of the work required under this contract on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event all efforts by the Contractor fail to gain permission from the property owner(s) for entry to the property for performing the required work, the Contractor shall contact the Contracting Officer to obtain instructions for further action. In the event that the Contracting Officer must take action to obtain right-of-entry for the Contractor, the Contractor will be entitled to an equitable extension of time for the period required to obtain said right-of-entry. The Contractor shall assume all responsibility for and take all precautions to prevent damage to private and Government-owned property. The

Contractor shall be responsible for any claims covering actions not approved by the Contracting Officer.

b. Project Management: The Project Manager shall be the individual responsible for the validity of the material in all reports and shall have recognized expertise in the appropriate field. During execution of the work, the Project Manager shall provide adequate professional supervision to assure timeliness, accuracy, quality, and completeness. In the event of controversy or court challenge, the Project Manager may be called upon, under separate contract, to testify on behalf of the Government in support of the Contractor's findings.

c. Product Quality: The Contractor shall be responsible for accomplishing all work in an accurate and professional manner. Any work deemed inadequate or nonconforming by the Contracting Officer shall be re-done by the Contractor, as necessary, to comply with the contract requirements at no additional cost to the Government.

15. Personnel Qualifications: All professional persons employed under the terms of this contract must meet the minimum qualifications for their profession as established by the United States Office of Personnel Management. The duties and basic qualifications of key staff are as follows:

a. Project Manager/Principal Investigator.

(1) **Duties.** The Project Manager or Principal Investigator is the individual identified in the contract as being authorized to act for the Contractor and is responsible for contract administrative actions and research formulation for the contract firm. This individual usually selects the Technical Director and appropriate work crews, determines appropriate level of investigation and analysis, coordinates activities with the Contracting Officer's Representative, and performs other administrative functions. This individual is responsible for overall contract quality control.

(2) **Qualifications.** Persons in charge of a project or research investigation, in addition to meeting the appropriate standards for their respective profession, must have a doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in project formulation, execution, and technical monograph reporting. If prior projects were of a sort not ordinarily resulting in a publishable report, a narrative should be included, detailing the proposed Project Manager/Principal Investigator's previous experience along with references suitable to obtain opinions regarding the adequacy of this earlier work.

b. Technical Director.

(1) **Duties.** The Technical Director is the individual in charge of accomplishing specific scientific data collection, analysis, evaluation, and reporting. This individual follows work from initiation to completion and

provides technical support to the Project Manager/Principal Investigator utilizing a basic understanding of scientific methods and procedures. The Technical Director is responsible for conducting literature reviews; office, field, and laboratory research; field surveys; site testing; and scientific analyses using various reference materials, maps, interviews with knowledgeable individuals, scientific instruments, and aerial photographs and other remotely-sensed data. The Technical Director is the individual who authors reports under the supervision of the Project Manager/Principal Investigator. Under the guidance of the Project Manager/Principal Investigator, this individual is responsible for making day-to-day decisions regarding the data collection, testing and analysis, and evaluations. The Technical Director is responsible for the accuracy of the information collected and for the scientific validity of recommendations made in draft and final reports. Technical Directors oversee and supervise the crewmembers assigned to their projects. The Technical Director assures that assignments are carried out in a safe and timely manner according to procedures established by the Project Manager/Principal Investigator.

(2) **Qualifications.** Individuals in this job category must hold a Master's or higher degree in the field of their work assignment, or possess an equivalent level of professional experience.

c. Scientist.

(1) **Duties.** Personnel in this category must carry academic and experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if this person has not been retained at the time of proposal.

(2) **Qualifications.** Individuals in this job category must hold a Bachelor's or higher degree in the field of their work assignment and must possess at least 12 month combined field and laboratory experience.

d. Technician.

(1) **Duties.** Technicians work under the direction of the Technical Director. Technicians conduct a variety of tasks, including locating field sites by using maps and instruments, conducting scientific data collection, performing analytical procedures and techniques, and performing accurate record-keeping. Technicians may be required to calibrate and operate various types of analytical instruments. Technicians may also be required to perform preliminary treatments on samples or specimens requiring later detailed analyses.

(2) **Qualifications.** Technicians must possess an Associate's or higher degree (except archaeological technicians, who must have a Bachelor's degree) in the field of their work assignment, or at least 12 months combined field and laboratory experience.

e. Consultant.

(1) **Duties.** Consultants are personnel subcontracted on a short-term basis for their special knowledge and expertise.

(2) **Qualifications.** Consultants must carry academic and/or experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if the consultant has not been retained at the time of proposal.

16. Equipment And Facilities: The Contractor must provide or demonstrate access to the following capabilities:

a. Adequate field and laboratory equipment necessary to conduct whatever operations are defined in this Scope of Work

b. Adequate facilities necessary for the proper treatment, analysis, and storage of samples and/or specimens likely to be obtained from a given project. This does not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but it does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis that may be required.

c. Adequate facilities for secure storage and efficient retrieval of data and records.

17. Release Of Information: Neither the Contractor nor the Contractor's representatives shall release any report, data, specification, drawing, rendering, perspective, sketch, photograph, cost estimate, or other material obtained or prepared under this contract without prior specific written approval of the Contracting Officer.

18. Inspection Of Services: The Government's rights regarding the inspection of services under the terms of a fixed-price services contract are explained in Section I "Contract Clauses." Generally, under this clause, the Government has the right to inspect all services called for by this contract and any Task Order issued under it. If any of the services do not conform with the contract and the Task Order requirements the Government may require the Contractor to perform the services again in conformity with the contract and Task Order requirements, **at no increase in the contract amount**. If the Contractor fails to promptly perform the services again in conformity with the contract and Task Order requirements, the Government may: perform the services (or have the services performed) and charge the Contractor any cost incurred by the Government; cancel the services required under terms of a specific Task Order; or in extreme case may **terminate the contract** for default.

19. Travel: All travel and per diem in connection with work performed under this contract will be at the Contractor's expense, including travel time to and from work sites.

20. Payment: Payments will be made based on documented progress. Evidence of progress (e.g. percentage of task complete) shall be documented in the monthly progress report that must accompany invoices.

21. Method Of Payment: Partial payments to the Contractor will be made through the end of each month, for work or services performed by the Contractor during that month, upon submission of a proper invoice on the submitted on corporate letterhead. In order to be considered a proper invoice each invoice must be accompanied by the monthly status report accepted by the COR clearly indicating what the work has been accomplished during the billing period. Partial payments will not be made in amounts less than \$1,000 (except for final submittals). Each invoice must identify the contract and indicate whether the payment is a partial billing (e.g. "partial #1") or a final bill (e.g. "#4, final"). For purposes of billing, the acceptance date of deliverables (not delivery date or date of invoice) will constitute the billing date for the purposes of all payments.

22. References Cited:

Federal Energy Regulatory Commission

2003 *Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project FERC Project No. P-2009*, June 2003

U.S. Army Corps of Engineers

1988 *Environmental Quality - Procedures for Implementing NEPA*. Publication Number: Engineering Regulation 200-2-24 March 1988, U.S. Army Corps of Engineers, Washington D.C.

1992 *Authorized and Operating Purposes of Corps of Engineers Reservoirs July 1992* U.S. Army Corps of Engineers, Washington D.C.

2000 *Planning Guidance Note Book*. Engineering Regulation 1105-2-100, April 22, 2000, U.S. Army Corps of Engineers, Washington D.C.

U.S. Army Corps of Engineers, Wilmington District

1995 *Water Control Plan For John H. Kerr Dam And Reservoir*, Wilmington, North Carolina.

2004 Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina, Wilmington North Carolina.

2004 Wilmington District Authorized Project Web Site

http://www.saw.usace.army.mil/Authorized_Projects/Main.htm

U.S. Council on Environmental Quality

1978 *Regulations for Implementing National Environmental Policy Act*. 40 Code of Federal Regulations Parts 1500-1508, 43 Federal Register 55990, November 28, 1978.

U.S. Water Resources Council

1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. 8 July 1983, United States Water Resources Council, Washington DC.

