Jordan Lake Watershed Trading Project – Expanding Innovative Approaches Throughout the Basin

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Table of Contents

List of Exhibits

1.0 Introduction

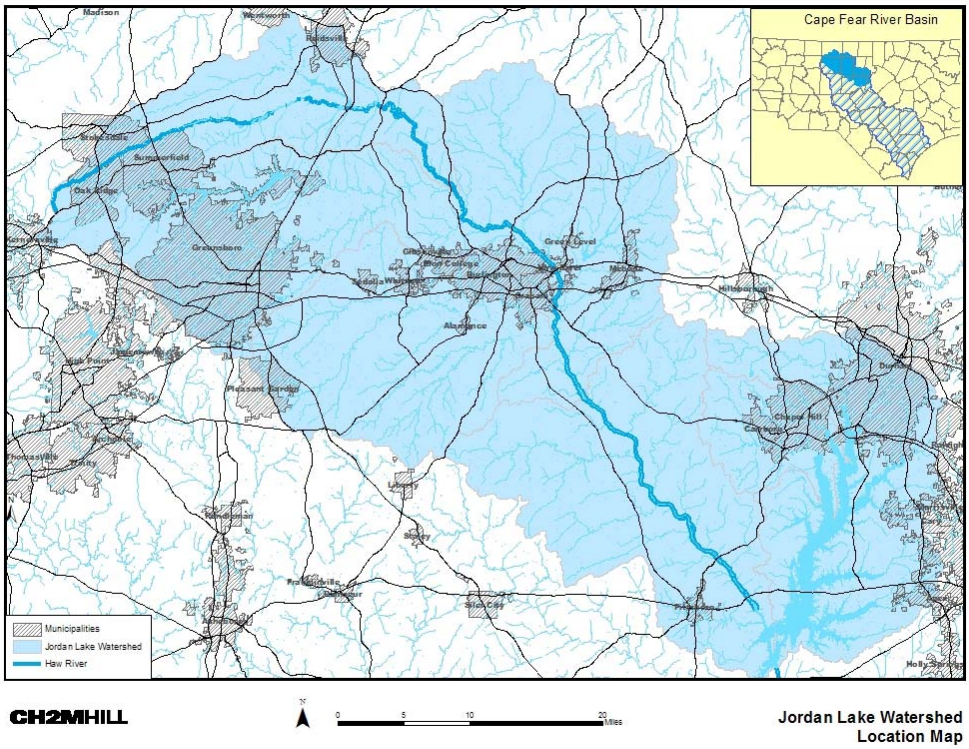
1.1 Background

Continued economic growth in the Cape Fear River Basin (the Basin) is essential for North Carolina's economy and quality of life. The Basin includes many of the state's largest urban areas —Greensboro, High Point, Burlington, Durham, Cary, Fayetteville, and Wilmington, as seen in Exhibit 1. As the largest watershed in the state, it represents 23 percent of the state's land area (CFRA, 2002). The Basin is currently home to 26 percent of the state's population and supports jobs in a variety of industries, including manufacturing, high-tech, and agriculture (CFRA, 2002). Growth rates currently exceed the state-wide average—water usage, one key growth indicator, is projected to increase nearly 95 percent by 2030 (NC DWR, 2002).

Jordan Lake is an important resource within the Cape Fear River Basin. Jordan Lake was created by the US Army Corps of Engineers (USACE) and provides the following services: downstream flood protection; downstream water quality protection; water supply; and recreation.

Two main tributaries form Jordan Lake: the Haw River which accounts for the majority of the lake's drainage area and New Hope Creek. The North Carolina Division of Water Quality (DWQ) considers Jordan Lake impaired due to chlorophyll *a* violations.

EXHIBIT 1
Cape Fear River Basin and Jordan Lake Watershed Detail



Water quality problems such as the chlorophyll *a* impairment in Jordan Lake can limit---and even stop—economic growth opportunities. In the early 1980s, North Carolina's Water Quality Assessment Report (305(b)) cited many waters in the Cape Fear River Basin as impaired by specific toxic chemicals. As Exhibit 2 indicates, efforts over the last 20 years have been successful in improving water quality. As a result, very few waters remain on the impaired waters list because of toxic pollutants.

EXHIBIT 2
Successful Cape Fear River Basin Partnerships

Partnerships formed in the Basin have resulted in water quality improvements. Examples of successful efforts include:

- Addressed toxic substances and color problems in the Haw and Deep Rivers through a combination of grassroots groups, state regulatory efforts, and pretreatment.
- Improved the water quality of Jordan Lake through policies developed by NC DWQ in concert with the watershed stakeholders that addressed nutrient loads from upstream communities. This effort began with a voluntary water supply watershed program in the mid-1980s, followed by mandatory rules in the early 1990s.
- USGS monitored water supply watersheds on a regional scale to ensure long term data to evaluate quality and protect public health through local funding.
- Developed a nutrient response model for Jordan Lake through local funding.

Although these improvements benefit all in the Basin, there is still considerable work to accomplish. Twenty percent of the Basin's waters remain on the 303(d) list, including Jordan Lake for nutrient enrichment. Nutrients are also a concern downstream in the Cape Fear River and may contribute to the low dissolved oxygen in the estuarine portion of the river, also a 303(d) listed water.

Accordingly, watershed management strategies must be formulated and implemented in a manner to balance the competing goals of growth and the environment. The Mid-Carolina Council of Governments (MCCOG) and the Cape Fear River Assembly (CFRA) are proposing to establish a framework for water quality credit trading as a potentially important component of a strategy that will build upon past successes and integrate powerful incentive-based options with existing regulatory and voluntary approaches.

1.2 Water Quality Credit Trading Study

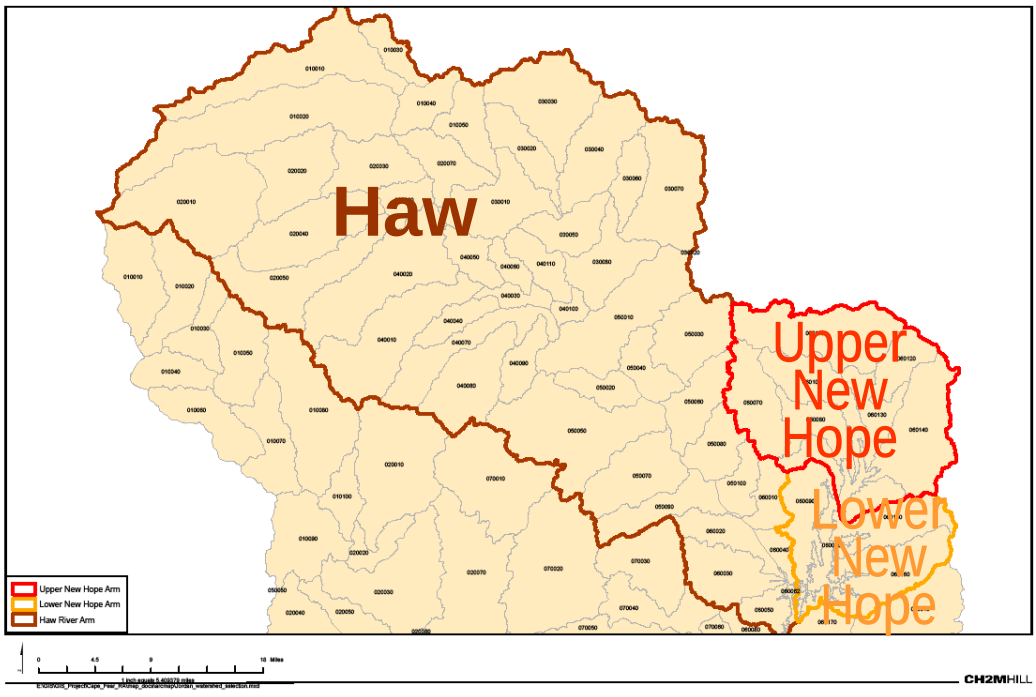
The MCCOG and the CFRA were awarded a targeted watershed grant from EPA to evaluate water quality credit trading within the Jordan Lake Watershed. The goal of this grant project is to develop, demonstrate, and evaluate a water quality credit trading program for the Jordan Lake Watershed. The project builds on work conducted to date; provides an innovative, incentive-based framework to support implementation of the regulatory requirements based on the final TMDL embodied in the Jordan Water Supply Nutrient Strategy Rules (the "Rules" located in 15A NCAC 02B .0262-.0273); and supports cost-effective water quality management strategies.

