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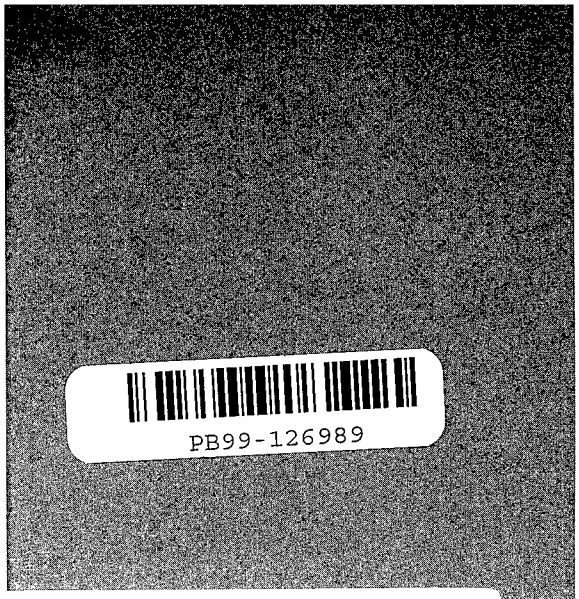

Final Report

Economic Analyses of and Institutional Mechanisms for Wetlands Mitigation and Banking in North Carolina

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The Center for Transportation and the Environment
Campus Box 8601
Raleigh, NC 27695-8601
http://itre.ncsu.edu/

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North Carolina State University

Final Report

Economic Analyses of and Institutional Mechanisms for Wetlands Mitigation and Banking in North Carolina

Prepared By:

Frederick W. Cubbage
Deborah A. Gaddis

Department of Forestry
North Carolina State University
Box 8008
Raleigh, NC 27695-8008
(919) 515-2891

June 1998

Centennial Campus
Box 8601, Raleigh, NC 27695-8601
(919) **515-8899** ☎ (919) 515-8898 fax
http://itre.ncsu.edu/itre/cte

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16. Abstract

The scientific bases, economic costs, and institutional arrangements for creating and maintaining wetlands are developing rapidly. The costs of wetland development and banking were estimated in this study for different types and scales of projects, and the implications for privately or publicly owned and managed wetlands banks were analyzed. Appropriate policy approaches, legal arrangements, and the division of property rights for created wetlands were examined and recommendations made for the state of North Carolina. Production function data were identified for restoring wetlands in North Carolina in order to perform discounted cash flow analyses of wetland mitigation banks. Wetland restoration projects typical of conditions in North Carolina were also identified. With regard to the legal and institutional components of the project, a history of wetlands regulation development in North Carolina was developed, and a thorough analysis of current legislation and regulation was drafted. Selected wetland restoration and banking programs in other states were analyzed to provide insight for decision makers planning legislation and regulations for private wetlands in North Carolina.

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Department of Forestry

NC STATE UNIVERSITY

College of Forest Resources
Campus Box 8008
Raleigh, NC 27695-8008

919.515.2891
919.515.6193 (fax)

FINAL REPORT:

ECONOMIC ANALYSES OF AND INSTITUTIONAL MECHANISMS FOR WETLANDS MITIGATION AND BANKING IN NORTH CAROLINA

Frederick W. Cubbage and Deborah A. Gaddis
Department of Forestry
North Carolina State University

June 1998

1. Final Report Summary

This research project on "Economic Analyses of and Institutional Mechanisms for Wetlands Mitigation and Banking in North Carolina" was completed on schedule, and this report is being submitted to finalize the project. As the title indicates, the project was intended to analyze the economic and policy frameworks regarding wetlands mitigation banking. The master project was divided into several components, which are summarized here. Fred Cubbage served as the general project leader, and three students or recent graduates led individual components of the study. The several accomplishments of the study are summarized below. Much more detailed reports and manuscripts that were developed as part of the study are attached as part of the final report.

Wetlands Law and History.--Research performed by Deborah Gaddis on this grant produced several articles on wetlands mitigation. Taking a broad approach, a history of wetlands regulation was produced, starting with the 1899 Rivers and Harbors Act and extending through current case law and regulations. This research was published as a chapter in the newly released book "Southern Forested Wetlands: Ecology and Management", edited by Michael G. Messina and William H. Conner. Related articles were published in other publications as indicated in this bibliography, and are attached as part of this final report.

State Wetlands Programs Comparisons.--A comparative analysis of state wetland restoration programs was performed by Bonnie Mullen, who was working on her Master of Natural Resources Administration (MNRA) degree. Mullen examined programs in Florida, Maryland, Massachusetts, and New Jersey--states with existing nontidal and/or freshwater wetland protection programs. Similarities among the states included goals, objectives, utilization of program funding sources, mitigation policies, mitigation ratios, permitting, and regulation. Important differences among state programs that were analyzed included the level of public involvement, the funding sources, and the support for state vs. entrepreneurial mitigation banking. Mullen developed several recommendations for North Carolina, including public involvement (1) to generate local support for the North Carolina Wetland Restoration Program; (2) to provide more public education opportunities; and (3) to monitor selected streams or

watersheds. A pilot program for developing the best compensatory mitigation opportunities also was recommended.

Mullen has since accepted a position with the North Carolina Wetlands Restoration Program, Division of Water Quality. Two manuscripts by Mullen are attached as part of this final report, including (1) her Master's Thesis and (2) an abbreviated summary document with the salient findings and recommendations from the research project.

Mitigation Banking Economic Analysis.--Paul Voigt performed an economic analysis of private wetland mitigation banking opportunities for North Carolina. The study examined the development, construction, and operation of a wetlands mitigation bank. This included an analysis of all the activities associated with the completion of a mitigation bank, from initial planing through the debiting of all credits generated by the bank. This research could be used by the North Carolina Department of Transportation; the North Carolina Wetlands Restoration Grant Program staff; public officials involved in wetlands permitting; and individuals interested in entrepreneurial mitigation banking opportunities.

Under ideal conditions, project planning, agency review, revisions, and a final memorandum of understanding would take two years before site construction could begin in that year. Planting would occur in year three, and if site establishment were

successful, site monitoring and wetland bank credit sales would continue through year 7. The total project expenses for planning, site construction, planting, and monitoring was slightly more than $2,000 per acre, excluding land costs. Land costs would add at least $1,000 per acre in even the most rural counties in the state, and range up to $20,000 per acre in urban counties. Internal rates of return for a wetlands mitigation establishment would depend on the per-acre wetland credit price received. For example, for rural land a per credit price of $4700 would yield annual real internal rates of return of 10%; prices of $6800 per credit would yield a rate of return of more than 20%. Conventional bank loans at 6% real interest rate per annum could make the net present values of the investments much more attractive than self-financing, almost doubling the net returns. Bankers, however, indicated reluctance to underwrite these loans, so venture capital loans at a 50% per annum could be required for such risky investments. These rates would reduce the net present values back to about the same return levels as self-financing. These scenarios indicate that wetland bank creation offers significant opportunities for financial gain, although both biological and policy risks remain significant.