ATTACHMENT 9
SCOPE OF WORK – DIADROMOUS FISH AND DOWNSTREAM RIVERINE AQUATIC RESOURCES

John H. Kerr 216 Study
Work Group 7 - Diadromous Fish and Riverine Aquatic Resources Workgroup
(DFRARW)

Aerial Videography and Mapping of Important Fish Habitat including Woody Debris

Task 7.A.1. Phase II Scope of Work

BACKGROUND: Bankside and instream woody debris are recognized as important components of aquatic habitats in the lower Roanoke River. The presence and operation of three reservoirs on the upper Roanoke River may be affecting the abundance, distribution and fate of woody debris along and within the lower Roanoke River. However, related information is virtually nonexistent. Aerial videography of important fish habitat including bankside woody debris can provide quantified baseline information to assess the status of woody debris. This in turn may be used to assess the potential effects of the three reservoirs and their operation, and the effectiveness of alternative flow regimes. The geographic scope for proposed videography work will be from Roanoke Rapids, North Carolina downstream to Plymouth, North Carolina.

Task 7.A.1.a

CORPS AND STATE VIDEOGRAPHY AND MAPPING TASKS

OBJECTIVE: Retain an Aerial Videography Contractor for the proposed work, and manage the contract for the work, assuring that the Contractor's final products meet all project requirements. Present final map product to the Executive Committee.

TASKS:

1. Retain an Aerial Videography Contractor for the proposed work, as follows:
 - Adhere to contracting requirements of Wilmington District or NCWRC during procurement.
 - Contact at least three (depending upon availability) contractors who are experienced in the practice of aerial videography of the type required, and review their qualifications, including examples of prior work.
 - Present the parameters of aerial videography, as defined by Wilmington District or NCWRC, to each contractor and obtain cost proposals.
 - Select the preferred aerial videography Contractor based upon the following:
 - Qualifications
 - Cost proposal
 - Availability
 - Retain the selected contractor using contracting procedures approved by Wilmington District or NCWRC.

2. Manage and monitor the Aerial Videography Contractor's work-in-progress. Provide a Corps or State representative to accompany the Contractor's crew on each flight.

3. Review Contractor's aerial videography products to ensure that they satisfy all requirements of the contract. If they do not satisfy the contract provisions, require remedial action to bring within requirements. If Contractor's ultimate efforts do not satisfy the requirements, terminate the contract and select a new contractor according to contracting provisions.

4. Prepare scopes of work for any additional studies that become necessary to complete the evaluation of bankside and instream woody debris and aquatic habitat features. Evaluate the Contractor's aerial videography and mapping products and isolate any gaps in data which would require additional study. Prepare a scope of work for each area of additional study. Establish funding for any additional studies in coordination with the Executive Committee.

5. Based upon the Contractor's aerial videography and aquatic habitat map, complete a final review and analysis of the status of bankside and instream woody debris, and aquatic habitat, along the work site reach in the lower Roanoke River. Consider the functions of existing bankside and instream woody debris, and other elements, as components of aquatic habitat, for example:

- Protective cover for aquatic organisms
- Temperature modulation of shaded waters and streambed
- Surface and shelter for reproductive cycles of aquatic organisms
- Local modulation of stream flow rate for rest and reproduction of aquatic organisms
- Local reduction of bed scour and improvement of bank stability
- Local reduction of water turbidity
- Harbor for foodsource species

6. Present the final videography, aquatic habitat map, and team product assessment review and analysis data and findings, in the form of a Final Report to the Executive Committee.

Task 7.A.1.b
CONTRACTOR AERIAL VIDEOGRAPHY AND MAPPING TASKS

OBJECTIVE: Obtain aerial videography showing bankside and instream woody debris along each bank of, and aquatic habitat features within, the work site reach in the lower Roanoke River. Complete all videography in compliance with contract requirements, and create an aquatic habitat map showing woody debris and other aquatic habitat features along the entire work site reach. Submit all products for Corps and State review, and revise according to review comments.

TASKS:

1. Complete a preflight review with the Corps and State prior to each flight, to confirm conditions of work and tasks to be completed for that day. Make available space in the aircraft for at least one Corps or State representative for each flight.
2. Complete the aerial videography according to contract requirements, including the following videography parameters:
 - Base the proposed contractor work and product parameters upon requirements used for the prior videography contract on the Pee Dee River. Video record the following location and extent of river reach: lower Roanoke River, from the NC Highway 48 bridge in Roanoke Rapids downstream to Washington Street in Plymouth, North Carolina.
 - Video record each bank in separate flights, maintaining the best angle to view all bankside and instream woody debris.
 - Maintain a consistent altitude, airspeed, and line of sight angle to line of bank for best clarity of bankside and instream woody debris and other habitat components, including the following:
 - Assets:
 - Woody debris.
 - Tributaries.
 - Point bars.
 - Runs, pools, glides, riffles: include as individual occurrences where practical; where combinations make this impractical, include each combined area as a run-pool-glide-riffle matrix.
 - Streamside vegetation.
 - Backwaters.
 - Stressors:
 - Levee breaks/guts.
 - Highly eroded banks.
 - Choose flight times with fair, relatively calm weather conditions, and at a time of

- day when the sun angle is most favorable to the bank being video-recorded.
- Schedule the videography flights during fall leaf transition season, October 15 – November 15, for best visibility of dead woody debris, in contrast to live streambank and instream vegetation.
 - Schedule videography flights during low flow conditions to maximize visibility of woody debris.
 - Clearly capture all special events along each reach; including, for example, significant changes in slope and flow characteristics (including pools, runs, glides, and riffles), tributary intersections, and breaks in the main river levee (guts).
 - Use a videography format which complies with the following:
 - Continuous motion image.
 - Reasonably consistent scale of image.
 - Date, time, and GIS coordinates captured on image.
 - Digital format to comply with Wilmington District standards.

3. Image resolution, clarity, sharpness, brightness, contrast, color balance maintained to a level which most clearly shows the subject of primary interest, bankside and instream woody debris, along with other aquatic habitat features.

4. Create methodologies for mapping the status of woody debris and other aquatic habitat features, based upon data obtained from the completed aerial videography and field observation. Consider a full range of elements for documentation , including such items as the following:

- Location of woody debris; patterns and trends
 - River bends
 - Varying water depths and flow rates
 - Bank conditions
 - Association with live vegetation
 - Tributary intersections
 - Structures
- Types and density of woody debris
 - Individual stems vs. groupings
 - Heavy trunks and limbs
 - Light brush
- Stability of occurrences of woody debris
- Channel and bed characteristics
- Pools, riffles, glides, and runs
- Bank height, composition, and stability/erosion zones (to benefit the Sedimentation/Channel Morphology Work Group as well)
- Relation to existing reservoir operational cycles and potential variations in reservoir operation.

5. Complete the following aerial videography products:

- ❑ Continuous aerial videography footage showing bankside and instream woody debris along each separate bank of the work site reach in the lower Roanoke River.
- ❑ Electronic mapping of woody debris and other aquatic habitat elements of the entire work site reach.
- ❑ Coordination and review of videography and aquatic habitat mapping with the Corps and State.
- ❑ Final revision of videography and aquatic habitat mapping, with three (3) electronic copies, and three (3) hard copies of aquatic habitat mapping, presented each to Corps and State. All electronic data must be provided in format complying with all Wilmington District requirements.