This study is organized into the following tasks:

1. Visioning and Project Chartering;
2. Designing the Trading Program;
3. Developing an Implementation Framework;
4. Evaluating the Monitoring Program;
5. Demonstrating the Trading, Implementation, and Monitoring Frameworks in a Pilot Subwatershed; and
6. Expanding Innovative Approaches throughout the Basin.

In conjunction with Tasks 1, 2, and 5, segments of the Haw and the entire Upper New Hope subwatersheds were selected as the pilot areas in which to focus the stakeholder processes and analytical efforts for this project. They are both in the Upper Cape Fear River Basin and are tributaries to Jordan Lake—the subject of the water quality concerns and management efforts discussed above. Exhibit 3 shows the pilot areas within the Upper Basin.

EXHIBIT 3
Pilot Subwatersheds



1.3 Technical Memorandum for Task 6

This Technical Memorandum (TM) is submitted in fulfillment of the deliverable requirements for Task 6, entitled "Expanding Innovative Approaches in the Basin and Elsewhere." This TM

documents the results and lessons learned through the Jordan Lake watershed trading pilot and describes how trading and watershed permitting programs could be applied to other watersheds within the Cape Fear River Basin and throughout the nation. As referenced in the body of this TM and selected footnotes, portions of other project deliverables directly and indirectly augment and/or support Task 6 objectives. This TM is organized under the major headings listed below, consistent with the project workplan subtasks as indicated in parentheses:

- *Section 2 – Evaluate Demonstration Results and Propose Final Jordan Lake Program (6.1);*
- *Section 3 – Sharing Information Regarding This Project Within the Cape Fear River Basin (6.2);*
- *Section 4 – Documentation of Lessons Learned for Transfer to Other Watersheds (6.3); and*
- *References.*

2.0 Evaluate Demonstration Results and Propose Final Jordan Lake Program

2.1 Overview

A detailed evaluation of this project's results are embodied in the TM *Nutrient Credit Trading Framework for the Haw and Upper New Hope Watersheds* (the "Framework TM"), as well as the other TMs and stakeholder meeting presentations listed in the Reference section of this TM. These address drivers, opportunities, potentially creditable nutrient reduction actions, relative cost-effectiveness, and assessment of credit supply and demand dynamics. The types of benefits that could be expected from a nutrient trading option for point and nonpoint sources subject to the Rules are also addressed. The Framework TM describes the proposed program for the Jordan Lake watersheds. It is important to note that as of the date of the TM, the primary driver and opportunity for trading—the Rules—are not yet final, nor are they expected to be implemented until at least 2011 (this assumes the Rules would go into effect in 2009).

To a great extent, therefore, the Framework TM and its associated and preceding project deliverables fulfill the intent of Task 6.1 (i.e., "*this evaluation will provide the basis for developing a trading framework and implementation program for the Jordan Lake watershed").* The recommendations in the Framework TM reflect significant stakeholder input. It presents the consensus of those in attendance at the last stakeholder meeting held August 11, 2008 along with additional written comments received and feedback from stakeholders in attendance at the June 19 and May 22, 2008 meetings. Additionally, stakeholders had significant review, evaluation, and input opportunities when the various technical elements of this project that formed the building blocks of the proposed Framework were presented and discussed during the eleven stakeholder meetings held from April 12, 2006 to August 11, 2008.

As such, the evaluation presented in this TM focuses on the Project Vision, Project Goals, and Successful Project Outcomes established in the endorsed Project Charter.

2.2 Project Vision

> *To develop, demonstrate, and evaluate an innovative water quality trading program for the Jordan Lake watershed that will enable more cost-effective water quality restoration, protection and implementation of the TMDL. This program will provide a model that can be evaluated for application in other watersheds within the Cape Fear River Basin, in North Carolina, and other areas of the country.*

As the Framework TM and other TMs document, the project vision has been met. The proposed trading Framework should afford point and nonpoint sources subject to the Rule greater flexibility in choosing how and when they comply with their requirements, and specifically the ability to comply more cost-effectively than without a trading option. The proposed Framework is tailored directly to the Rules, which are the primary state-level implementation mechanism for the TMDL. The flexibility the Framework would afford is described in the Framework TM and the opportunity for greater cost-effectiveness through trading was documented in the two TMs addressing agriculture and urban BMP cost-effectiveness and potential point source trading opportunities.

For point sources, the proposed Framework builds on and is consistent with existing point-point trading programs in North Carolina and elsewhere in the U.S., but could have the added

dimension of being more tightly integrated with local stormwater management programs. Specifically, the proposed Framework would support point sources selling (or transferring) nutrient credits to their local government counterpart and/or to private parties, in addition to supporting point sources buying credits from agricultural and/or urban best management practices (BMPs).

The proposed Framework is consistent with and builds on local and national experiences and includes new and unique approaches that have been tailored for the Jordan Lake watersheds, but which could be adapted or tailored for other watersheds in North Carolina and the U.S.

For nonpoint sources, in particular the urban sector, the proposed Framework positions the trading option as an extension of the existing "buy-down" provision, under which new development must meet a minimum on-site performance threshold before the developer may buy credits to meet the total on-site performance requirement (defined as a loading limit). Adding a trading option to the existing "buy-down" option currently only accessible through the state's Environmental Enhancement Program (EEP) would provide even greater opportunity to access the most cost-effective credits.

2.3 Project Goals

The chartered project goals have been met to the extent feasible, given the reality of the schedule for developing and finalizing the Rules—expected to be the primary driver for any actual trading. These include goals related to developing a trading framework that:

- Includes both point and nonpoint sources;
- Provides opportunities to meet TMDL-related requirements more cost-effectively than without trading; and
- Demonstrates the benefits of such an option have largely been met by results or by way of example.

Additionally, it is expected that the stakeholder processes and work products from this project will contribute to improvements in water quality over the longer term as jurisdictions and private parties begin implementing programs and actions in compliance with the Rules. Even without trading, the analysis of the relative cost-effectiveness among specific BMPs and the evaluation of the monitoring programs, both prepared for this project (see under References) substantially adds to the body of information that will help public and private parties optimize their BMP selection by type and site. Exhibit 4 lists the Project Goals and summarizes the extent to which they have been met.

The project was not without its challenges. The six BMPs that were designed for installation as potential pilot trading projects were selected with stakeholder input and endorsement, but the project workplan acknowledged that implementation of the BMPs was at the discretion of the public and private landowners. Local governments and private parties have been hesitant to implement these six BMPs due in part to a lack of clarity about how reductions from BMPs implemented between now and the effective date of the Rules will be considered for compliance purposes. Other site-specific factors may also have affected the ability and interest in installing these BMPs, and it is possible but not confirmed that pilot BMP sponsors may have implemented one or more BMPs at alternative sites as local governments adjusted their

stormwater BMP prioritization list(s) or as private landowners allocated resources across multiple sites. As a result, the project was unable to produce immediate improvements in water quality directly and exclusively attributable to the project over its timeframe.

2.4 Successful Project Outcomes

The project success measures that the stakeholders agreed to meet during chartering have largely been met as applicable and feasible. These include:

- Stakeholders have actively participated at every stage of the technical effort and agree the proposed Framework, which includes a process for tracking and documenting trades, would provide greater flexibility in compliance with the Rules than without trading; and
- The project was completed on time and on budget, though a no-cost increase schedule extension was requested and approved by EPA to better align the technical effort with the publication and review of the draft Rules and associated water quality data assessments.