The attached research products developed by Voigt are summarized in (1) a detailed report and (2) an abbreviated manuscript that has just been submitted to a journal for consideration of publication. At the time of the research, Voigt was finishing his Master of Science degree in Agricultural Economics, and was employed as

part-time research assistant. He now works as staff employee at Western Carolina University.

Management Options for Private Wetlands Landowners.--Deborah Gaddis led the component of the research that focused on the possible management options for private wetlands owners. These options include legal protection of wetlands through easements and restrictive covenants; government assistance programs for various conservation treatments including tree planting; and sources for technical assistance. The tax consequences of various management options were discussed, including income tax credits and deductions for conservation easements; property tax breaks for land managed for forestry; the federal reforestation tax credit; and federal/state capital gains treatment for timber income. Special attention was given to North Carolina's new tax credit program for conservation easements.

The research on landowner management options will be used as part of Gaddis's dissertation. Plans for further use include coordination with the North Carolina Cooperative Extension Service to post the material on the World Wide Web and to publish the material in a format suitable for public education and outreach. This research is still being improved. The current version of this private wetlands analysis is attached as manuscript. Gaddis is continuing to finish her research on forested wetlands policy and management.

2. Bibliography of Articles and Manuscripts

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3. Bibliography of Theses and Dissertations

6) Gaddis, Deborah A. 1988. Wetlands protection: management, conservation easements, assistance programs, and other options. Department of Forestry, North Carolina State University. Raleigh, NC. Ph.D. Dissertation. Draft.

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ATTACHMENT 1

State Wetlands Restoration Program Components and Strategies: A Comparative Analysis with Recommendations for North Carolina

Summary of Findings and Recommendations

Bonnie L. Mullen
Department of Forestry
North Carolina State University
Box 8008
Raleigh, NC 27695-8008

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States Winning With Wetlands Programs

With growing concerns over water quality, stormwater damage and wildlife habitat, wetland functions have become increasingly significant over the years. As with most natural resources, our supply is limited, requiring protective actions to ensure we do not overdevelop these once perceived "wastelands." Today, the majority of regulations affecting wetlands are derived from Sections 404 and 401 of the Federal Water Pollution Control Act Amendments of 1972, now known as the Clean Water Act of 1972. In addition to these regulations many states have other regulations, policies and programs which also affect development and conservation in wetland areas. As a result, many states have implemented wetlands restoration and protection programs in efforts to better plan, develop, and monitor mitigation associated with permitted unavoidable impacts of land development.

Because no two states are identical in location, wetland acreage, resources and information, there is no means to discern what an ideal wetlands restoration program should look like. Thus an evaluation of selected state program's components, in Florida, Maryland, Massachusetts and New Jersey was conducted based on program goals, implementation and success. As a new opportunity to satisfy compensatory mitigation requirements within the states reviewed, the mitigation banking component within wetlands programs was particularly emphasized throughout the analysis.

The economic effectiveness of sponsoring and supporting a state wetlands program must guarantee identifiable and measurable results to maintain long term state funding. Thus, the review of state programs which have been established and operated over a number of years could help improve program effectiveness and efficiency within the early stages of a younger program's development. Sixteen criteria were used to summarize selected state program components and strategies, along with seven general categories: Assessment of Existing Wetlands Protection Efforts, Program Goals, Objectives and Opportunities; Mapping Information and Data; Mitigation Policy and Banking Opportunities; Funding Strategies and Use of Accrued Resources, Program Monitoring and Evaluation; and Enforcement (Appendix A). The evaluation of these criteria were not intended to produce the structure of an ideal state wetlands program, or to develop new levels of bureaucracy – rather its intent was to provide a useful framework by which government officials could identify administrative problems early in program development to suggest workable solutions for better achieving state wetland protection

goals. From the evaluation, each of the seven categories will be briefly described followed by a synopsis of similarities and differences among the states reviewed.

ASSESSMENT OF EXISTING WETLANDS PROTECTION EFFORTS

In all of the states reviewed, each has its own enabling act or acts to regulate various activities in wetlands. Unavoidable impacts as a result of permitted activities in wetlands require compensatory mitigation under Section 404 of the Clean Water Act. In addition to the requirements of Section 404, a state or other level of government, may have additional regulatory requirements for impacting wetland areas. Some states have implemented specific environmental legislation to handle wetlands and mitigation regulation, while others may have pieces of legislation or law tacked onto other already established laws. For example, Florida's Environmental Reorganization Act was added to the existing Florida Water Resources Act of 1972 to expand the resource management and regulatory authority of the five Water Management Districts and to include limited power for local governments.

Massachusetts also has similarly expanded the meaning of legislation through adding Wetlands Protection Regulations to the Massachusetts Wetlands Protection Act. Because Florida and Massachusetts have each delegated regulatory permitting authority to local/district levels of government, these levels may also have their own individual/separate by-laws, regulations or rules for accomplishing wetlands mitigation goals.

Other states such as New Jersey and Maryland operate their mitigation and restoration functions around one key piece of legislation. New Jersey's Freshwater Wetland Protection Act and Maryland's Nontidal Wetlands Act are both separate and individual Acts which regulate activities and mitigation requirements in freshwater/nontidal wetlands. Although, this particular analysis was confined to nontidal/freshwater wetland programs, some states also have individual pieces of legislation and programs pertaining to tidal/ coastal wetlands.

PROGRAM GOALS, OBJECTIVES AND OPPORTUNITIES

One of the most important steps in establishing a state wetlands program is to establish strong, clear goals. According to the World Wildlife Fund's *Statewide Wetlands Strategies* book, a goals should: "promote consistency, provide a benchmark for assessing progress, help garner support, provide an underlying purpose for all activities and help transcend changes in leadership"(WWF 1992, p.11-12). States generally implement wetlands restoration programs to remedy problems associated with the

slowness of the permitting process, monitoring small plots of mitigated lands, and the limited success in mitigating small areas. Among the four states reviewed in this analysis, each has its own unique programmatic tools to accomplish restoration objectives. These tools are used to administer, facilitate and measure program success. Some programs have implemented general statewide legislation, by which broad goals are accomplished. As mentioned, other states delegate authority to smaller units of government, which are more familiar with local resources and circumstances. Nevertheless, program goals are accomplished through a variety of measures at numerous levels of government within all the states analyzed.