John H. Kerr 216 Study
Work Group 7 - Diadromous Fish and Riverine Aquatic Resources Workgroup
(DFRARW)

Diadromous Fish Restoration
Task 7.B.1 Phase II Scope of Work

TEAM LEADERS: Bennett Wynn, LEAD - NCWRC
Chuck Wilson, LEAD - USACE

PARTICIPANTS: Pete Kornegay, - NCWRC
Jim Mead - NCDWR
Wilson Laney – USFWS
John Ellis - USFWS
Bill Bolin & Bob Graham - Dominion
Sara Winslow - NCDMF
Bud LaRoche - VADGIF
Pres Brownell & Ron Sechler- NMFS
Joe Hightower - USGS
Allen Davis - USACE

BACKGROUND: A Review Draft of the Roanoke River Diadromous Fish Restoration Plan (“Draft Plan”) was completed April 22, 2002. This Draft Plan (Attached) was prepared jointly by the following agencies:

- ❑ U.S. Geological Survey, NC Cooperative Fish and Wildlife Research Unit
- ❑ U.S. Fish and Wildlife Service, South Atlantic Fisheries Coordination Office
- ❑ U.S. National Marine Fisheries Service, Habitat Conservation Division
- ❑ NC DENR, Division of Marine Fisheries
- ❑ NC Wildlife Resources Commission, Division of Inland Fisheries
- ❑ VA Department of Game and Inland Fisheries, Division of Inland Fisheries

The Draft plan was coordinated for agency review in 2002. Comments have been received but have not been incorporated into the final plan.

The overall objective of this task is to finalize the Draft Plan, and to determine the need, and create attendant Scopes of Work, for any additional studies found necessary. The Draft Plan will be finalized by the original author agencies in coordination with the Diadromous Fish and Riverine Aquatic Resources Workgroup (DFRARW). The final Plan will be reviewed for DFRARW concurrence, and may identify additional study needs.

Task 7.B.1.a.
DRAFT PLAN REVIEW

OBJECTIVE: Complete a DFRARW final review of the Draft Plan and review comments and document changes to be incorporated to produce a Final Plan.

TASKS:

- 1.** Review of the current Draft Plan and review comments by individual members of the DFRARW, who compile their comments for consideration by the joint Work Group as to changes needed for a final Plan.
- 2.** Consideration of individual comments, and documentation of a final set of comments for changes to the Plan, by the joint DFRARW.
- 3.** Presentation of the documentation of final comments to NCWRC by the DFRARW.

Task 7.B.1.b.
FINAL PLAN PREPARATION

OBJECTIVE: Finalize the plan.

TASKS:

- 1.** Final Draft Plan prepared by the original author agencies, based upon comments and documentation from Task 7.B.1.a., and submitted to the DFRARW for review.
- 2.** Review of the Final Draft Plan by the DFRARW, and documentation of comments for any further changes to the Plan returned to NCWRC.
- 3.** Plan is finalized by the original author agencies.
- 4.** Final Plan review and concurrence by the DFRARW, with Final Plan document forwarded to Corps.

TASK 7.B.1.c
CONCEPTUAL DESIGN OF FISH PASSAGE FACILITIES AT JOHN H. KERR
DAM

OBJECTIVE: Prepare an assessment of biological and engineering feasibility considerations pertinent to upstream and downstream fish passage at John H. Kerr.

TASKS:

- 1.** Preliminary engineering onsite meeting (engineering staff from NMFS, USFWS, COE, NC). Includes preparation of preliminary site survey memorandum.
- 2.** Identification of upstream passage alternative designs for consideration.
- 3.** Identification of downstream passage alternative designs for consideration. Prepare Conceptual Design Study report, draft and final. Include in the Report an analysis of alternative designs and recommendations of preferred alternatives to be analyzed in detail during Phase 3 of the Feasibility Study.

Task 7.B.1.d.
PRESENTATION TO EXECUTIVE COMMITTEE

OBJECTIVE: Compile and confirm final products, and presentation by the Corps to the Executive Committee.

TASKS:

- 1.** Final review by the Corps, of the Final Plan document and any Scopes of Work for needed additional studies. Review any potential modifications with the DFRARW and NCWRC as applicable, and finalize all documents with concurrence of all participants.
- 2.** Presentation by the Corps of Final Plan document and any Scopes of Work for needed additional studies, to the Executive Committee.

Task 7.B.1.d.
SCOPING FOR ADDITIONAL STUDIES

OBJECTIVE: Prepare scopes of work for any additional studies that become necessary for effective Diadromous Fish Restoration.

TASKS:

1. DFRARW evaluation of the Final Plan to isolate and document any gaps in data that would require additional study for effective Diadromous Fish Restoration.

2. NCWRC and Corps prepare scopes of work for each area of additional study. Funding for any additional studies would be established in coordination with the Executive Committee.

ATTACHMENT 10
SCOPE OF WORK – WATER SUPPLY

SCOPE OF WORK
JOHN H. KERR SECTION 216 FEASIBILITY STUDY
WATER SUPPLY
COLLECTION OF DATA, DESCRIPTION OF EXISTING
AND
WATER SUPPLY

1. Introduction: The U.S Army Corps of Engineers, Wilmington District, in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for improving the quality of the environment in the overall public interest. Public, stakeholder, and local, state, and federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis is being done in accordance with U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website: [http://www.saw.usace.army.mil/Authorized Projects/Main.htm](http://www.saw.usace.army.mil/Authorized%20Projects/Main.htm). The purpose of this contract is to inventory the existing conditions and to forecast future conditions for water supply if no operational changes are implemented at John H. Kerr Dam. Information gathered during the course of this contract will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of implementation of various modifications to the operation or structure at John H. Kerr Dam.

2. Technical Proposal: The Contractor shall prepare a Technical Proposal to be submitted along with the required Cost Proposal. The Technical Proposal will consist of a detailed description of the methods the Contractor proposes to use to collect the data requested by this Scope of Work. In addition to demonstrating a clear understanding of the technical requirements of this Scope of Work, the Contractor must demonstrate a clear understanding of: (1) current operation of the John H. Kerr Reservoir; and (2) the relationships among flow release operations variables including duration, frequency, seasonality, and management of flows and their relationship to water supply in the lower Roanoke River.

3. Study Area Description: *(The following discussion is based on material contained in the John H. Kerr 216 Feasibility Study Project Management Plan.)* The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the

Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952.

Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced farming and forestry opportunities. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl.

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The study area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina.

4. Relevant Operational Guidance and FERC Settlement Agreement: John H. Kerr Reservoir is operated in accordance with the “*Water Control Plan for John H. Kerr Dam and Reservoir.*” which was updated in February 1995. A copy of this plan is attached (Attachment 1). The Contractor shall become familiar with this plan and shall use it as the basis for the future without conditions analysis.

While the operation of John H. Kerr Reservoir under the terms of the 1995 Water Control Plan has a significant influence on the Lower Roanoke River Basin, the lower basin is also influenced by the downstream Roanoke Rapids and Lake Gaston Reservoirs, which are operated by Dominion Power. Roanoke Rapids and Lake Gaston are operated under the terms of the 2003 “*Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project*” (Attachment 2) that resulted from the Federal Energy Regulatory Commission (FERC) relicensing process. The Contractor shall be come familiar with this settlement agreement and shall use it to help distinguish between downstream influences water supply caused by the operation of John H. Kerr and the downstream influences caused by the operation of Roanoke Rapids and Lake Gaston.

5. Water Supply: The Kerr 216 water supply work group original goal was to answer whether a reallocation of storage at the John H. Kerr Dam and Reservoir project is needed to meet the regional water supply needs and if so how much? The work group proposed a detailed investigation of future water supply needs in the areas of Virginia and North Carolina that were likely to view John H. Kerr as a viable water supply option. The results of this regional water supply needs assessment could have been used as a basis for allocating some portion of the hydropower pool in Kerr as future water supply. Lack of existing future needs assessments in the regions coupled with difficulty in predicting what regional area might make use of this resource precluded the completion of this type of investigation. The water supply work group now proposes that, at a minimum, a study be made to determine the economic value of water supply in Kerr project, based on least cost alternatives as a measure of value and to guide future storage allocation decisions.

6. Determination of Water Supply Cost: The water supply work group proposes that contractual services be sought to determine the likely range and expected value of costs for development of future raw water supplies on a dollar per acre-foot basis and dollar per MGD yield. The selected contractor should evaluate recently completed and currently planned water supply projects in Virginia and North Carolina to determine the total unit cost of raw water that is or will be delivered by these projects. Costs to be considered include all costs associated with development of water supply projects but do not include the costs of transmission of water from the projects to their ultimate points of use or treatment to meet drinking water standards. The contractor will contact water resource agencies in both states and will evaluate a minimum of 5 and a maximum of 10 existing or proposed projects.