As of the date of this TM, NCDWQ and EPA have had the opportunity to review and comment on all deliverables and their input has been incorporated. Final acceptance of the proposed Framework by NCDWQ, USEPA, and the public would not occur until after completion of this project, following the suggested implementation plan outlined in the Framework TM.

Exhibit 5 lists the Project Outcomes and summarizes the extent to which they have been met.

EXHIBIT 4
Summary of Project Status Against Charter Goals

Project Goal	***Summary Status Evaluation***
Develop a trading and watershed permitting framework for the Jordan Lake watershed that builds on past successes in North Carolina and around the nation.	Met: Documented in *Nutrient Credit Trading Framework for the Haw and Upper New Hope Watersheds.*
Improve and protect water quality in the Jordan Lake watershed.	Proposed Trading Framework is consistent with TMDL, implementing Rules, is readily integratable with existing point and nonpoint source compliance programs. Framework includes certification, auditing, and oversight components which gives credence to expectation that the proposed trading options would help improve and protect water quality. If/when implemented, the six BMPs designed under this project will produce site-specific nutrient reductions.
Develop a trading and watershed permitting framework that provides point source and nonpoint source discharges with options for implementing the TMDL in a more cost-effective manner.	Met: Documented in *Nutrient Credit Trading Framework for the Haw and Upper New Hope Watersheds*; *Point Source Nutrient Loading Estimates and Potential Trading Scenarios for the Haw and Upper New Hope Watersheds*; and *BMP Cost Estimates and Cost-Effectiveness*.
Include all point and nonpoint sources in the trading and watershed permitting framework including urban stormwater and highway runoff.	Met: Documented in *Nutrient Credit Trading Framework for the Haw and Upper New Hope Watersheds*.
Demonstrate the utility of the trading and watershed permitting framework in selected watersheds.	Demonstrated by way of example in two pilot subwatersheds (selected segments of the Haw and all of the Upper New Hope) through: • the cost-effectiveness screening analysis that showed some nutrient control options are less expensive than others; and • the development of illustrative point-point trading bubbles that could be implemented with a watershed permit. Not demonstrated with actual trades executed during the project period.[1] Not demonstrated with draft watershed permits for either point and/or nonpoint sources.[2]
Evaluate this trading framework and document lessons learned for application in the remainder of the Cape Fear River Basin and other watersheds around the country.	Met: Documented in Section 3 and 4 of this TM.

[1] See discussion on previous pages regarding schedule for implementation and compliance with the Rules, which are the primary driver for trading in this watershed: no trades would be expected until 2011. The Framework TM outlines a pro forma trading program that could be implemented between 2009 and 2011. Its adoption would occur outside the period of this project and at the discretion of potentially participating entities.

[2] As discussed in the Framework TM: for point sources, watershed permits are premature; for nonpoint sources, stakeholders elected to not pursue such mechanisms for the sole purpose of implementing a trading option. No jurisdictions are currently pursuing such mechanisms to support implementing or coordinating their stormwater programs within or across jurisdictions. As local governments more specifically develop their plans for complying with the Rules, they may or may not elect to re-examine watershed permits.

EXHIBIT 5
Summary of Project Status Against Charter Success Outcomes

Project Success Outcome	***Summary Status Evaluation***
Development and inclusion of a tool which enables the regulated community to evaluate options for meeting the TMDL requirements.	Not Applicable/Alternatively Fulfilled: This outcome was included in the initial project charter, but stakeholders later acknowledged that DWQ is responsible for such a tool, so funding associated with this outcome was largely reallocated to BMP design, in support of the outcome "protection, maintenance, and enhancement of water quality." The tool that DWQ produces is expected to be similar to the tools DWQ developed through contractors to support implementation of nutrient TMDLs in the Neuse and Tar-Pamlico River Basins. Alternatively, in response to stakeholder requests, a spreadsheet-based analysis was prepared to calculate the level of nutrient reductions provided by BMPs installed in series in selected combinations on pre-defined land uses and identify how the reductions compared to the buy-down threshold, loading limits, and credit-creating baselines. The results of this analysis are presented in *BMP Cost Estimates and Cost-Effectiveness*.
Trading framework provides more flexibility for the regulated community within the Jordan Lake watershed than conventional TMDL implementation.	Yes: Participating stakeholders agree the proposed Framework will provide a greater number of Rule compliance options, including more cost-effective choices, than will be available without trading.
Acceptance by NCDWQ, USEPA, and the public.	Pending: NCDWQ has actively participated in the stakeholder process and its representatives' input is reflected in this project's work products. EPA has received all formal work products; final acceptance of their sufficiency would occur during the grant close out process, which will occur after the submission of this TM and Final Report. The public, as represented by the stakeholder group has accepted the products and results of this project as sufficiently successful, given the lack of a need for a functional trading program for the next several years. They have endorsed the proposed Framework and implementation plan.
Protection, maintenance, and enhancement of water quality.	Pending: The proposed trading Framework is consistent with TMDL, implementing Rules, is readily integratable with existing point and nonpoint source compliance programs, and includes certification, auditing, and oversight components. This gives credence to expectation that the proposed trading options would help improve and protect water quality. This outcome was not demonstrated with nutrient reductions achieved during the project period directly attributable to this project. However the designed BMPs will produce nutrient reductions when implemented and the project's other work products will support implementation of the Rules which will protect, maintain, and enhance water quality. The monitoring programs in the watershed were evaluated and deemed to be sufficient to evaluate water quality trends.
Inclusion of process for documenting trades and tracking each participant's pollutant credits.	Yes: the proposed Framework includes such processes at a conceptual level of detail for each of the sectors that may be involved in trading.
Stakeholder participation in pilot program development and watershed trades.	Yes: The project team hosted 11 all-stakeholder meetings, with attendance ranging from approximately 20-40, and averaging about 30, and facilitated or attended other smaller meetings with regulators, source sector representatives, and individual sources (both point and nonpoint). Numerous other smaller meetings were held over the course of the project. Through these meetings and other communication, including maintenance of a web site dedicated to this project, stakeholders had the opportunity to discuss, review, and comment on all major evaluations and work products. Additional activities, including phone interviews and short electronic surveys were used selectively to provide additional participation opportunities.
Project completion within the schedule and budget established by USEPA.	Yes: On schedule, with approved extension; and on budget.

3.0 Sharing Information Regarding This Project in the Cape Fear River Basin

3.1 Overview

The demonstration developed under this project in the Jordan Lake watershed, located in the Upper Cape Fear River Basin, was tailored to the conditions, needs, and preferences in that watershed, and specifically to the pilot subwatersheds (selected segments of the Haw and all of the Upper New Hope—see Exhibit 3). From the outset, it was anticipated that stakeholders from the Lower and Middle Basins would be interested in the processes, technical approaches, and results (as applicable) for potential application in their basins.

This section describes the approach followed in the demonstration watersheds in general terms, and identifies those aspects or results that are unique to the demonstration area, and those that appear to be similar to other watersheds in the Cape Fear River Basin. Drawing on the project's collective findings, this section offers observations about how and why certain market conditions, trading options, and implementation approaches may or may not be feasible or appropriate for other areas in the Cape Fear River Basin and what type(s) of innovative approaches may provide the best fit for areas beyond Jordan Lake.

3.2 General Study Approach for the Demonstration Project

This project was organized around well-documented assumptions that opportunities for successful and meaningful water quality credit trading depend on a few key conditions as listed below. [3]

1. ***Driver for action:*** A desire or requirement for additional pollutant reductions or other actions aimed at protecting, maintaining, or improving water quality.
2. ***Understanding of water quality:*** Sufficient knowledge about the causes, sources, and relative contributions to the water quality problem or concern, and further capacity for load reductions (or other improvements).
3. ***Alternative feasible solutions:*** More than one possible "solution" set—a variety of combinations of enhanced treatment, best management practices, and/or restoration projects could meet the environmental objectives—note that it is not necessary that it be possible to mandate all solution sets, only that more than one exists.
4. ***Greater cost-effectiveness:*** Sufficient differences in relative cost-effectiveness (for example measured by $/lb/yr) among the various options within the solution sets such that those who could do better than their requirements would be financially interested in doing so (i.e., selling credits) and that those with relatively expensive compliance costs would be interested in less expensive alternatives (i.e., buying credits).