As a means of developing the best possible goals and objectives for state wetland resources, some states such as Massachusetts have implemented a pilot/"wait and see" approach to implementing program components. By 1998, Massachusetts plans to initiate a three year pilot banking project within its WRBP. This project is meant to test success rates and feasibility of implementing a statewide mitigation banking program in advance of making regulatory or legislative changes. The idea behind testing the strategy and success of the banking tool before implementing it, is unique to Massachusetts.

Similar to Massachusetts, Florida adopted provisions for preconstruction of mitigated lands without specific rules mentioning banks until the State gained more experience. Rules for banking in Florida were not field tested within a limited amount of time, requiring that different test banks be established to determine their appropriateness for the State. Florida did take a "wait and see" approach, although it was never implemented or organized in the same results-oriented manner Massachusetts's program is. More about the banking components and opportunities available in Massachusetts, Florida, Maryland and New Jersey will be discussed in the *Mitigation Policy and Banking Opportunities* section.

In addition, to Massachusetts's pilot banking component, the Wetlands Restoration and Banking Program (WRBP) emphasizes proactive restoration to accomplish strategies through the "Groups Restoring Our Wetlands" initiative. Under this initiative, restoration projects are developed and managed by Wetlands Assistance Teams (WetRATs), composed of volunteers, scientists and members of local communities. WetRATs work to help GROWetlands project sponsors evaluate and determine restoration potential of wetland sites. Through this initiative, local citizens can participate in reinstating their "wetland heritage" within their own communities. Some citizens may be concerned with flooding or water quality issues, others may enjoy wetland's unique scenery and wildlife species. Massachusetts has

promoted this initiative based on the conviction that more can be accomplished to promote wetlands restoration and protection through educating people about what wetlands are, what they consist of, and how to protect and restore them. Through establishing a partnership with local communities, instead of a strict regulatory bureaucracy, the local community is more responsive and involved. Overall, this grassroots effort managed at the State level is setting an environmental precedent by helping local communities understand and participate in resource protection.

As another means of implementing and achieving state goals and objectives, some states have designated trusts/fund type arrangements for promoting restoration, enhancement, creation and preservation of wetland priorities for improving and increasing function and acreage of state wetland resources. If a state or local entity has a fund in place, on an approved basis developers can make payments in-lieu of compensatory mitigation. The accrued resources within these funds are then used to restore or replace lost and degraded wetlands within the state. A state with this sort of mechanism in place will often prioritize wetland restoration needs and purchase private lands or restore wetlands activities on public lands accordingly. This type of mitigation activity usually takes place after impacts have occurred, to achieve economies of scale in acquiring the best restorable land opportunities for the state.

While the idea of a mitigation trust fund does not squarely fit the definition of a mitigation bank, these funds are used to accomplish the same goals a mitigation bank will, only at a state level. While a mitigation bank will generally service a certain watershed or region, this type of component can benefit wetland areas of a state where no banks exist. Some states are currently deliberating over the effectiveness of a trust fund, due to political implications in making mitigation decisions. The fear is that people and government agencies will buy the right to create significant impacts without minimizing impacts, by contributing to this type of fund. Additionally, in some states, decisions in terms of where money is allocated and when a contribution to the fund is an acceptable form of mitigation are controlled by governor-appointed committees, boards or councils. These political appointments may also dilute mitigation decisions in terms of when compensation to such a fund would be appropriate. Massachusetts, in particular, has asserted concerns about this type of in-lieu fee payment system and currently does not have such a program in place.

New Jersey has implemented a trust/fund type component called the Wetlands Mitigation Bank. While this component is termed a "bank" it really serves the same functions as a statewide restoration fund. The Wetlands Mitigation Bank does not buy or sell credits, thus the word "Bank" in its title is misleading. Wetlands Mitigation Bank is administered within the Executive Branch of State Government, by a seven member Wetlands Mitigation Council appointed by the governor. In-lieu fees or donations of land to the State Mitigation Bank are deemed acceptable forms of mitigation by the Council, in consultation with USEPA. Money paid to the Bank must equal the cost of enhancing degraded wetlands to replace values lost for long-term preservation or the costs of creating freshwater wetlands equivalent to those being lost, whichever is less. Upon accruing funds in the Bank, the Council will assess the areas in greatest need of restoration, prioritize them and allocate funds for land acquisition and restoration activities accordingly. To fulfill mitigation requirements through donation of land, the Council must first approve the land for donation as valuable or potentially valuable land for freshwater wetlands ecosystems. Additionally, it is the permittee's responsibility to find a nonprofit or other management organization to manage the site in perpetuity.

Maryland, similar to New Jersey, has a Nontidal Wetlands Compensation Fund in place. Moneys contributed to this fund in-lieu of mitigation are only to be used for creation, restoration or enhancement of wetlands. DEP may also accept donations of land in-lieu of mitigation if deemed acceptable for restoration activities. Maryland may contract with private entities or other public agencies to construct, maintain and monitor these sites.

Currently, Florida does not have a State mitigation bank or fund in place. Payment of in-lieu fees for mitigation may be acceptable if "cash payments are specified for use in a District or DEP endorsed environmental preservation, enhancement or restoration project and the payments initiate a project or supplement an ongoing project" (St. John's River Water Management District 1995, p.81). Moneys generated in this fashion must be used for wetland improvements within the same watershed or "area" of impacts (Lowe, 5-7-97).

MAPPING INFORMATION AND DATA

An important component of actually implementing wetlands goals and objectives centers around an agency's abilities make decisions based on on-site and regional impacts. Without this information, agencies could be making blind decisions, ultimately hurting long-term watershed productivity. To

address these concerns, most states organize information for their programs by watershed. Watershed plans help identify and prioritize degraded wetlands for restoration activities. These plans also help identify where mitigation banks would most beneficially serve the needs of the watershed. Watershed plans are generally developed and updated by districts, local governments, and in some cases by the states, within mitigation programs.