7. Detailed Project Proposal: The contractor will provide a detailed project proposal for water supply work group approval prior to initiation of the work. The proposal needs to include at a minimum a timeline, details on the deliverables, the list of projects that will be evaluated, similar related work experience and cost proposal. Three printed copies and a MS-Word copy of the detailed scope of work needs to be submitted to the work group for review and approval. The proposal must be less than 20 pages in length, but there is no limit on the length of attachments.

8. Technical Report: The contractor will provide a final report that documents the range and expected value of costs per acre-foot for development of water supply storage and dollar per MGD yield. This report shall contain all background information necessary to support the conclusions reached and will include one final meeting to present the results to the water supply work group.

9. Monthly Status Reports: The Contractor shall submit written monthly status reports by the 5th day of each month the contract is in force. A Monthly Status Report must accompany all requests for payment. These reports may be in brief letter format and should summarize work performed and problems encountered. A concise statement and/or graphic presentation of estimated work progress (incremental and cumulative percentage completed), by task, shall be included in each report. The report should also note difficulties in meeting the work schedule. The Contractor shall be responsive to verbal requests from the Contracting Officer for specific information to be included in the monthly reports. Any matters requiring an immediate action or decision by the Contracting Officer shall be identified by expeditious telephone contact with the Contracting Officer's Representative (COR).

10. Project Reports: Upon completion of all work tasks under the terms of this contract, the Contractor shall submit a draft report for review. The report and findings shall be objective and fully substantiated by documentation. The report shall follow the format required by reputable scientific periodicals, including abstract, summary, introduction, methods, results, discussion, conclusions and recommendations, references, and appendices. The appendices will contain tabulations of all physical, biological, and statistical data and a list of all participating technical staff and their respective responsibilities on the project. The report shall contain appropriate summary tables and figures. Text material shall be printed on 8-1/2" by 11" bond paper with 1-1/2" margins on the left for binding. All pages must be consecutively numbered. Drawings or plates bound in the report shall be no larger than 11" by 17" and shall include a graphic bar scale for control during reduction or enlargement. Additional larger maps or drawings shall be

provided on standard 30" by 42" sheets, unless the Contracting Officer and the Contractor agree otherwise. **Draft reports requiring extensive proofreading or incomplete draft reports are unacceptable and will be returned to the Contractor.** The Contracting Officer will provide written comments on the accepted draft report. The Contractor will revise the report in accordance with these comments and submit the report as final. In some instances a revised draft report to assure that all agency requirements are properly addressed prior to release of the report for agency or public review may be required.

11. Required Number of Report Copies: (*Need Team recommendation on number of required copies.*).

12. Report Title Page: The title page of the project report(s) will bear an inscription that indicates the source of funding for the particular item of work covered by the report. This inscription will reference the Contract Number. In addition, the title page shall bear the following inscription: "Project Manager: (Name)." If someone other than the Project Manager has prepared the document, this inscription will state Prepared Under the Supervision of (Name), Project Manager.

13. CONTRACTOR OBLIGATIONS:

a. Permits, Licenses, and Approvals: The Contractor shall obtain all necessary permits, licenses, and approvals required by federal, state, or local authorities for conducting work under this contract. Personnel conducting work on endangered and threatened species must have demonstrable knowledge of the biology and current conservation practices for the species in the work area or be able to demonstrate the ability to obtain all necessary permits required to survey and monitor listed species. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress to perform any of the work required under this contract on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event all efforts by the Contractor fail to gain permission from the property owner(s) for entry to the property for performing the required work, the Contractor shall contact the Contracting Officer to obtain instructions for further action. In the event that the Contracting Officer must take action to obtain right-of-entry for the Contractor, the Contractor will be entitled to an equitable extension of time for the period required to obtain said right-of-entry. The Contractor shall assume all responsibility for and take all precautions to prevent damage to private and Government-owned property. The Contractor shall be responsible for any claims covering actions not approved by the Contracting Officer.

b. Project Management: The Project Manager shall be the individual responsible for the validity of the material in all reports and shall have recognized expertise in the appropriate field. During execution of the work, the Project Manager shall provide adequate professional supervision to assure timeliness, accuracy, quality, and completeness. In the event of controversy or court challenge, the Project Manager may be called upon, under separate contract, to testify on behalf of the Government in support of the Contractor's findings.

c. Product Quality: The Contractor shall be responsible for accomplishing all work in an accurate and professional manner. Any work deemed inadequate or nonconforming

by the Contracting Officer shall be re-done by the Contractor, as necessary, to comply with the contract requirements at no additional cost to the Government.

d. Digital Data Standards: U.S. Army Corps of Engineers, Wilmington District, Digital Data Standards can be found in Attachment 5.

14. Personnel Qualifications: All professional persons employed under the terms of this contract must meet the minimum qualifications for their profession as established by the United States Office of Personnel Management. The duties and basic qualifications of key staff are as follows:

a. Project Manager/Principal Investigator.

(1) **Duties.** The Project Manager or Principal Investigator is the individual identified in the contract as being authorized to act for the Contractor and is responsible for contract administrative actions and research formulation for the contract firm. This individual usually selects the Technical Director and appropriate work crews, determines appropriate level of investigation and analysis, coordinates activities with the Contracting Officer's Representative, and performs other administrative functions. This individual is responsible for overall contract quality control.

(2) **Qualifications.** Persons in charge of a project or research investigation, in addition to meeting the appropriate standards for their respective profession, must have a doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in project formulation, execution, and technical monograph reporting. If prior projects did not result in a publishable report, a narrative should be included, detailing the proposed Project Manager/Principal Investigator's previous experience along with references suitable to obtain opinions regarding the adequacy of this earlier work.

b. Technical Director.

(1) **Duties.** The Technical Director is the individual in charge of accomplishing specific scientific data collection, analysis, evaluation, and reporting. This individual follows work from initiation to completion and provides technical support to the Project Manager/Principal Investigator utilizing a basic understanding of scientific methods and procedures. The Technical Director is responsible for conducting literature reviews; office, field, and laboratory research; field surveys; site testing; and scientific analyses using various reference materials, maps, interviews with knowledgeable individuals, scientific instruments, and aerial photographs and other remotely-sensed data. The Technical Director is the individual who authors reports under the supervision of the Project Manager/Principal Investigator. Under the guidance of the Project Manager/Principal Investigator, this individual is responsible for making day-to-day decisions regarding the data collection, testing and analysis, and evaluations. The Technical Director is responsible for the accuracy of the information collected and for the scientific validity of recommendations made in draft and final reports. Technical Directors oversee and supervise the crewmembers assigned to their projects. The Technical Director assures that assignments are

carried out in a safe and timely manner according to procedures established by the Project Manager/Principal Investigator.

(2) **Qualifications.** Individuals in this job category must hold a Master's or higher degree in the field of their work assignment, or possess an equivalent level of professional experience.

c. Scientist.

(1) **Duties.** Personnel in this category must carry academic and experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if this person has not been retained at the time of proposal.

(2) **Qualifications.** Individuals in this job category must hold a Bachelor's or higher degree in the field of their work assignment and must possess at least 12 months combined field and laboratory experience.

d. Technician.

(1) **Duties.** Technicians work under the direction of the Technical Director. Technicians conduct a variety of tasks, including locating field sites by using maps and instruments, conducting scientific data collection, performing analytical procedures and techniques, and performing accurate record keeping. Technicians may be required to calibrate and operate various types of analytical instruments. Technicians may also be required to perform preliminary treatments on samples or specimens requiring later detailed analyses.

(2) **Qualifications.** Technicians must possess an Associate's or higher degree (except archaeological technicians, who must have a Bachelor's degree) in the field of their work assignment, or at least 12 months combined field and laboratory experience.

e. Consultant.

(1) **Duties.** Consultants are personnel subcontracted on a short-term basis for their special knowledge and expertise.

(2) **Qualifications.** Consultants must carry academic and/or experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if the consultant has not been retained at the time of proposal.