[3] See for example USEPA 1996, 2003, 2004, and 2007. The list presented here is consistent with principles and/or steps described in these publications but the condition categories presented here have been developed specifically to reflect the approach taken for this project.

5. ***Market warrants investment:*** The scale and scope of the expected credit market (as measured by number, frequency, and size of trades, as well as number, distribution, and size of traders) and potential cost-savings attainable through trading, on an individual and collective basis are sufficient to warrant an acceptably proportional investment in the mechanisms needed to support trading.

6. ***Equal or better results:*** Science-based assessments and program rules (such as trading ratios, and trading area restrictions) support the hypothesis that a trading program can be designed to produce equal or greater environmental benefits than projected for what will reasonably be expected to happen without a trading option.

7. ***Stakeholder-endorsed framework:*** If all the other conditions are met, a regulatory, policy, and administrative framework for trading can be developed and implemented that is acceptable to the participants, key stakeholders (including cognizant regulatory agencies), and the public.

Exhibit 6 summarizes in tabular form how this project explored the presence or absence of each of these conditions in the pilot subwatersheds (please see the referenced work products for more detail).

EXHIBIT 6
General Study Approach for the Jordan Lake Watershed Trading Project

Precursor for Successful and Meaningful Trading Explored	Process, Analyses, and Work Products Produced
1. Driver for Action	• TMDL and draft Rules provide driver for trading. Draft Rules require nutrient reductions from urban, agricultural, and government nonpoint sources; also require point source reductions • Found many sources/segments facing new requirements that will mean additional action.
2. Understanding of Water Quality	• Watershed modeling for TMDL identified existing sources. Rules do not identify existing nonpoint source loads which was identified as a problem by urban stakeholders. However, Rules recognize it is missing and have identified assigning baseline nonpoint loads to local governments as a first step to implementing the rule. • Evaluation of instream monitoring programs found good understanding and data at large and small scales.
3. Alternative Feasible Solutions	• Most sources had more than one option: agriculture, multiple BMPs; urban stormwater, multiple BMPs; POTWs have range of capital and O&M options. • Yes, individual sources or groups of sources have more than one solution. In addition, when looking at all sources, overall there are multiple options if focus on what technically could be done to reduce nutrient levels rather than focusing on who is required to implement reductions.
4. Greater Cost-Effectiveness	• Reviewed capital and operation/maintenance costs and effectiveness of various options. Calculated unit costs and compared within and across source categories (agriculture, urban stormwater, point sources). • Found some significant cost differences among and across sources/options.

EXHIBIT 6
General Study Approach for the Jordan Lake Watershed Trading Project

Precursor for Successful and Meaningful Trading Explored	Process, Analyses, and Work Products Produced
5. Market Warrants Investment	• Looked at level of reduction and investment needed to meet nutrient targets, number of sources/jurisdictions involved, scope/scale of requirements. • Found that agriculture may not need market to comply and that after sector goals are met, may be able to generate extra credits for trading to urban sector, but supply may be small compared to total demand. • Found that urban potentially in need of many credits, particularly in Upper New Hope watershed. For high density development, it may be difficult and expensive to meet the buy-down threshold. Stakeholders expressed interest in more options than just using EEP for buy-downs or EEP as the sole trading facilitator. There is potential for some sources to do better than their nutrient reduction requirements and provide credits to other sources. Expanding buy-down option to include credit trading would expand the supply of credits and provide incentives to do better than rule requires.
6. Equal or Better Results	• Rules specify trading areas—noted additional restrictions may be needed for site-specific conditions. • Identified existing delivery factors and basis for their use—concluded could be used to develop locational ratios to establish equivalency between two trading partners, consistent with EPA guidance and other trading program precedent.[4] • Showed how trading could expand public and private opportunities to implement buy-down provision, which without trading would be implemented solely through EEP. Purpose of such expansion would be to incentivize creditable actions, increase candidate offset sites, prioritize location of implemented BMPs, and increase cost-effectiveness of credits beyond what EEP could do alone.
7. Stakeholder-Endorsed Framework	• Started with chartering—established stakeholder group, project vision and goals, success factors for project, laid out work plan and workgroup/workshop process. • Held 11 stakeholder meetings to solicit information and gain endorsement of methods, data, and approach. In addition, had meetings with agencies and universities to discuss analytical methods and obtain data. • Worked through iterative process over and between three major meetings to: (1) present and discuss framework alternatives; (2) narrow down to strawman that met expressed preferences and design criteria; and (3) finalize the proposed framework to level of detail feasible and appropriate for state of Rules.

[4] See for example the Neuse and Tar-Pamlico River programs in North Carolina, the Lower Boise River pilot, and the Virginia Nutrient Credit Exchange.

3.3 Observations About the Potential Applicability of Trading in Cape Fear River Basins

In the near term, there do not appear to be any immediate trading opportunities in other areas of the basin, based on a review of the seven pre-conditions for successful and meaningful trading as identified above. The basis for this observation relates predominantly to a combination the status of these areas relative to three of the key pre-conditions: (1) of a lack of or still uncertain regulatory drivers; (2) a need for greater understanding of sources, causes, relative loading, and relative impacts; and (3) therefore an insufficient understanding about what the "default" solution might be under a traditional regulatory program versus what alternative solutions might exist with a trading option. With respect to pre-conditions relating to cost-effectiveness, a market warranting investment, and achieving equal or better results (conditions 4, 5, and 6 as identified in Exhibit 6), these are generally dependent, if not heavily influenced by the first three, and as such it is impossible to make any accurate observations about the presence or absence of these conditions at this time.

As existing regulatory and scientific efforts proceed, additional information and understanding is likely to be developed that will help determine if a trading option may be worth exploring in one or more basins or subwatersheds beyond the pilot areas covered in this study. It appears that sufficient stakeholder relationships, organizations, and processes exist in each basin to support such an exploration, which will be important to the possibility of arriving at a stakeholder-endorsed framework (condition 7) should trading opportunities later be identified.

A summary of the situation in each basin is provided below relative to the status of the four conditions observable at this time.

Upper Basin exclusive of the Jordan Lake Watershed (UB-xJL)

- ***UB-xJL Drivers for Action:*** The Jordan Lake Watershed does not include the Deep River and the examination of potential drivers for trading in that subwatershed needs to address two separate sections of Deep River: (1) Randleman Lake; and (2) lower reaches of Deep River. Randleman Lake is a new reservoir (filled in 2007) where there is a nutrient management strategy in place (see 15A NCAC 02B .0248-.0251). If this strategy is not effective, additional measures may be needed that would introduce an opportunity for exploring trading. At this time, no loading targets have been generally established, but there is one point source which has limits outlined in the Rules. The Rules also require riparian buffers and new development stormwater BMPs for developments where imperviousness exceeds twelve percent. However, the stormwater requirements are not tied to nutrient loading targets as they are in the Jordan Lake watershed. Thus, opportunities for trading in the upper Deep River do not appear to currently exist. In the lower Deep River, DWQ has implemented localized nutrient requirements for point sources due to excessive attached algal growth, on a permit-by-permit basis in the form of concentration limits for total phosphorus (TP). ***If DWQ determined a more comprehensive program was needed to address nutrient loadings, a TMDL or alternative mechanism might impose additional requirements which might warrant considering trading options among them.***
- ***UB-xJL Understanding of Water Quality:*** With respect to Randleman Lake, currently there are insufficient data (the Lake is too new) to determine whether the adopted nutrient

management strategies are working. It will be several years before the strategy's effectiveness can reasonably be evaluated. ***In the lower Deep River, nonpoint sources, including predominantly agricultural land uses, are likely significant contributors to nutrient loading*** given that the towns are relatively small and major POTWs already have phosphorus limits in their NPDES permits. There are also several impoundments in this section of the Deep River, and the longer residence times behind the dam structures also likely contribute to nutrient enrichment.