In Massachusetts and Maryland watershed plans are not currently required. Massachusetts has already initiated some planning for the proactive restoration of wetlands, however pilot bank approval is contingent upon watershed plans existing within any proposed watershed for bank operation. In addition, the bank sponsor will incur the responsibility and costs of developing such plans for the watershed, if they do not already exist. These plans will then be approved by the State and adopted for the watershed. On the other hand, Maryland's regulations leave development of watershed management plans up to local governments. Maryland does encourage development of such plans, however does not require them.

On the other hand, Florida does require watershed management plans. Florida's Water Management Districts are required to implement these plans, however the Districts can delineate watershed boundaries according to their own specific needs. For example some Districts with less developmental pressure will adopt larger watershed boundaries, while Districts with more developmental expansion will adopt smaller watershed boundaries.

In a state as over-developed as New Jersey, watershed plans, due to their limiting scope are impractical. Instead, the U.S. Geologic Survey (USGS) is implementing drainage basin plans covering numerous watersheds based on the Federal Guidance for Mitigation Banking's eight digit hydrologic codes. Currently USGS has established 13 drainage basins in the State. Because New Jersey has assumed the Section 404 program, the federal government is managing wetlands units according to the Federal Guidance, by which the Council must comply in assessing impacts for mitigation and available opportunities.

MITIGATION POLICY AND BANKING OPPORTUNITIES

To regulate permitted impacts and assign mitigation requirements, all states have their own specific policies and regulations regarding amounts of mitigation required for unavoidable impacts. and how mitigation will be accomplished. Usually state mitigation policies can be found in Section 401

requirements and sometimes in wetlands restoration program goals and objectives. State compensatory mitigation ratios will often be assigned based on the type of mitigation practice proposed or required and/or the type of wetland to be impacted.

Required compensatory mitigation for permitted impacts can be accomplished in a number of ways. Creation, restoration, enhancement, and in some cases, preservation are all types of compensatory mitigation. States will generally prioritize mitigation ratio requirements depending on what type of mitigation activity is being undertaken. Accordingly, states define the preferred method of compensation, awarding that type of mitigation the lowest mitigation ratio. These preferences are similar among states, as will be discussed later. On a case-by-case basis some states allow in-lieu fee payments to a state trust or fund type of mechanism to the take place of actual compensation by the permittee. In addition, as a key reason for implementing state wetland programs, incorporating a banking component to permit the operation of private and public mitigation banking, can help a state achieve long term restoration goals. Through awarding bank permits, states with banking components regulate and monitor mitigation banks and banking activities to ensure compliance and to achieve state wetlands restoration goals.

Mitigation banks are generally large tracts of land, in which creation, restoration, enhancement and/or preservation activities take place for the benefit of permittees needing to compensate, off-site, for permitted impacts. The banking system works similarly to a regular checking account. Wetland values at the banking site are assessed initially and throughout different phases of the bank's development to assign various amounts of available credit. These credits, much like deposits into a checking account, are put into a "bank account." Mitigation credits are assessed and assigned based on a number of valuation methods. Habitat Evaluation Procedures, developed by the U.S. Fish and Wildlife Service, Wetland Evaluation Technique, and Hydrogeomorphic Modeling, are all example methods used to assign credits based on wetland values and functions. Credits are then withdrawn as debits from the bank account, as permitted impacts require mitigation.

Bank credits in all the states reviewed are released, for use or sale, on a success/developmental phase basis. The state agency administering the wetlands restoration program within the state will perform an initial assessment of existing values and will in some cases release some credits prior to

meeting defined success criteria. Then, as mitigation success occurs with apparent replacement of defined functions and values, on a phase-by-phase basis more credits will be released.

Over time, as credits are exhausted from bank accounts, states generally require easements or transfer deeds to turn mitigated land over to the state, federal government agency or an approved nonprofit group or organization to perpetually manage the land for intended wetland function and use. Generally, the state will make the determination in terms of where the land will go. Of all the states reviewed each had specific requirements for bank permits with stipulations for including long-term funds and/or legal mechanisms to ensure long-term management of the mitigated area. If for some reason a bank failed to accomplish its agreed upon goals, or breached its bank permit conditions, the management of such an area would be immediately turned over to the state and arrangements would be made to assure compensatory mitigation for credits already sold took place. As punishment for violations and breach of rules, states can also freeze bank credits until banks come back into compliance, and issue penalties.

The objective of a mitigation bank is to restore unavoidable biological and physical impacts and losses for long-term functional and ecological benefits of wetlands. Banking provides a larger area, aggregating a number of replacement activities for small impacts better serving wetland functions. Wetlands mitigation banks best serve small project impacts in which on-site mitigation is not feasible. These "small" impacts on an individual basis may not be substantial, however, over time as more impacts occur within an area, cumulative impacts could be significant. Banking provides a viable alternative to small ad hoc mitigation practices. Banks also normally provide mitigation before the wetland impact or loss ever takes place. This aspect of utilizing a bank for compensatory mitigation helps relieve uncertainty and success concerns for mitigation impacts and losses. In these instances, off-site mitigation through use of a mitigation bank may be more amenable for long-term function replacement purposes.

On the other hand, there are some concerns about using mitigation banks. While the idea of aggregating small impacts may replace watershed functionality better, depending on the location of the bank, these benefits could be poorly situated. Furthermore, due to the relatively new technology involved in restoring, creating and enhancing, the effectiveness of these mitigation practices for some wetland types is still being tested. There also are concerns about politics and whether implementation of

a banking component will weaken the sequencing process. Finally, implementing a banking component may further diffuse agency responsibility, causing diversions from other permitting and wetlands protection tasks. Overall, because mitigation banking is a fairly young concept, methods of banking and government frameworks to incorporate a banking component will continue to be evaluated.

There are two basic categories of mitigation banks. "Dedicated Banks" are banks which are usually sponsored by one user or group for the purposes of mitigating future permitted impacts caused by that sponsor. These banks are usually operated by government agencies such as departments of transportation. The second general category of bank types is "Commercial Banks." These banks are generally operated by entrepreneurial private bank sponsors for the purposes of selling credits. Payments made to these banking entities are in-lieu payments, taking the place of the permittee actually performing mitigation practices (Reppert 1992, p.3). The definition for what a public and private bank is varies depending on the state, and will be discussed later.

To better develop the background for the recommendations of this analysis, each state's program chosen for this analysis will be briefly described in terms of its mitigation policy and banking component features.