15. Equipment and Facilities: The Contractor must provide or demonstrate access to the following capabilities:

a. Adequate field and laboratory equipment necessary to conduct whatever operations are defined in this Scope of Work

b. Adequate facilities necessary for the proper treatment, analysis, and storage of samples and/or specimens likely to be obtained from a given project. This does

not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but it does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis that may be required.

c. Adequate facilities for secure storage and efficient retrieval of data and records.

16. Release of Information: Neither the Contractor nor the Contractor's representatives shall release any report, data, specification, drawing, rendering, perspective, sketch, photograph, cost estimate, or other material obtained or prepared under this contract without prior specific written approval of the Contracting Officer.

17. Inspection of Services: The Government's rights regarding the inspection of services under the terms of a fixed-price services contract are explained in Section I "Contract Clauses." Generally, under this clause, the Government has the right to inspect all services called for by this contract and any Task Order issued under it. If any of the services do not conform with the contract and the Task Order requirements, the Government may require the Contractor to perform the services again in conformity with the contract and Task Order requirements **at no increase in the contract amount**. If the Contractor fails to promptly perform the services again in conformity with the contract and Task Order requirements, the Government may: perform the services (or have the services performed) and charge the Contractor any cost incurred by the Government; cancel the services required under terms of a specific Task Order; or in extreme case may **terminate the contract** for default.

18. Period of Services: The draft report required by paragraph 9 of this contract shall be delivered to the Contracting Officer 18 months from the date of contract award.

19. Travel: All travel and per diem in connection with work performed under this contract will be at the Contractor's expense, including travel time to and from work sites.

20. Payment: Payments will be made based on documented progress. Evidence of progress (e.g. percentage of task complete) shall be documented in the monthly progress report that must accompany invoices.

21. Method of Payment: Partial payments to the Contractor will be made through the end of each month, for work or services performed by the Contractor during that month, upon submission of a proper invoice on the submitted on corporate letterhead. In order to be considered a proper invoice each invoice **must** be accompanied by the monthly status report accepted by the COR clearly indicating what the work has been accomplished during the billing period. Partial payments will not be made in amounts less than \$1,000 (except for final submittals). Each invoice must identify the contract and indicate whether the payment is a partial billing (e.g. "partial #1") or a final bill (e.g. "#4, final"). For purposes of billing, the acceptance date of deliverables (not delivery date or date of invoice) will constitute the billing date for the purposes of all payments.

REFERENCES CITED

- Federal Energy Regulatory Commission. 2003. *Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project FERC Project No. P-2009*, June 2003
- U.S. Army Corps of Engineers. 1988. *Environmental Quality - Procedures for Implementing NEPA*. Publication Number: Engineering Regulation 200-2-24 March 1988, U.S. Army Corps of Engineers, Washington D.C.
- U.S. Army Corps of Engineers, Washington D.C. 2000. *Planning Guidance Note Book*. Engineering Regulation 1105-2-100, April 22, 2000
- U.S. Army Corps of Engineers, Wilmington District. 1995. *Water Control Plan For John H. Kerr Dam And Reservoir*, Wilmington, North Carolina.
- Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina, Wilmington North Carolina. 2004
- Wilmington District Authorized Project Web Site. 2004
http://www.saw.usace.army.mil/Authorized_Projects/Main.htm.)
- U.S. Council on Environmental Quality. 1978. *Regulations for Implementing National Environmental Policy Act*. 40 Code of Federal Regulations Parts 1500-1508, 43 Federal Register 55990, November 28, 1978.
- U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. 8 July 1983, United States Water Resources Council, Washington DC. *Planning Guidance Note Book*. Engineering Regulation 1105-2-100

consultant available at each review to assist with any digital data discrepancies. The data will be analyzed for subject content and system compatibility. The Contractor shall incorporate review comments to data and text prior to approval of the final submittal.

(5) **Ownership:** All digital files, final hard-copy products, source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of U. S. Army Corps of Engineers, Wilmington District and will not be issued, distributed, or published by the Contractor.

SCOPE OF WORK
JOHN H. KERR SECTION 216 FEASIBILITY STUDY
OPERATING POLICIES AND ADMINISTRATIVE PROCEDURES
COLLECTION OF DATA, DESCRIPTION OF EXISTING
AND
FUTURE WITHOUT THE PROJECT CONDITIONS

1. Introduction: The U.S Army Corps of Engineers, Wilmington District (Wilmington District) in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for improving the quality of the environment in the overall public interest. Public, stakeholder, and local, State, and Federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis being done in accordance with U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website: [http://www.saw.usace.army.mil/Authorized Projects/Main.htm](http://www.saw.usace.army.mil/Authorized%20Projects/Main.htm). The purpose of the contract is to identify, review and summarize current operating and administrative procedures. For each identified operating and administrative procedure the Contractor shall identify the constraints to changing the procedure and identify what steps would be necessary to make changes to the procedure. Information gathered during the course of this contract, will be used along with information gathered for the other identified areas of interest, to evaluate the impacts and feasibility of implementation of various modifications to the operation or structure at John H. Kerr Dam.

2. Study Area Description: *(The following discussion is based on material contained in the John H. Kerr 216 Feasibility Study Project Management Plan.)* The John H. Kerr Dam and Reservoir is located on the Roanoke River, about 178.7 river-miles above the mouth. It is in Mecklenburg County, Virginia, 20.3 miles downstream from Clarksville, Virginia, 18 miles upstream from the Virginia-North Carolina border, and 80 air-miles southwest of Richmond, Virginia. The area of inundation at the top of the gate elevation for the Reservoir extends upstream on the Roanoke River 56 miles and extends 34 miles on the Dan River. The project was completed in 1952.

Kerr Reservoir is a significant regional resource. It provides quality natural resource-based recreation for area residents and a desirable outdoor experience for more than 2 million visitors a year. It provides municipal and industrial water supply, wastewater assimilation, and enhanced

farming and forestry opportunities. Federal Hydropower generated at Kerr Dam is sold to 76 electric cooperatives and municipalities throughout North Carolina and Virginia. The Roanoke River Basin below John H. Kerr Dam and Reservoir is one of the finest remaining river swamp forest ecosystems within the eastern United States. These bottomland hardwood forests, uplands, and streams provide a high quality habitat for fish, wildlife and waterfowl.

The study area includes the John H. Kerr Dam and Reservoir and the Roanoke River Basin beginning at the Dam and proceeding downstream to the Albemarle Sound. For this study, the area will be referred to as the Lower Roanoke River Basin. The Study Area is located in Charlotte, Halifax, Mecklenburg, and Brunswick Counties of Virginia, and in Granville, Vance, Warren, Halifax, Northampton, Bertie, Martin and Washington Counties of North Carolina.

3. Relevant Operational Guidance and FERC Settlement Agreement: John H. Kerr Reservoir is operated in accordance with the “*Water Control Plan for John H. Kerr Dam and Reservoir.*” which was updated in February 1995. A copy of this plan is attached (Attachment 1). The Contractor shall become familiar with this plan and shall use it as the basis for the future without conditions analysis.

While the operation of John H. Kerr Reservoir under the terms of the 1995 Water Control Plan has a significant influence on the Lower Roanoke River Basin, the lower basin is also influenced by the downstream Roanoke Rapids and Lake Gaston Reservoirs, which are operated by Dominion Power. Roanoke Rapids and Lake Gaston are operated under the terms of the 2003 “*Comprehensive Relicensing Settlement Agreement for the Roanoke Rapids and Gaston Dam Project*” (Attachment 2) that resulted from the Federal Energy Regulatory Commission (FERC) relicensing process. The Contractor shall be come familiar with this settlement agreement and shall use it to help distinguish between downstream influences on sedimentation, erosion, and channel morphology caused by the operation of John H. Kerr and the downstream influences caused by the operation of Roanoke Rapids and Lake Gaston.

4. Literature Review: As part of the Literature Review, the contractor should become familiar with (a) the Corps, Virginia State Water Control Board, and FERC authorizations to Virginia Beach for the operation of the Lake Gaston Pipeline, (b) the FERC and Virginia DEQ rules for minimum releases from Smith Mountain Lake, and (c) the settlement agreement and FERC license articles pertaining to the hydroelectric facilities at Gaston and Roanoke Rapids dams.