- ***UB-xJL Alternative Feasible Solutions:*** For the Lake, there is one major point source serving the City of High Point. Nonpoint sources include urban runoff from the Cities of High Point and Greensboro and towns of Jamestown and Archdale in the headwater areas of the watershed. Closer to the lake's boundaries, more rural land uses exist. There is potential opportunity for local governments to work together to collectively meet any future nutrient loading targets. ***In the lower Deep River, it appears, mathematically, that additional controls would have to focus most on nonpoint sources, with some expected proportionate requirements or requests of the towns and agricultural sources given the existing nutrient limits.*** This might indicate an intra-agricultural and intra-town trading opportunity, with some possible cross sector opportunities depending on the level of additional controls imposed and relative cost-effectiveness among control options. Unless the point sources received even stricter limits, it would be unlikely they would emerge as potential credit buyers. However, it is possible that point sources might be able to generate additional reductions more cost-effectively than other sources and so could be potential sellers if other sources were forced into buying positions. There is also potential for nutrient sources to evaluate the cost of reducing nutrient inputs against the cost of removing the dams in the river. Removing the dams would result in higher velocity which may reduce the algal growth with the added benefit of restoring a natural habitat within the river.

- ***UB-xJL Stakeholder Relationships:*** Stakeholders in the Deep River watershed do participate in the Upper Cape Fear River Basin Association, a mechanism for cooperative monitoring, research, and education/outreach. Although the towns are generally smaller than in the Jordan Lake watersheds, it is possible that ***if trading opportunities emerged, Deep River stakeholders could piggy-back on any framework ultimately implemented for Jordan Lake subwatersheds,*** or readily transfer the proposed framework for their own use.

Middle Basin (MB)

- ***MB Drivers for Action:*** The Cape Fear River upstream of Buckhorn Dam and Lock and Dam (L&D) 3 are listed as impaired due to chlorophyll *a* violations. A TMDL or other management strategy could produce mandatory requirements or cooperative management decisions that would involve reductions of one or more pollutants or other types of actions aimed at reducing chlorophyll *a* levels. Within this context, it appears however that the Middle Basin will not experience the levels of development observed and forecasted for the Jordan Lake watersheds. Thus any management strategies may have more focus on more rural land uses.

- ***MB Understanding of Water Quality:*** The impairment may be hydrologically driven in that water slows down behind Buckhorn Dam and the L&D structures. There has been some research by UNC (Whalen and Dubbs, 2005) that concludes light is limiting algal growth in these areas; thus reducing nitrogen or phosphorus will not have a significant impact on

water quality. There is a mix of point sources which include both POTWs and industrial facilities—in general they are smaller facilities, in terms of permitted flow, than exist in the Jordan Lake watershed with the exception of the facilities operated by PWC Fayetteville. Nonpoint sources include the urbanized areas of Fayetteville, Lillington and Elizabethtown as well as agricultural land uses. Relative loading contributions for precursors of chlorophyll *a*, including nutrients, have not been determined. Currently, neither point sources nor nonpoint sources have nutrient limits in permits, but there is a point source strategy that would require mass-based nutrient loading limits using permitted maximum monthly flows and a concentration of 2 mg/L TP and 6 mg/L TN, respectively, for new and expanding facilities. It is noted that some jurisdictions have requirements for stormwater controls (NPDES Phase II and water supply watershed rules), and agricultural cost share programs may have some requirements for pollutant control. However, they do not have sector loading limits as included in the Jordan Lake Rules.

- ***MB Alternative Feasible Solutions:*** The alternative solutions to the chlorophyll *a* problem may include a variety of traditional and basin-specific controls and BMPs. In addition to the usual list of point source controls and BMPs for agricultural and urban land uses, in this case because hydrology appears to be determining much of the water quality conditions, the USACE has looked at removing the L&D structures, in part to address fish passage issues. However, local governments and selected industries have water supply intakes upstream of these structures and it may not be possible to remove the structures and still provide sufficient depth at the intake(s) such that they are still viable. Thus it could be that a combination of traditional and cooperative solutions are needed where trading may or may not have a role in increasing cost-effectiveness and/or expanding the set of solutions that could be combined to address the water quality problem while protecting water supply.
- ***MB Stakeholder Relationships:*** Stakeholders in the basin have experience working together through the Middle Cape Fear River Basin Association, which among other programs support similar monitoring and research efforts as in the Upper Basin. For example, the Association has a Memoranda of Agreement with DWQ for monitoring, and has also funded research exploring a variety of water quality in the middle basin.

Lower Basin (LB)

- ***LB Drivers for Action:*** There is a TMDL underway in the estuary due to impairment for dissolved oxygen (DO). New Hanover and Brunswick Counties are rapidly growing, but other areas of the watershed are not growing and likely will not in the near future. It is not uncommon in such situations that the TMDL imposes tighter point and/nonpoint source pollutant loading requirements on growing areas, and relatively more moderate restrictions on slow- or no-growth areas. However, it is premature to speculate on potential new requirements until the draft TMDL is released.
- ***LB Understanding of Water Quality:*** There is a mix of point sources (municipal and industrial), urban areas, agricultural land use, and swampland in the Lower Basin. Early modeling indicates that point sources have little impact on predicted DO levels: for example, one analysis removed all point source loads and predicted DO did not significantly change (Bowen et al, 2008). There is a large amount of agriculture (mainly confined animal operations) in the Black/South River and Northeast Cape Fear River watersheds in this basin that may be an important source category contributing to the DO

problems. It also is possible that low DO could be caused or exacerbated by the natural swamp systems, and/or salt wedge associated with the estuarine environment. It is still uncertain how much nutrients contribute to the DO problem, as well as the sources of nutrients—more information is needed from the ongoing modeling to make such determinations. If the modeling analyses indicate that natural sources/conditions contribute to the low DO, DWQ may revise the DO standard if they deem it appropriate. However, depending on how the TMDL and allocations are structured, it is possible that the regulated parameters (and potentially tradable pollutants) would more likely be BOD/NH3 than total nitrogen or total phosphorus.

- ***LB Alternative Feasible Solutions:*** With respect to the point sources, with the exception of the City of Wilmington's two plants on the River currently at secondary limits, all are close to the limits of technology for BOD and ammonia. Under this situation, a TMDL might not require additional treatment except for Wilmington. At that point the City could evaluate its control costs against other options, such as agricultural BMPs as a potentially viable trade. If additional point source reductions were needed from facilities in addition to Wilmington, there might be an opportunity for point-point trading if Wilmington's facilities, and/or other point sources had lower unit treatment control costs compared to their potential trading partners. Even so, because point sources appear to be a relatively small contributor, mathematically significant reductions will be needed from nonpoint sources to address the problem. ***This may create an opportunity for a nonpoint-nonpoint trading program, within or across the agriculture and urban sectors.*** Ultimately if an orphan (i.e., unowned, unregulatable) source is found to be a major contributor, the TMDL implementation plan might look more like a collaborative funding effort at mitigation and restoration, than a trading program in which pollutant reduction credits are exchanged between sources.
- ***LB Stakeholder Relationships:*** The NPDES-permitted facilities participate in the Lower Cape Fear River Program that conducts monitoring and research in cooperation with academics, mainly from UNC-Wilmington. This provides them with experience working together that could be leveraged into exploring trading opportunities.