Maryland

Maryland's mitigation policy has a "threshold requirement" for requiring mitigation. The threshold is determined by Maryland Department of Environmental Protection (DEP) and generally requires that impacts be reduced to less than 5000 square feet. If impacts for a permit proposal exceed the threshold, DEP assigns a mitigation reviewer to work with the permit reviewer. Mitigation proposals are reviewed concurrently with avoidance and minimization. Mitigation strategies could include creation, restoration, enhancement, and utilization of a mitigation bank or monetary contribution to the Maryland Nontidal Wetlands Compensation Fund, on a case-by-case basis. Maryland has its mitigation requirements written directly into State statutes.

Mitigation ratio requirements in Maryland are based on the type of wetland impacted given that restoration and creation practices will be proposed or required in almost all cases. Furthermore, Maryland requires extra mitigation if a bank is utilized. For example impacts to emergent nontidal wetlands require one acre of mitigation for every acre lost, however if a bank is utilized, 1.5 mitigated acres are required for every one acre lost. Maryland only allows banking by public/governmental and

private sponsors on private lands. For all permitted impacts, a minimum of 1:1 (e.g., acreage to be mitigated to acreage lost) "in-kind" mitigation through creating, restoring, or enhancing wetlands is required. The term "in-kind" according to Maryland Statutes means "characteristics closely approximating those of a nontidal wetland before it was adversely impacted by a regulated or an agricultural activity" (Md. Regs. Code tit. 08 § .05.04.01 (1994)). Restoration mitigation activities are preferred, yet because there are so few restoration opportunities in Maryland, mitigation generally takes the form of creation.

Maryland also has special mitigation provisions for agricultural and forestry activities occurring in nontidal wetlands outlined within State statutes. Provisions for agricultural impacts could include, creation or restoration of emergent, scrub-shrub, or forested nontidal wetlands or enhancement activities. If an area is logged, to be exempt from mitigation requirements, the area logged must be returned to forest, otherwise more specified mitigation requirements will apply. Maryland is the only state of those reviewed which spells out specific mitigation requirements for these activities within program requirements.

Timing and success standards are also applicable to all mitigation activities. Maryland DEP has its own specified success requirements to decide if mitigation activities will accomplish replacement goals. Components considered in making these determinations include: long-term success, location of and type of proposed mitigation, impacts created by mitigation activities, and how compatible the activity is with watershed management plans, if they exist within the watershed being mitigated.

Different from the other states reviewed, Maryland does not separate wetlands bankers from general mitigation requirements. Requirements for financial assurances and long-term maintenance of mitigated sites for permittees, public agencies, and bankers performing mitigation practices are all basically the same.

Wetland bankers are required to acquire bank permits and submit annual reports to DEP every year for five years or until all credits are sold, whichever is later. After the five year period, or all the credits in a bank are sold, Maryland relies on nonprofit organizations and stewardship programs to help monitor activities on mitigation sites. Responsibility for long-term maintenance of a bank is flexible in Maryland. Land could go to a nonprofit organization, governmental agency or DEP depending on the circumstances, and what DEP feels is best for the mitigated nontidal wetland.

New Jersey

In New Jersey, compensatory mitigation requirements may be accomplished through restoration, creation, enhancement or donation of land and/or money to the State Mitigation Bank or other approved public or private entity. New Jersey also adds a special twist to the general definition of restoration, defining it as actions to restore a site to preactivity condition, within six months of the regulated activity. Most states do not attach time limits to mitigation type definitions. Unlike Maryland, mitigation proposals for any project submitted to New Jersey Department of Environmental Protection (NJDEP) are reviewed separately and subsequent to permit approvals. After a mitigation proposal is approved, mitigation activities must begin before or during project activity initiation. If creation and/or enhancement are utilized by the applicant or if the approval of the mitigation proposal requires one of these mitigation types, a conservation easement must be signed assuring that no regulated activities will take place on the tract of mitigated land.

Unlike Florida, Maryland, and Massachusetts, New Jersey bases its mitigation ratios solely on the type of mitigation activity performed. Restoration, creation and enhancement are all acceptable mitigation types, although restoration is preferred. Allowances for preservation to fulfill compensatory mitigation requirements are made on a case-by-case basis, but generally require the highest compensatory mitigation rates. NJDEP also stipulates that wetland impacts to coastal, brackish, tidal and nontidal freshwater wetlands must be replaced by the same type of wetland.

Permittees may also participate in private banking to fulfill their mitigation obligations only after all other opportunities to compensate for impacts have been exhausted. Restoration is the preferred method of mitigation followed by creation, enhancement, and preservation. Additionally, to utilize a mitigation bank, the bank's location must be within the same drainage basin as the one in which the impacts occurred. Finally, as previously mentioned, the type of wetlands impacted must correspond to the wetlands mitigated, even if an off-site bank is utilized to fulfill mitigation requirements.

In New Jersey, anyone can apply to operate a mitigation bank. Types of mitigation banks approved include both public and private banks. However, the definitions of these bank types are different from those in other states. In New Jersey a private bank is "one that is established by a public or private group, and will only be used by the applicant" (NJDEP 1995, p.2) On the other hand, a public bank is "one that is established by a public or private entity, and is open for the general public to

purchase credits from the bank" (NJDEP 1995, p.2). Different from the other states reviewed, New Jersey defines banks by who would use a bank, instead of who would run it.

To operate a mitigation bank in New Jersey, the applicant for a permit must make sure all the appropriate jurisdictional delineations, long-term maintenance and construction funds, and deeds of transfer are all in place before the Council will make a determination for final approval of the bank permit New Jersey also stipulates that banks be a minimum of five aces in size. The Council must determine if, based on the proposed goals and replacement activities of the bank if at least "85 percent real coverage for each zone (emergent, scrub/shrub and/or forested wetland zones) of the mitigation plantings" will survive for a minimum of three years to succeed in their intended function. N.J. Admin. 7:7A. After all this information is completed and reviewed, upon approval, the Council will adopt a written resolution called a "Mitigation Banking Instrument," for how the bank will be established and operated.

Florida

In Florida, depending on whether the State or District is permitting an activity, the mitigation ratios, and types of acceptable mitigation will vary. Florida uses a seven item public interest test to assign mitigation ratios for permitted projects. The State does not use a rigid wetland type or mitigation type format to make mitigation ratio assignments as other states do. Instead, on a case-by-case basis, the public interest test serves to reveal which habitat productivity factors an applicant has to mitigate. This mechanism will also help Florida's Department of Environmental Protection (DEP) assign an appropriate mitigation ratio.

Florida's quasi-governmental Water Management Districts operate similar to the Mitigation Council appointed in NJDEP, although regulatory authorities are arranged differently. Florida's Districts operate on a much broader scale than New Jersey's mitigation focused Council, although in terms of mitigation decisions, they operate quite similarly. In Florida, mitigation requirements can vary across District boundaries.