5. Review of the Operating and Authorized Project Purposes:

- a. The U.S. Army Corps of Engineers 1992 publication “*Authorized and Operating Purposes of Corps of Engineers Reservoirs*” lists the following purposes for John H. Kerr Dam and Reservoir:

<u>Operating Purposes</u>	<u>Authorized Purposes</u>	<u>Authorizing Laws</u>
Recreation	Recreation	Flood Control Act of 1944 (PL 78-534)
	Low Flow Augmentation ¹	Flood Control Act of 1944 (PL 78-534)
Water Supply	Water Supply	Water Supply Act of 1958 (PL 85-500)
Flood Control	Flood Control	Flood Control Act of 1944 (PL 78-534)
Hydroelectric Power	Hydroelectric Power	Flood Control Act of 1944 (PL 78-534)
Fish/Wildlife	Fish and Wildlife	Fish and Wildlife Coordination Act of 1958 (PL 85 -624)

1. John H. Kerr is not regulated for low flow augmentation since the Federal Energy Commission assigned the requirement to the two Virginia Power Company [Now Dominion Power] projects located downstream. The projects Gaston and Roanoke are operating under project license No. 2009.

b. Authorized project purposes are defined in Federal law and are grouped in to three categories: (1) law which authorize initial construction; (2) laws specifically related to a project that were passed subsequent to construction and (3) laws that apply generally to all reservoirs. Authorized project purposes may be added or deleted by laws passed by congress subsequent to construction. Operating purposes are those reservoir purposes for which the water control decisions are made. Operating purposes, generally address the authorized purposes. (See USACE 1992, pp 2 - 3)

c. Power from the project is marketed by the Southeastern Power Administration as provided by federal law. In the subsequent sixty years, this statutory authorization has been implemented through operating policies and administrative procedures of the U.S. Army Corps of Engineers (USACE). Presently, the dam is operated under the "*Water Control Plan for John H. Kerr Dam and Reservoir.*" guide curve, contracts for hydroelectric generation and water supply, and other non-statutory requirements. It is operated in hydrologic coordination with the USACE, Wilmington District's Philpott Dam, located upstream, and Dominion Inc.'s Roanoke Rapids and Gaston Projects operated under FERC License Number 2009), located just downstream.

d. As stated in the John H. Kerr Reservoir Section 216 Study Reconnaissance Report (March 2001) (which can be found at http://www.saw.usace.army.mil/Authorized_Projects/Main.htm, the Feasibility Study now being prepared could result in a recommendation to modifying the project structures or their operation and for of improving the quality of the environment in the overall public interest, which includes John H. Kerr Reservoir and the Roanoke River downstream to Albemarle Sound. The Contractor shall: (1) identify and describe each policy that guides project operation, storage allocations, and downstream releases including its legal authority and terms; (2) describe how the many policies are integrated in actual operational decisions, including the respective responsibilities of the USACE, Wilmington District and third parties for implementation; (3) describe the policies that allocate the revenues associated with such hydroelectric generation; (4) evaluate the scope of discretion available to the USACE, Wilmington District to change current operation or storage allocation for the stated purpose of the Feasibility Study; (5) describe the statutes, rules, and policies that direct the marketing of power from the project by the Southeastern Power Administration (SEPA) and how they interact with the authorities under which the USACE, Wilmington District operates the project; (6) describe the rules governing Dominion's impending FERC-required participation in the Regional Transmission Operator (RTO) arrangement and evaluate the potential influence that Dominion's TRO participation may have on operations at John H. Kerr reservoir, and (7) determine how much latitude is available for operational changes under each policy affecting, the project and what procedure is necessary to change each policy.

e. The Contractor shall compile and review relevant documents and interview appropriate employees and consultants of USACE, Wilmington District and third parties. This review will consider informal and unwritten policies and arrangements and coordination efforts – as well as written policies and procedures. The report resulting from this effort shall describe these policies in pragmatic terms. It may be organized by policy, project purpose, or in any other functional manner that the Contractor and the Contracting Officer's Representative (COR) in consultation with the John H. Kerr Section 216 Feasibility Operating Policies and Administrative Procedures Study Team

determines will best assist the USACE, Wilmington District, study's sponsors, and other stakeholders to understand how alternative plans would change current policies for operation or storage allocation. In sum, the report will put the reader into the shoes of the actual operators, so that the procedures they follow, and the actual factors they consider for their operational decisions will be transparent.

6. *Review of Policy Constraint and Opportunities for Policy Changes:* The Contractor shall identify each policy that guides the current operation of the reservoir and the storage allocation. The Contractor shall describe the origin including any express legal authority history or administration, and specific terms, including any provision for amendment, termination, or expiration, of each policy.

Policy under the terms of this Contractor shall be broadly defined to include any form of written document or unwritten practice or procedure that guides reservoir operation. Such policies include: (1) the 1944 authorization and the Chief of Engineers' report incorporated therein; (2) an other relevant acts of Congress, (3) the USACE's Engineering Regulations and Pamphlets; (4) the John H. Kerr Reservoir Water Control Plan; (5) any policy for coordination of John H. Kerr and Philpott; (6) any contract or other form of agreement with Dominion Inc. or Progress Energy for operation of the John H. Kerr Powerhouse or for the benefit of the Roanoke Rapids and Gaston Project; (7) any contract or other form of agreement with the SEPA; (8) any contract or other form of agreement for storage or release of water for the purpose of water supply; (9) any form of agreement with North Carolina Department of Environment and Natural Resources (NCDENR), North Carolina Division of Water Quality (NCDWQ) or North Carolina Wildlife Resources Commission (NCWRC) for storage or release for downstream environmental quality; (10) any policy agreements or informal coordination with the Smith Mountain and Leesville projects; (11) the FERC License for the Dominion Inc.'s projects on the Roanoke River and the related settlement agreement; and (12) any other policies relevant to the operation of the John H. John H. Kerr project.

7. *Influence of Policy on Day-to-Day Operation:* The Contractor shall describe how the policies identified during the review required by paragraph 6 are integrated in the actual decisions for storage, allocation of storage, and release of water. The Contractor shall describe the extent to which the John H. Kerr Reservoir Water Control Plan, on its face (especially the guide curve and the release schedule), is consistent with such policies, and the extent to which they are written or otherwise extraneous to that plan.

The Contractor shall describe the relative priorities for water management by season or otherwise, for example under high and low inflow conditions, and the procedure for resolving any potential or actual conflict between project purposes. The Contractor shall describe whether and how the USACE, Wilmington District delegates or shares any responsibility for operation to Dominion Inc., SEPA, or any other third parties with which it has contractual or other relationships for such management. The final topic will include any storage accounts. For example, describe how the USACE, Wilmington District establishes the Weekly or Daily Declaration, and how Dominion Inc. implements such declaration these declarations are modified and implemented.

8. *Economic Relationships Regarding Power Generation:* The Contractor shall describe the economic relationships between the USACE, Wilmington District, and Dominion Inc., Progress Energy, SEPA, and any other third parties involved in power generation. This task shall include: (1) documentation of the payments among the parties since 1952; (2) identification of retail customers of such generation services, by location and amount, over the same period; and (3)

definition of the relationship among the flows, hydraulic head, power generation, headwater benefits, and power values at John H. Kerr so that alternative flow schedules can be financially evaluated. The Contractor shall document these relationships in suitable detail and format to be used in subsequent modeling of reservoir operations. The analysis should distinguish between firm and secondary power commitments and their values. The analysis shall include both wholesale and retail power rates and should include the effects of planned power generation upgrades at John H. Kerr.

9. Monthly Status Reports: The Contractor shall submit written monthly status reports by the 5th day of each month the contract is in force. A Monthly Status Report must accompany all requests for payment. These reports may be in brief letter format and should summarize work performed and problems encountered. A concise statement and/or graphic presentation of estimated work progress (incremental and cumulative percentage completed), by task, shall be included in each report. The report should also note difficulties in meeting the work schedule. The Contractor shall be responsive to verbal requests from the Contracting Officer for specific information to be included in the monthly reports. Any matters requiring an immediate action or decision by the Contracting Officer shall be identified by expeditious telephone contact with the Contracting Officer's Representative (COR).