4.0 Documentation of Lessons Learned for Transfer to Other Watersheds

4.1 Overview

This project's process and results make important contributions to the body of information about water quality credit trading that both reinforce generally held assumptions and illustrate interesting trading arrangements that to date have not been extensively explored. In a project with a duration and an analytic-geographic breadth as this one, numerous lessons are generated—many of which are neither new, nor surprising. As such, this section presents several aspects unique to North Carolina, the Jordan Lake Watersheds and/or the pilot watersheds in order to place these lessons in context, and then focuses on highlighting the most important challenges and opportunities confronted in this project that could benefit stakeholders in other watersheds. This section concludes with some observations about how stakeholders in the Jordan Lake watersheds leverage collaborative approaches for traditional watershed management and how that leverage can be extended into a water quality credit trading framework.

4.2 Unique Aspects of the Jordan Lake Watersheds

There are several contextual elements of this project associated with its location in North Carolina. NCDWQ has implemented nutrient TMDLs in a manner that is unique to the state. Three elements in particular are worth mentioning because they influenced the process and results of this project, including the lessons learned presented in Sections 4.3 and 4.4. These elements and the effect they may have on the transferability of methods, results, and lessons from Jordan Lake to watersheds in other states are identified and discussed below.

The agricultural sector receives specific load reduction targets and the state's Division of Soil and Water Conservation is charged to track individual and sector progress on these targets.
Compared to many other states, the load reductions required of the agricultural sector and the level of oversight given to evaluating compliance is relatively high. Some may argue that the targets and documentation requirements imposed on the agricultural sector are still less strict and/or less onerous than those placed on the urban and/or point source sectors, but they are nonetheless among the most specific and enforced of those with which the consulting team and stakeholders on this project are familiar.

This approach has several implications for trading opportunities. First, because the state was addressing nutrient loadings from the agricultural sector even before the new Rules were introduced, most agricultural lands have one or more BMP in place already, limiting the extra capacity to generate credits from this sector. Additionally, the Rules specify that no agricultural credits may be traded to another sector until the agricultural sector has collectively met its reduction targets. This further limits the potential supply of agricultural credits and delays the time until such credits may be traded to other sectors, if any cost-effective credit creation capacity still exists. In other states, even with cost-share funding, there is typically a relatively greater potential for creating credits in the agricultural sector.

The Rules themselves are a relatively unique mechanism for a state to promulgate a wide variety of load reduction targets, land-based loading limits, and wasteload allocations for point sources all in one document and regulatory process.
Many states simply translate TMDL wasteload and load allocations from the primary TMDL document(s) directly into the mechanisms commonly associated with the various sectors, including: agricultural cost-share program requirements; MS4 permits or requirements for local stormwater management programs/plans; and NPDES permits for point sources. The nonpoint source load reductions set in these programs are often voluntary or incentive-based rather than mandatory as in the draft Jordan Rules. Notably, these translations may ordinarily occur on different timetables, but in the case of the Jordan Lake watersheds, it is occurring relatively simultaneously.

With regard to exploring trading opportunities, this approach has the advantage of synchronizing all the potentially applicable requirements that will establish trading baselines. It has the disadvantage that getting the consensus on all sectors needed for the entire Rule to take effect can delay the onset of the driver for trading.

Stormwater management in these watersheds is not considered in the context of NPDES permitting (i.e., MS4 permits, general permits, etc.) as much as it is in many other watersheds.
NCDWQ could include urban stormwater requirements in the NPDES MS4 permits as done in many other states rather than through rulemaking. In watersheds with nutrient TMDLs, NCDWQ has used rules as the mechanisms by which the state establishes requirements for local jurisdictions' stormwater management programs, including specific requirements localities must place on private parties, as well as specific requirements the locality must meet. The advantage for trading of including stormwater requirements in rule format is that it results in urban stormwater being treated as a nonpoint source (as opposed to a point source), which enables the agricultural and urban sources to work together. The disadvantage for trading is that the rules may have less clarity. For example, the Jordan Rules do not include specific loading targets for each urban area which make it difficult to track progress toward overall watershed goals.

4.3 Lessons Regarding Challenges

The four primary lessons about challenges encountered during this project that can be applied in other watersheds are described below. How they played out in this project is perhaps unique, but they are common challenges and issues to water quality credit trading feasibility studies and demonstration projects. Thus, the main lessons associated with these challenges are to design a water quality credit trading study effort that provides early identification and definition of these issues, and provides sufficient flexibility within the project workplan and stakeholder process to adapt the project's goals, objectives, analyses, and methods to overcome the challenges where possible, and provide the most value when challenges remain.

Be clear about what issues are rooted in the driver and are independent of trading.
This lesson is applicable when the driver for trading is relatively new or underdevelopment and also when it is well/long established. However, driver issues that exist whether or not trading occurs separate from trading-specific issues is frequently more difficult when the driver is new and/or in flux. In this project, the Rules that will establish the baselines for trading were in draft form during most of the study and underwent at least two revisions. Selected provisions of the

Rules were the subject of much discussion, irrespective of trading, and some stakeholders commented that certain assumptions were unfounded, inaccurate, or unfair. In these circumstances, it is not surprising when such reactions also are attributed to proposals for a trading program to be based on the driver in contention.

As much as possible, discussion and debate about the underlying driver and the fundamentals of the trading program should be kept on separate tracks until they are ready to be successfully linked. For example, stakeholders may disagree about a nutrient reduction requirement,[5] but can make progress in agreeing that whatever the requirement ends up being, it will establish the baseline for trading.

Understand that a delayed driver may dampen incentives for early actions if baselines are unclear and/or "grandfather" provisions are limited or absent.

As noted in Section 2, none of the six BMPs designed under this project have been installed to date. While this may be due to site specific factors and the reasonable discretion of the site owners in managing the candidate site among many in their property portfolios, it also may at least be partly due to the fact that compliance baselines for public and private entities were in flux during this project.

Under these circumstances, it was difficult for the site owners to accurately determine the number of potential nutrient reduction credits they might generate for the proposed investment. Further, it also was difficult to compare the demonstration BMP credit potential to other possible BMP options that might also be on the owner's own list of candidate BMPs.

In this and similar situations, securing an agreement that the reductions from demonstration BMPs be grandfathered as creditable at some minimum/maximum level could create stronger incentives for implementation. Beyond just the demonstration BMPs, the fact that the Rules will not take effect for several years also dampened the urgency to create a turn-key trading program proposal under this project.

As a result, the proposed framework will require additional detail, agreement, and tools before it can be implemented. The pro forma trading program proposed for the interim period between the conclusion of this project and when the Rules take effect is designed to serve this purpose.

Plan data collection approaches that are consistent with and account for data evolution and decision-making that is external to the project.

Many trading feasibility studies and demonstration projects are of a fixed duration and budget and must make do with the best data that are available within the practical data collection, analysis, and evaluation window of the project's period of performance. During this open window, data and assumptions about the data can still be in flux, and disagreements can exist about which data source(s) to use and what key assumptions to make. It also is possible that as older data is better understood, adjustments will be reasonably made in how published model inputs (e.g., associated with a TMDL) will be translated into program implementation (e.g., assumptions for nutrient loading rates by land use/impervious area). If planned for in process and budget, these circumstances can better be accommodated without disruption to the overall project.

[5] See for example documents mentioned at http://h2o.enr.state.nc.us/nps/JordanNutrientStrategy.htm.

Another aspect of this lesson is that sometimes it is necessary to present the data in the format of the trading analysis—be it relative unit cost comparisons or specific trading scenarios—before stakeholders fully understand how their data will be used and what level of detail is needed. In such situations, examples help, but nothing seems better at ultimately garnering the best data than going ahead and presenting "preliminary" data, expecting that it will be improved upon during the review and comment process.

Having an existing or planned "offset" or "in-lieu fee" program is a useful bridge to an expanded trading option but it means being prepared to address the question of whether trading will be of marginal additional value.