Similar to Massachusetts, most Water Management Districts in Florida assign mitigation ratios by the type of wetland impacted and method of mitigation. In particular, the St. John's District and Massachusetts both utilize a range of listed mitigation ratios including minimums and maximums for each mitigation assignment. Variability among ranges for different types of mitigation "is based on degree of improvement in ecological value expected from each type" (St. John's River Water

Management District 1995, p.81). For example, if creation or restoration practices are selected or required to fulfill mitigation requirements for impacts in a Mangrove Swamp, the mitigation ratio could range from 2:1 to 5:1, depending on loss of wetland functions. Acceptable forms of mitigation include restoration, creation, enhancement, and on a limited basis, preservation. In the instance that a local government, District and the State should disagree on appropriate mitigation requirements and methods of accomplishing mitigation, the State's decision will always prevail.

Florida's rules, applicable to all Districts with banking programs, allow operation of both public and private banks. Different from New Jersey's definitions of these bank types, Florida considers public banks, as banks initiated by public entities (e.g., governmental/public agencies). Private banks are considered to be banks operated by private bank sponsors, i.e. companies, individuals, or groups. Anyone can apply to establish a bank in Florida, where a District has a program to accommodate such an entity. Similarly, anyone meeting DEP and/or District requirements to utilize a mitigation bank can do so on an approved basis. In other words, private entities can buy credits from public or private banks, or vice-versa. Additionally, public and private banks can buy credits from each other.

To utilize a mitigation bank, the impacts of the permitted activity must occur within or partially within the bank's Mitigation Service Area (MSA). A Bank's MSA, is defined by local ecological and hydrological conditions and can encompass an area smaller, larger or equal to a watershed. In addition, much like other states, Florida and its Districts with banking programs require delineations, long-term financial assurances, credit schedules, surety bonds, etc. for consideration of a bank permit. However, different from Maryland's $20,000 per acre, Florida's financial assurances, whether a surety bond, or other form of assurance, must be equal to 100 percent of the total cost of restoration before any credits can be sold.

Banking partnerships in Florida are somewhat different from those in the other states reviewed permitting mitigation activities on public lands. Under the public land banking arrangement in Florida, a private bank would restore a public lands area to an improved wetlands status, selling credits to developers, with the city eventually taking over long-term maintenance activities. Under this sort of set-up, the banker would pay "the city $1000.00 per acre for an escrow fund to maintain the site, plus another $8,800 for a performance bond to guarantee that the work is completed satisfactorily" (Redmond 1996, p.61). Florida allows private and public bankers to establish banks on public lands.

While banking activities on public lands seem to design a sort of win-win scenario, there are many concerns about disproportionate economic advantages. Because there is no overhead involved with property acquisition, public land banking is cheaper for bank sponsors, allowing them to sell credits for less, distorting the competition. Because of these concerns, Florida has recently implemented a one year moratorium for private banking on state lands until this discrepancy is resolved.

Massachusetts

In Massachusetts mitigation is required for almost all fills less than 5,000 square feet. While Maryland does not require mitigation if impacts are reduced to within 5,000 square feet, Massachusetts's mitigation policy is much more stringent. Massachusetts also requires that mitigation occur at least within close proximity of impacts such that "at least 75% of the surface of the replacement area shall be reestablished with indigenous wetland plant species within two growing seasons" (Mass. Regs. Code tit. 310 § 10.55(4)(b) (1994)). Much like the state of New Jersey, success of vegetation is very significant in weighing whether mitigation will be successful.

After project proposals have been through the sequencing process to avoid and minimize, if compensatory mitigation is required, a mitigation ratio will be assigned. Similar to Florida, Massachusetts's uses the type of wetland impacted with the intended or required practice of mitigation to assign a mitigation ratio from a specified range. Massachusetts has a base mitigation ratio established for each mitigation practice as the minimum ratio requirement in addition to a maximum, depending on functional loss associated with impacts. For example, if compensatory mitigation is required for coastal marsh impacts through the practice of creation, the Mitigation Banking Review Team (MBRT) can assign a ratio ranging from 2:1 to 3:1.

After a mitigation ratio is assigned, the WMRT will determine if on-site, off-site or a combination of both is appropriate to fulfill mitigation requirements. If off-site mitigation is deemed acceptable by the WMRT, restoration must take place "at a priority wetlands restoration site identified in a Watershed Wetlands Restoration Plan adopted by the Wetlands Restoration & Banking Program" (WRBP) (WRBP-AC. p.30). Because mitigation can be required by local governments, conservation commissions and the State, if a conflict in determining appropriate mitigation requirements occurs, Massachusetts has a set appeals process in place. Generally the State's decision will prevail, however decisions can be appealed in court.

Differing from other states, Massachusetts defines two types of restoration, "RI" and "RII," with no reference to an enhancement mitigation type. Restoration activities in Massachusetts are preferred for compensatory mitigation practices. Massachusetts defines "RI" Restoration as "putting back a wetlands where one previously existed but where no wetland presently exists" (WRBP-AC, p.18). "RII" Restoration is defined as the practice of "improving functions of a degraded wetland," which most states consider enhancement. The definition of creation is the same as other states reviewed, embodying the process of creating a wetland where none previously existed.

During Massachusetts's pilot banking project "functional assessment methods, types of restoration, monitoring approaches, and other variables" will be tested and evaluated for effectiveness (WRBP-AC 1995, p.21). The WRBP's Wetlands Banking Advisory Committee in coordination with the Mitigation Banking Review Team will choose banks to participate in the pilot banking program. The Committee will approve at least one private bank, one public bank, and no more than one bank per watershed. Preference will be given to banks implementing restoration practices over those implementing creation practices. The Advisory Committee will review the performance of approved mitigation banks and submit an annual report to the Secretary of Environmental Affairs.

FUNDING STRATEGY AND USE OF ACCRUED RESOURCES

The success of a wetlands restoration program significantly relies on funding resources from various avenues. Furthermore, without funding, legislation and regulations to protect wetland areas are basically useless without people and resources to implement them. Of all the states reviewed, most programs were based on general revenues allocated by their respective legislative bodies, in addition to some funds from various awarded federal grants. States also receive some funding from penalty fees assigned for noncompliance actions and activities.