10. Project Reports: Upon completion of all work tasks under the terms of this contract, the Contractor shall submit a draft report for review. The report and findings shall be objective and fully substantiated by documentation. The report shall follow the format required by reputable scientific periodicals, including abstract, summary, introduction, methods, results, discussion, conclusions and recommendations, references, and appendices. The appendices will contain tabulations of all physical, biological, and statistical data and a list of all participating technical staff and their respective responsibilities on the project. The report shall contain appropriate summary tables and figures. Text material shall be printed on 8-1/2" by 11" bond paper with 1-1/2" margins on the left for binding. All pages must be consecutively numbered. Drawings or plates bound in the report shall be no larger than 11" by 17" and shall include a graphic bar scale for control during reduction or enlargement. Additional larger maps or drawings shall be provided on standard 30" by 42" sheets, unless the Contracting Officer and the Contractor agree otherwise. **Draft reports requiring extensive proofreading or incomplete draft reports are unacceptable and will be returned to the Contractor.** The Contracting Officer will provide written comments on the accepted draft report. The Contractor will revise the report in accordance with these comments and submit the report as final. In some instances a revised draft report to assure that all agency requirements are properly addressed prior to release of the report for agency or public review may be required.

11. Required Number of Report Copies: *(Need Team recommendation on number of required copies.)*

12. Report Title Page: The title page of the project report(s) will bear an inscription that indicates the source of funding for the particular item of work covered by the report. This inscription will reference the Contract Number. In addition, the title page shall bear the following inscription: "Project Manager: (Name)." If someone other than the Project Manager has prepared the document, this inscription will state Prepared Under the Supervision of (Name), Project Manager.

13. CONTRACTOR OBLIGATIONS:

a. Permits, Licenses, and Approvals: The Contractor shall obtain all necessary permits, licenses, and approvals required by federal, state, or local authorities for conducting work under this contract. Personnel conducting work on endangered and threatened species must have demonstrable knowledge of the biology and current conservation practices for the species in the work area or be able to demonstrate the ability to obtain all necessary permits required to survey and monitor listed species. Should it become necessary in the performance of the work and services for the Contractor to secure the right of ingress and egress to perform any of the work required under this contract on properties not owned or controlled by the Government, the Contractor shall, if practicable, secure the consent of the owner, his representative, or agent prior to effecting entry on such property. In the event all efforts by the Contractor fail to gain permission from the property owner(s) for entry to the property for performing the required work, the Contractor shall contact the Contracting Officer to obtain instructions for further action. In the event that the Contracting Officer must take action to obtain right-of-entry for the Contractor, the Contractor will be entitled to an equitable extension of time for the period required to obtain said right-of-entry. The Contractor shall assume all responsibility for and take all precautions to prevent damage to private and Government-owned property. The Contractor shall be responsible for any claims covering actions not approved by the Contracting Officer.

b. Project Management: The Project Manager shall be the individual responsible for the validity of the material in all reports and shall have recognized expertise in the appropriate field. During execution of the work, the Project Manager shall provide adequate professional supervision to assure timeliness, accuracy, quality, and completeness. In the event of controversy or court challenge, the Project Manager may be called upon, under separate contract, to testify on behalf of the Government in support of the Contractor's findings.

c. Product Quality: The Contractor shall be responsible for accomplishing all work in an accurate and professional manner. Any work deemed inadequate or nonconforming by the Contracting Officer shall be re-done by the Contractor, as necessary, to comply with the contract requirements at no additional cost to the Government.

d. Digital Data Standards: U.S. Army Corps of Engineers, Wilmington District, Digital Data Standards can be found in Attachment 5.

14. Personnel Qualifications: All professional persons employed under the terms of this contract must meet the minimum qualifications for their profession as established by the United States Office of Personnel Management. The duties and basic qualifications of key staff are as follows:

a. Project Manager/Principal Investigator.

(1) **Duties.** The Project Manager or Principal Investigator is the individual identified in the contract as being authorized to act for the Contractor and is responsible for contract administrative actions and research formulation for the contract firm. This individual usually selects the Technical Director and appropriate work crews, determines appropriate level of investigation and analysis, coordinates activities with the Contracting Officer's Representative, and

performs other administrative functions. This individual is responsible for overall contract quality control.

(2) **Qualifications.** Persons in charge of a project or research investigation, in addition to meeting the appropriate standards for their respective profession, must have a doctorate or an equivalent level of professional experience as evidenced by a publication record that demonstrates experience in project formulation, execution, and technical monograph reporting. If prior projects did not result in a publishable report, a narrative should be included, detailing the proposed Project Manager/Principal Investigator's previous experience along with references suitable to obtain opinions regarding the adequacy of this earlier work.

b. Technical Director.

(1) **Duties.** The Technical Director is the individual in charge of accomplishing specific scientific data collection, analysis, evaluation, and reporting. This individual follows work from initiation to completion and provides technical support to the Project Manager/Principal Investigator utilizing a basic understanding of scientific methods and procedures. The Technical Director is responsible for conducting literature reviews; office, field, and laboratory research; field surveys; site testing; and scientific analyses using various reference materials, maps, interviews with knowledgeable individuals, scientific instruments, and aerial photographs and other remotely-sensed data. The Technical Director is the individual who authors reports under the supervision of the Project Manager/Principal Investigator. Under the guidance of the Project Manager/Principal Investigator, this individual is responsible for making day-to-day decisions regarding the data collection, testing and analysis, and evaluations. The Technical Director is responsible for the accuracy of the information collected and for the scientific validity of recommendations made in draft and final reports. Technical Directors oversee and supervise the crewmembers assigned to their projects. The Technical Director assures that assignments are carried out in a safe and timely manner according to procedures established by the Project Manager/Principal Investigator.

(2) **Qualifications.** Individuals in this job category must hold a Master's or higher degree in the field of their work assignment, or possess an equivalent level of professional experience.

c. Scientist.

(1) **Duties.** Personnel in this category must carry academic and experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if this person has not been retained at the time of proposal.

(2) **Qualifications.** Individuals in this job category must hold a Bachelor's or higher degree in the field of their work assignment and must possess at least 12 months combined field and laboratory experience.

d. Technician.

(1) **Duties.** Technicians work under the direction of the Technical Director. Technicians conduct a variety of tasks, including locating field sites by using maps and instruments, conducting scientific data collection, performing analytical procedures and techniques, and performing accurate record keeping. Technicians may be required to calibrate and operate various types of analytical instruments. Technicians may also be required to perform preliminary treatments on samples or specimens requiring later detailed analyses.

(2) **Qualifications.** Technicians must possess an Associate's or higher degree (except archaeological technicians, who must have a Bachelor's degree) in the field of their work assignment, or at least 12 months combined field and laboratory experience.

e. Consultant.

(1) **Duties.** Consultants are personnel subcontracted on a short-term basis for their special knowledge and expertise.

(2) **Qualifications.** Consultants must carry academic and/or experiential qualifications in the field of their work assignment. Such qualifications are to be documented by means of vitae attachments submitted with the proposal or at a later time if the consultant has not been retained at the time of proposal.

15. Equipment and Facilities: The Contractor must provide or demonstrate access to the following capabilities:

a. Adequate field and laboratory equipment necessary to conduct whatever operations are defined in this Scope of Work

b. Adequate facilities necessary for the proper treatment, analysis, and storage of samples and/or specimens likely to be obtained from a given project. This does not necessarily include such specialized facilities as pollen, geochemical, or radiological laboratories, but it does include facilities sufficient to properly preserve or stabilize specimens for any subsequent specialized analysis that may be required.

c. Adequate facilities for secure storage and efficient retrieval of data and records.

16. Release of Information: Neither the Contractor nor the Contractor's representatives shall release any report, data, specification, drawing, rendering, perspective, sketch, photograph, cost estimate, or other material obtained or prepared under this contract without prior specific written approval of the Contracting Officer.