Many stormwater management programs in particular have offset or in-lieu fee provisions that allow developers and re-developers to comply with stormwater ordinances through off-site mitigation/restoration and/or cash payments to a pre-approved entity (usually but not always the local jurisdiction). Some jurisdictions have minimum requirements for on-site controls that must be met before an offset or in-lieu fee provision may be accessed. This is the case with the "buy-down" provisions established in the Rules for the Jordan Lake watersheds that require subwatershed-specific loading limits be reached before a developer may comply with the remainder of their responsibilities by buying offsets from the Ecosystem Enhancement Program (EEP). In terms of enhancing understanding about offsets, credits, and trading, and in terms of having a pre-existing springboard for trading options, a pre-existing offset or in-lieu fee provision can be beneficial.

However, it may be difficult to quantitatively predict or demonstrate the additional value a trading option could provide, for example in terms of the percentage of developers that would access various trading options instead of the offset provision, or in terms of relative prices of credits available through the new trading option as compared to the in-lieu fee program. Sometimes insufficient data are available to do so; sometimes such an analysis would be too speculative—especially in this case where the Rules have yet to take effect and no history of accessing an in lieu fee program yet exists. Instead, stakeholders will have to consider how such factors as credit demand and supply, prices, certification, and oversight compare between a compliance scheme with only an in-lieu fee option and one with an additional trading option involving public and/or private parties. See also under Opportunities below for more detail on the positive companion to this lesson.

4.4 Lessons Regarding Opportunities

The four primary lessons about opportunities uncovered during this project are described below. They are certainly defined and shaped by local circumstances, but they also reflect possibilities other watersheds could readily find or create. The important lessons revealed in these opportunities revolve around crafting a project workplan and stakeholder process that assumes any trading option would be consistent with and integrated with existing programs in such a way that they would be enhanced, not hindered, and that trading would create benefits not otherwise attainable without trading.

Stakeholder processes and technical analysis for trading can illuminate and complement parallel efforts for ongoing and new programs.

This lesson grows mainly out of this project's focus on the urban sector as a potentially major source of demand for nutrient credits (likely predominantly nitrogen). Jurisdictions in the study area have been implementing their Phase 1 or 2 programs and water supply watershed

programs, as applicable, for some time and had largely completed whatever coordination and collaboration they elected to do to get those programs up and running. Selected activities, including monitoring and public education are collectively implemented through the Councils of Government (COGs), but the jurisdictions otherwise largely plan and operate independently.

Through the course of discussions at stakeholder meetings, and in supplementary conversations , representatives from several jurisdictions have concluded that some collaboration and information transfer beyond current levels, including related to data management, decision tools, and BMP site identification-prioritization may be of mutual interest. Even without trading, such collaboration and transfer would help leverage local resources and establish consistent approaches and common tools across the watershed, while still preserving local discretion and ability to tailor individual programs that must be expanded to comply with the forthcoming Rules.

Screening-level unit control cost estimates across nonpoint source categories and control options highlight the merit in exploring ways to maximize cost-effectiveness on-site even without trading, and indicate how strong the economic driver for credit trading is likely to be.

The results of the cost-effectiveness analyses and the way they have been presented are instructive for those looking for examples of how to systematically develop relative cost-estimates that can be compared within and across source categories and control options, keeping in mind that the specific results would only be directly transferable where similar/identical methods and assumptions were followed.

With the understanding that every individual site will have opportunities and constraints for BMP design and implementation, the analyses clearly show that among the pre-approved BMPs, some appear to be unambiguously more cost-effective than others. Moreover, the range of unit costs observed was broad enough in the screening—sometimes an order of magnitude, or even two—that even if costs converged among options for a specific site, it would still seem that many sites will afford opportunities to optimize BMP selection and sizing for cost-effectiveness.

The cost of compliance with trading will depend on credit prices, which may not be known until further into the program design effort than this project ventured but which will presumably have some relationship to credit costs, which can be estimated earlier in the process, as was done here.

With respect to whether a market for credits can be created (irrespective of demand, supply, and other considerations), the differences in the cost of compliance with trading versus without trading must be significant enough (as defined by the participants) to warrant the investment of resources needed to create the market. Notably, the cost of compliance with trading will depend on credit prices, which may not be known until further into the program design effort than this project ventured but which will presumably have some relationship to credit costs, which can be estimated earlier in the process, as was done here. This project concluded that unit cost differences among control options are significant enough to proceed to the next step of exploring trading opportunities and designing an appropriate program, as reflected in the stakeholder-endorsed recommendation to proceed to a pro forma stage, as described in The Framework TM.

North Carolina's Ecosystem Enhancement Program (EEP) is an interesting centralized offset program being applied statewide for Department of Transportation (DOT) Projects and at the watershed level to support local implementation of nutrient TMDLs.

EEP was originally established within the North Carolina Department of Environment and Natural Resources to provide a centralized, state-managed program to identify and implement preservation and restoration projects to satisfy the DOT's mitigation requirements. The EEP program is identified in the rules implementing nutrient TMDLs for the Tar Pamlico and Neuse River Basins, and in the Draft Rules implementing the nutrient TMDLs for the Jordan Lake watersheds as a pre-approved mechanism for compliance with loading limits applicable to new development and re-development, once buy-down minimum provisions have been met.

The trading framework proposed for the pilot watersheds seeks to leverage and expand upon this option by not only increasing credit options for offset purchasers beyond EEP as the major supplier, but also expand EEP's access to ready-made credits so that it can better fulfill its aggregation and distribution mission (currently EEP either implements offset projects itself, or contracts for them through solicitation processes).

By itself, EEP is analogous to a publicly owned and operated credit bank; in combination with other credit options, it follows a multi-buyer/multi-seller model (see ref framework for more). This model will not be selected by everyone, but it is certainly worth considering in whole or in part along with other credit market options.

As proposed, and notably endorsed by EEP, the trading option would introduce managed, facilitated competition for credit creation and exchanges in which EEP could participate as a buyer, seller, or aggregator.

Point sources, including in this case publicly owned wastewater treatment plants (POTWs), can be considered a source of credits for compliance with public and/or private stormwater control obligations.

Many trading feasibility studies, including this one, examine opportunities for point-point trading, and point-nonpoint trading in which point sources buy credits from nonpoint sources. This study also considered the possibility that point sources could sell credits to urban sources subject to the stormwater-related sections of the Rules.

In the Jordan Lake pilot areas, particularly the Upper New Hope, the urban sector is likely to be a significant source of demand for nitrogen credits and a number of the POTWs might have to (if lack of alternative credit supply limits trading opportunities) or want to invest in technology and process upgrades that take their nutrient loadings below their applicable wasteload allocation—thereby generating credits. The proposed framework provides for such trades if stakeholders elect to pursue them and regulators find them approvable.

The conditions that warrant considering nonpoint-point trades include:

- Potential over-supply of point source credits;
- Potential under-supply of urban and agricultural credits;
- POTW unit control costs less than those for urban BMPs, in selected situations and on average;
- Interest on the part of some jurisdictions in "keeping" their POTW-generated credits within the public sector, e.g., making extra credits available (by sale or transfer) to another governmental entity/department within the same city or county (this may be of particular interest if local governments receive load reduction targets for "existing development", a category the jurisdiction will be responsible for meeting, as provided for in the Draft Rules); and
- Willingness on the part of the POTWs and their companion local governments, including the stormwater management agency/department, to make extra credits available to the private sector.

Stakeholders in other watersheds should pay attention to the potential for point source credit sales/transfers to nonpoint sources where these and other conditions (as identified in Section 3) exist.

4.5 Leveraging Collaborative Approaches to Watershed Management

Many watershed management efforts involve collaboration in identifying the problem and crafting the solution, but then oftentimes stakeholders go their separate ways to implement "their piece" of the overall program. In several ways, including monitoring, education and outreach, and technical assistance, local jurisdictions, COGs, regulators, and other stakeholders in the Jordan Lake watersheds have already been collaborating in various combinations to implement their point and nonpoint source nutrient control programs. The proposed trading framework would expand this collaboration even more across jurisdictional boundaries and source sectors to create watershed-based nutrient credit markets that help prioritize selection of BMPs by type and location, optimize choices based on cost-effectiveness, and enhance the performance of existing local and state programs.