Currently, Maryland, New Jersey and Florida's State Programs each receive the majority of their funding from general revenues appropriated by their state legislatures. Maryland has always been funded by state revenues in addition to grants for 319 Water Quality Improvement. On the other hand, New Jersey's program began on fee-generated revenues and later moved to state general revenue support. Before receiving state support, monthly financial fluctuations had significant bearing on New Jersey's program functions and levels of functional consistency. While financial shortcomings of the program have gained some legislative attention, much more is needed. Currently. the Wetlands

Freshwater Protection Act program under the Land Use Regulation Program is managed by only two state employees.

Maryland and New Jersey also have funding mechanisms in place to promote and fund state restoration, creation and enhancement activities, as mentioned earlier in this analysis. New Jersey's Wetlands Mitigation Bank and Maryland's Nontidal Wetlands Compensation Fund both accept in-lieu fee payments as compensatory mitigation, based on agency approval. While these funds do not support wetlands programs or state employees directly, they do help carry out program objectives. Maryland's program currently employs 40 to 50 state employees to handle all water permits, evaluations and follow-ups regarding mitigation requirements.

On the other hand, Massachusetts's program is supported mostly on federal and state grants, with some agency support. The project manager for the pilot banking project under the Wetlands Restoration & Banking Program (WRBP) is sponsored by the Massachusetts Executive Office of Transportation and Construction and the Corps/New England District.

Because the pilot project will serve to benefit the State and wetlands banking sponsors, sponsor funds are also a chief source of program support. Because of limited state funding, bank sponsors are expected to incur many of the costs of research, set-up, planning, auditing and monitoring at least until the pilot period is over. Without this foundational backing, future mitigation banks in Massachusetts may never develop.

Florida's state program is supported by general revenues, however Florida's five Water Management Districts, managed and operated by governor-appointed boards, use a tax scheme to generate funds. Each of the five Districts has ad valorem taxing authority within their respective Districts. The Districts also have the authority to issue penalties for noncompliance with regulations and rules, although penalty fees are not their chief source of funding support. The individual Districts do not receive any general revenues from the State for operation of wetlands programs unless a grant for some specified activity or project is awarded.

PROGRAM MONITORING AND EVALUATION

Monitoring and evaluation of program activities and functions helps to expose weaknesses and idiosyncrasies in program operation and management tactics. Through implementing evaluative components within state programs, state goals can be measured. Furthermore, results of program

evaluation can be used to account for program success, and potentially program dollars. Conversely, if program goals are not adequately being reached, evaluation will show need for modification of program components and/or strategies for achieving state goals.

Generally, states evaluate and monitor success through reports, on-site inspections, and permit tracking. Of all the states reviewed, each has its own computerized permit tracking system or database to monitor individual mitigation projects and mitigation banking progress. The information organized in these formats is generally shared among different state, and sometimes federal agencies for regulatory purposes.

To ensure and record success of various mitigation projects, most states have reporting requirements in place. In Massachusetts, pilot bank sponsors are required to submit quarterly reports to the WRBP. These reports will then be reviewed to measure success between defined goals and activities. The WRBP hopes to use these reports to help justify the need for a statewide mitigation banking program after the pilot phase is over.

New Jersey's program also requires annual reports from all approved banking entities until all the credits are used up or until the land of the bank is donated. Maryland has a similar reporting requirement in place, requiring annual reports for five years, or until all credits are sold, whichever is later.

Florida has reporting requirements in place for District banks and/or State banks. Essentially, these entities are responsible and accountable for the sale, transfer, or use of mitigation credits from their banks. Because the St. John's Water Management District was the only District reviewed, with no current banking program in place, no reporting requirements currently exist.

In monitoring, measuring and accounting for success on individual banking sites, all states reviewed used wetland functionality and state-developed success criteria to evaluate projects and bank success on a phase-by-phase basis. New Jersey uses the *1989 Jurisdictional Wetlands Manual* for evaluating bank success in replacing functionality. In Florida, DEP in conjunction with Districts, writes the success criteria for Florida's banks.

In addition, Massachusetts's DEP and New Jersey's DEP each have, or have had, overall program reporting requirements. Massachusetts's pilot project experiences will be submitted in a report with an evaluation of success and recommendations to the Massachusetts General Assembly at the end of the three year pilot period. Tentatively, this report will be submitted in 2001, since the initiation of the

pilot bank program is anticipated to begin in mid-1998. New Jersey's DEP was also required to submit a report to the New Jersey General Assembly on the first five years of program performance, successes, failures and expenditures. The other two states analyzed did not have specific requirements in program legislation, program components or regulations mentioned to require reporting to their respective legislative bodies.

Maryland measures mitigation success through assessing the difference between wetland acreage lost and acreage gained through mitigation and other efforts. The amount of permits issued on a yearly basis is also used to assess Maryland's program success. The goal is to reduce the number of permits issued over time and to streamline the process for issuing permits for regulated activities.

Massachusetts plans to measure program success through field testing and evaluating various banking types, practices and methods of assessment. Other than Massachusetts, none of the other states reviewed had specified pilot phases, or feed back/evaluative mechanisms in place prior to official program initiation.

ENFORCEMENT

How successful a wetlands restoration program is can depend on enforcement of program regulations and rules. Compliance with mitigation standards and objectives is necessary to achieve program goals. Furthermore, without penalties and noncompliance oversight, program regulations and requirements will not be taken seriously by all program participants. Enforcement is another form of program and participant accountability for achieving state goals for wetlands restoration.

In Florida, enforcement is handled at State and/or District levels, depending on the type of regulated activity causing wetland impacts. The issuing of penalty fees is often triggered through the permit tracking system notices or on-site inspections revealing noncompliance.

In New Jersey, DEP is the chief enforcer of program regulations and requirements. Violations and penalties may be issued for noncompliance with rules, regulations or permits or orders. DEP is authorized to issue penalty fees up to $10,000 per day for violations if the Federal Water Protection Act is breached. The permit tracking system in this state is also used to trigger penalties for noncompliance.

Massachusetts has empowered citizens, conservation commissions, police authorities and DEP employees to help enforce mitigation requirements. At any time any of these enforcers can report noncompliance activities or concerns to DEP's regional offices.

In Maryland, DEP has primary responsibility for enforcing mitigation requirements and regulations. DEP can also issue civil and criminal penalties for various illegal actions according to Maryland's laws and regulations. Of all the states reviewed, Maryland seems to have the most in-house manpower to regulate and enforce permit compliance.