17. Inspection of Services: The Government's rights regarding the inspection of services under the terms of a fixed-price services contract are explained in Section I "Contract Clauses." Generally, under this clause, the Government has the right to inspect all services called for by this contract and any Task Order issued under it. If any of the services do not conform with the contract and the Task Order requirements, the Government may require the Contractor to perform the services again in conformity with the contract and Task Order requirements **at no increase in**

the contract amount. If the Contractor fails to promptly perform the services again in conformity with the contract and Task Order requirements, the Government may: perform the services (or have the services performed) and charge the Contractor any cost incurred by the Government; cancel the services required under terms of a specific Task Order; or in extreme case may **terminate the contract** for default.

18. *Period of Services:* The draft report required by paragraph 9 of this contract shall be delivered to the Contracting Officer 18 months from the date of contract award.

19. *Travel:* All travel and per diem in connection with work performed under this contract will be at the Contractor's expense, including travel time to and from work sites.

20. *Payment:* Payments will be made based on documented progress. Evidence of progress (e.g. percentage of task complete) shall be documented in the monthly progress report that must accompany invoices.

21. *Method of Payment:* Partial payments to the Contractor will be made through the end of each month, for work or services performed by the Contractor during that month, upon submission of a proper invoice on the submitted on corporate letterhead. In order to be considered a proper invoice each invoice **must** be accompanied by the monthly status report accepted by the COR clearly indicating what the work has been accomplished during the billing period. Partial payments will not be made in amounts less than \$1,000 (except for final submittals). Each invoice must identify the contract and indicate whether the payment is a partial billing (e.g. "partial #1") or a final bill (e.g. "#4, final"). For purposes of billing, the acceptance date of deliverables (not delivery date or date of invoice) will constitute the billing date for the purposes of all payments.

ATTACHMENT 12
SCOPE OF WORK - UPDATE OF RRBROM MODEL

**SCOPE OF WORK
FOR
KERR 216 ROANOKE RIVER BASIN RESERVOIR OPERATIONS MODEL (RRBROM)
UPGRADES COMPLETION**

1. Background

A. The U.S. Army Corps of Engineers (USACE), Wilmington District, in partnership with the State of North Carolina and the Commonwealth of Virginia are sponsoring a feasibility study of John H. Kerr Dam and Reservoir under the authority of Section 216 of the River and Harbor and Flood Control Act of 1970 (Public Law 91-611). Section 216 authorizes the review of the operation of completed Corps of Engineers projects and development of recommendations for modifying the project structures or their operation and for improving the quality of the environment in the overall public interest. Public, stakeholder, and local, state, and federal agency input received during the early stages of this study indicated there is a public interest in reviewing the following areas: (1) downstream flow regime and effects on riparian ecosystem; (2) water quality; (3) sedimentation and channel morphology; (4) reservoir resources; (5) downstream flow based recreation; (6) salt wedge; (7) diadromous fish and riverine aquatic resources; and (8) water supply. Study Teams were formed for each of these areas of interest, and each of the teams has developed a Scope of Work to inventory existing conditions and to forecast the future conditions that would exist if no modifications are made to operating procedures at the John H. Kerr Dam. This analysis is being done in accordance with U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, as implemented by the U.S. Army Corps of Engineers' *Planning Guidance Note Book* (Engineering Regulation 1105-2-100). A summary of the progress made thus far on the John H. Kerr 216 Study can be found in the 2004 *Project Management Plan, John H. Kerr Feasibility Study, Under Section 216 Of Public Law 91-611, as Amended, John H. Kerr Dam and Reservoir, Lower Roanoke River, Virginia and North Carolina*. This management plan and other materials regarding the John H. Kerr 216 study are available at the following website:
http://www.saw.usace.army.mil/Authorized_Projects/Main.htm.

B. Having an acceptable mass-balance model is an integral part of the assigned tasks for the study teams. The Project Management Plan specifically states that the Roanoke River Basin Reservoir Operations Model (RRBROM) is the preferred mass-balance model for the study. This preference is due to the extensive use of RRBROM in the FERC relicensing for the Roanoke Rapids and Lake Gaston hydropower projects and the endorsement of RRBROM by numerous relicensing stakeholders also involved in the Kerr 216 study.

C. The Kerr 216 Modeling Oversight Team was formed to assure that: (1) required resource specific modeling programs are compatible, (2) data collected is gathered in a manner which can be used for the modeling program; (3) that duplication of modeling efforts is avoided. Accordingly, the Modeling Oversight Team is responsible for overseeing the enhancements to RRBROM. The team leader is Mr. Tony Young, USACE, Wilmington District.

D. The modeling oversight team convened a workshop in October 2004 with other RRBROM users and stakeholders to identify the corrections and enhancements to RRBROM needed for the Kerr 216 study use. The workshop summary notes are attached.

2. Tasks and Deliverables

A. The A-E shall perform the following RRBROM upgrades as described in the attached October 2004 RRBROM workshop summary notes by 30 September 2005:

- (1) Make corrections/updates cited in USACE memo of 27 April 2004 (attached),
- (2) Update inflows through 30 September 2004, including collection of water withdrawal and discharge data with which to update inflow data set
- (3) Reconfigure “Water” model operating modes, including:
 - a. Adding a “Weekly Operations to Guide Curve” mode, deleting the “Maximize Hydropower Revenue” mode
 - b. Updating the “COE Release Rules” mode to allow for redeclaration through Day 5
 - c. Deleting the “Prescribe Daily Allocation” mode
 - d. Adding peaking prescription options [maximum number of days per week and maximum number of consecutive weeks] to all modes
 - e. Alter flood control operations in all modes to account for flood storage in Lake Gaston
- (4) Reconfigure “Energy” model operating modes, including:
 - a. Delete the “Simple” energy option
 - b. Automate operations to make the starting storage in the energy run match that in the water run
- (5) Organize and conduct a 1-day workshop to address the proper valuation of energy generated at Kerr and Philpott projects. At a minimum, the workshop shall be attended by representatives of SEPA, USACE-Wilmington District, and Kerr 216 Modeling Oversight Team.
- (6) Develop post-processor to generate USACE-requested output format
- (7) Perform miscellaneous upgrades, including (a) renumbering nodes in the schematic to preserve upstream to downstream order, (b) changing the Kerr turbine capacity from 29,000 to 33,000 cfs, (c) adding Dominion Generation to the licensee list in the XA Message Window, (d) updating the GUI, and (e) updating the model documentation.

B. At the direction of the Government, the A-E may also be asked to perform any or all of the following additional RRBROM upgrades within the additional number of days shown for each task:

- (1) Add 10 water supply nodes for withdrawals from Kerr Reservoir, including the operation control language (OCL) to provide water supply storage accounting for each node. Also provide a single node for aggregate irrigation withdrawals from Kerr Reservoir. [11 additional days]
- (2) Automate the use of ensemble forecasts, including (a) the addition of Position Analysis mode to the model, (b) the ability to use both ESP (NOAA) and statistical (USGS) forecasts, (c) the addition of an “Update Hydrology” tab to

automate the maintenance of inflow records, (d) and the preparation of Position Analysis graphs. [19 additional days]

- (3) Modify output options to include the development of a time series flow graph that shows actual flows and historical ranges. [3 additional days]
- (4) Add up to 100 individual water supply nodes to allow disaggregation of existing water supply withdrawal nodes. [33 additional days]
- (5) Acquire Citrix software and install OASIS application on a North Carolina Division of Water Resources server. [6 additional days]

C. The A-E shall provide written documentation of each upgrade performed. In addition, the A-E shall make installable copies of the upgraded version of RRBROM available to all Kerr 216 work group members at no cost.

3. Points of Contact

The Wilmington District point of contact for this work is Mr. Tony Young (telephone: 910-251-4455; email: michael.a.young@saw02.usace.army.mil).

The point of contact for the RRBROM model is Mr. Brian McCrodden (telephone: 919-856-1288; email: bmccrodden@hydrologics.net).