The Jordan Lake Watershed Trading Project has helped set the stage for Jordan Lake stakeholders to go to the next level of collaboratively implementing selected elements of their watershed management programs.

Many stakeholder groups may want to craft a basinwide-team approach that embodies a "shared resource = shared responsibility" philosophy—for both developing and implementing their management plans, but have difficulty applying the concept of "shared responsibility."

Demonstrating shared responsibility can take many forms, from everyone implementing their assigned or voluntary commitments separately (as noted above), to agreements for joint and collaborative funding mechanisms. Mostly however, compliance with regulatory requirements is determined at the individual level—city, county, permittee, landowner—and so whatever form shared responsibility may take, individual entities will still need to demonstrate compliance with individual responsibilities.

Watershed permitting and water quality credit trading are two ways to help operationalize the concept of shared responsibility. Watershed permits establish collective regulatory requirements and enable the parties to focus more on managing toward the total loading cap (or load reduction goal) rather than on individual compliance. Trading provides a way for partners to seek out more cost-effective control options, or otherwise support collective goals, while still demonstrating individual compliance by virtue of counting the credits applied toward their own responsibilities. Watershed permits can provide administrative, financial, and environmental benefits without including trading; and trading can be implemented without watershed permits. EPA and others have provided guidance and examples on the various models (see for example USEPA, 2007b). The Framework TM describes the trading framework proposed for the Jordan Lake watersheds, which does not include reliance on watershed permits at this time.

At a minimum—and this project is no exception—trading studies usually provide a fresh and often unique look at the possible solution sets to water quality problems, even more than most TMDLs and similar watershed management planning processes.
This is because explorations into trading look beyond what actions can be compelled via regulation or ordinance, or purchased with cost-share, or achieved through altruistic volunteerism. By definition, trading analyses look at what technically could be done, why specific actions would or would not occur, and what combination of mandates and incentives might change the "default" (i.e., under a traditional regulatory structure) action. Trading studies generally try to examine as many options as possible and compare their relative cost-effectiveness—importantly this latter exercise is less common in many TMDLs and associated implementation plans than some argue it should be.

Even if such efforts do not immediately (or ever) lead to a trading program, stakeholders typically have a much better understanding of the options available to address their water quality problems and how they compare on a variety of metrics. This improved understanding can lead to enhancements in traditional point and nonpoint source management programs, such as implementing a stormwater BMP Capital Improvement Program or strategically phasing point source treatment upgrades. And, if trading feasibility studies and demonstration projects ultimately lead to a trading program, then stakeholders have concluded that they can collectively achieve environmental results equal to, if not better than, their programs without trading.

Through the proposed Jordan River Credit Trading framework, and in conjunction with ongoing and planned new programs geared toward reducing nutrient loads and improving water quality, Jordan Lake stakeholders are seeking to tangibly implement their shared responsibility philosophy regarding their watersheds. The stakeholders hope other watersheds can benefit from their experiences exploring water quality credit trading opportunities to tailor a collaborative approach to solving their watershed management challenges.

5.0 References

Project Deliverables and Posted Workproducts: Listed in Chronological Order by Subcategory

Project Charter

PEQ, CH2M HILL and TJCOG. 2006. Jordan Lake Targeted Watershed Project Charter.

Technical Memoranda

TM 1. CH2M HILL. 2007. Opportunities for Water Quality Credit Trading in the Jordan Lake Watershed. September 26, 2007.

TM 2. _____. 2008. BMP Conceptual Design. November 7, 2007, as revised December 28, 2007.

TM 3. _____. 2008. Historical Monitoring Evaluation. March 31, 2008.

TM 4. _____. 2008. Nutrient Credit Trading Framework for the Haw and Upper New Hope Watersheds. July 31, 2008.

TM 5. _____. 2008. Trading Areas and Ratios. August 22, 2008.

TM 6. _____. 2008. Point Source Nutrient Loading Estimates and Potential Trading Scenarios for the Haw and Upper New Hope Watersheds. *Point Source Review Draft August 22, 2008; Final Forthcoming.*

TM 7. _____. 2008. BMP Cost Estimates and Cost-Effectiveness. *Forthcoming.*

Powerpoint Presentations for Stakeholder Meetings

Note that presentations for Meetings 1-8 covered a wide range of technical topics, while presentations for Meetings 9-11 were focused as noted. Additionally, handout materials were occasionally prepared and distributed at the meetings.

PPT 1. CH2M HILL. 2006. Chartering Session 1: Visioning and Chartering. April 12, 2006.

PPT 2. _____. 2006. Chartering Session 2: Chartering Meeting No. 2. May 31, 2006.

PPT 3. _____. 2006. Stakeholders' Meeting 3. September 6, 2006.

PPT 4. _____. 2006. Stakeholders' Meeting 4. November 29, 2006.

PPT 5. _____. 2007. Stakeholders' Meeting 5. January 31, 2007.

PPT 6. _____. 2007. Stakeholders' Meeting 6. February 28, 2007.

PPT 7. _____. 2007. Stakeholders' Meeting 7. March 29, 2007.

PPT 8. _____. 2007. Stakeholders' Meeting 8. June 20, 2007.

PPT 9. _____. 2008. Stakeholders' Meeting 9. *Market Frameworks (including Sources and Credit Baselines Recap, Potential Relative Credit Demand and Supply, Relative Cost-Effectiveness among Nonpoint Source Credit Options, and Assessment of Trading Opportunities).* May 22, 2008.

PPT 10. _____. 2008. Stakeholders' Meeting 10. *Refined Market Framework(s).* June 19, 2008.

PPT 11. _____. 2008. Stakeholders' Meeting 11. *Proposed Market Framework.* August 11, 2008.

Other Workproducts

Meeting agendas and summaries were prepared for the 11 meetings listed above and posted on the project website. Selected additional workproducts are identified below.

CH2M HILL. 2006. Project Maps: Overview, Haw Pilot Area, and Upper New Hope Pilot Area. September 6, 2006.

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Other References

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North Carolina Department of Environment and Natural Resources, Division of Water Quality (DWQ). 2002. Permit to Discharge Wastewater under the National Pollutant Discharge Elimination System for the Neuse River Compliance Association and its Co-Permittees.

North Carolina Department of Environment and Natural Resources, Division of Water Quality (DWQ). 2007. Stormwater Best Management Practices Manual.

North Carolina General Assembly. 2007. Study of the Merger of Ecosystem Enhancement Program & Clean Water Management Trust Fund Final Report of Findings and Recommendations. Prepared by Dye Management Group, Inc., SEPI Engineering Group, and the Environmental Law Institute. June 2007.

Jordan Water Supply Nutrient Strategy Rules (the 'Rules' located in 15A NCAC 02B .0262-.0273)

Tetra Tech. 2003. *B. Everett Jordan Lake TMDL Watershed Model Development*. Prepared for North Carolina Division of Water Quality. Revised Draft – November 2003.

United States Environmental Protection Agency. 1996. Draft Framework for Watershed-based Trading (EPA 800-R-96-100).

_____. 2003. Water Quality Trading Policy.

_____. 2004. Water Quality Trading Assessment Handbook (EPA 841-B-4-001).

_____. 2007. Water Quality Trading Toolkit for Permit Writers (EPA 833-R-07-004).

Virginia Nutrient Credit Exchange Association. 2008. Exchange Compliance Plan: 2008 Annual Update.

Whalen, S.C. and L.L. Dubbs. 2005. Influence of Nutrient Reduction, Light, and Light-Nutrient Interactions on Phytoplankton Standing Stock, Primary Production and Community Composition in the Middle Cape Fear River, North Carolina. UNC Chapel Hill.