RECOMMENDATIONS

****State wetlands restoration programs should integrate a proactive component to generate local support from environmentally concerned, active citizens. This approach could help educate the public; generate local interest and support; expand the levels of program enforcement; and help identify potential restoration sites.***

A proactive, grassroots component of wetlands restoration programs, integrating the public in wetlands restoration, could change the way resource protection is viewed across the nation. Such an initiative could promote and possibly hasten reaching long term goals for wetlands protection. As in Massachusetts, "Wetlands Restoration Assistance Teams" (WetRATs), consisting of various scientists with experience and/or expertise in wetlands, could be recruited. These groups would lead local groups of active citizens such as "Groups Restoring Our Wetlands" (GROWetlands). The WetRATs would perform initial evaluations of wetlands sites to assess restoration potential. After a site is located, the WetRATs could collect information on reference (maximally ideal/model) wetland sites and potentially help with restoration/creation design and monitoring of a chosen site. This initiative could work similar to the way locally sponsored "Adopt-a-Stream" improvement projects work, allowing local groups to "Adopt-a-Wetland." After a site is located on (private land with permission or public/state owned land), local sponsorship of project supporters (i.e., local businesses, clubs, citizen groups, etc.) could be recruited. At the time adequate funding is acquired, the sponsor(s) and the state wetlands restoration program could work together to develop a work plan for the site to get GROWetlands involved.

Developers and farmers could form partnerships with environmentalists and demonstrate their commitment to resource protection through financially supporting these efforts. This initiative could also provide a local outlet for citizens to understand and participate in water quality and stormwater protection efforts. Furthermore, those interested in unique aesthetic and species values of wetlands will also have an opportunity to participate. This initiative, in establishing greenways and preserved pristine sites, could provide live learning laboratories for school children to experience and understand the significance and

role of wetlands in our human and environmental health. Members of GROWetlands and WetRATs could help advocate and promote these efforts through local school systems.

In addition to providing local opportunities for active citizens and bankers, this initiative could also help with program enforcement. Because staff are often limited within these types of state programs, a knowledgeable citizen base could assist with various enforcement efforts. While wetlands restoration programs are generally nonregulatory programs and enforcement is generally handled by the Corps, this sort of effort could provide another opportunity for local citizens to participate in resource protection. A wetlands protection hot-line could be established for citizens to call for reporting potential illegal/noncompliance activities. Knowing neighbors are knowledgeable through this type of "citizen watch" component, makes bank sponsors and developers more aware of their accountability. In addition, this effort could help issue penalties, and correct problems quicker, again helping to better and more efficiently achieve Wetlands Restoration Program goals.

Furthermore, permitted private banking entities within the vicinity of proactive restoration efforts could be required to assist with the design, development, oversight and monitoring of such an initiative. Since bank sponsors are beneficiaries of the insight and experience gained from such efforts to identify potential restoration sites and effective restoration/creation methods, private bank sponsors should be required or strongly advised to participate in this type of effort. This kind of experience will be invaluable in helping to determine what will and will not succeed within a given type of wetland. In addition, this type of initiative, offsets purely entrepreneurial motives, and allows local citizens to build trust in resource protection efforts.

Public land banking through allowing private bank sponsors to bank on public lands should be incorporated into wetlands restoration programs bank permitting to help achieve program goals and purposes.

Because restoration, creation and enhancement activities can be quite costly, allowing private development of a bank on public lands offers an opportunity for wetlands on State/public lands to be restored at minimal costs. This partnership describes a "win-win" situation in that bankers assume the costs of restoration and maintenance in addition to fiscal and legal liabilities of the restored land. On the other hand, the state and/or local government gets restored wetlands with picnic areas, nature trails, and expanded recreational and educational opportunities at minimal costs. Florida has public lands banking partnerships currently in place.

A typical example of the public lands banking partnership exists in Pembroke Pines, Florida. Florida Wetlandsbank, a private banking entity, has a licensing agreement with Pembroke Pines to restore an area infested with exotic species to its original mix of Everglades species. The licensing agreement stipulates that "The bank is responsible for designing, permitting, and constructing the ecosystem and pays the city $1,000 per acre for an escrow fund to maintain the site, plus another $8.800 for a performance bond to guarantee that the work is completed satisfactorily" (Redmond 1996, p.62). Restoring this area's original plant species types is hoped to attract wading birds and other wetland wildlife to the improved habitat. Under the agreement with the city, the bank has consented to restore the land, sell credits as awarded by the State, and maintain the land for five years after restoration development is successful and all credits are sold. After the five year period, the city will take over maintenance of the park/site.

One of the disadvantages of this type of partnership is the unfair economic advantage it currently gives bankers enabling them to sell credits at cheaper rates. Because there is no overhead cost involved in acquiring the actual property to mitigate, bankers are able to pass savings along to clients in the form of cheaper rates. Bankers developing private lands are claiming that this type of state endorsed arrangement is unfair economic competition. Due to these concerns, Florida has currently placed a moratorium on all proposals for banking on public lands until more precise rules regarding this arrangement can be implemented. According to Ann Ertman, an Environmental Specialist working in Florida's State Program, a "State Lands Rule" is soon to be approved. Requests For Proposals (RFPs) to bank on state advertised public lands would be submitted by interested banking entities to the State for review. The State Department of Environmental Protection (DEP) would then review and evaluate the banker's intentions, methods, expected profit quotient and past experience with regard to the proposal. After considering all RFPs for a public lands area in need of restoration, the will make a final decision and grant a permit to one bank.

To even the mentioned unfair economic advantage of not having to purchase property, DEP is considering implementing a banker's fee based on a formula associated with the appraised value of the public property advertised by the State. The money acquired through these fees would be held in a trust fund to improve other State lands on an as needed basis, much like funds/trusts mentioned in New Jersey, Maryland. Because all State lands in Florida are managed by a Board of Trustees appointed by

the Governor, the Board would have decision-making authority in terms of how money would be invested.

A similar set-up could be easily incorporated into other state's existing plans to permit private/public agency operated banks on private lands. After receiving and considering RFPs for prioritized wetlands, a bank could be permitted on public lands. Improving surface water quality and incorporating greenways and educational/recreational uses within restored riparian/wetland areas could be defined in agreements with banks to improve public access and benefits. Because these are "public" lands, GROWetlands and WetRATs could also become involved in various aspects of restoring these sites for various public benefits. Instead of requiring an appraised value of property based fee, the programs could slightly decrease the value of credits on these lands to help even the competitive advantage of not having to purchase lands. This set-up would mean that the same work, development and maintenance would be expected of the mitigated site, only at slightly less economic value to the banker. Again this expands the opportunities for public, private, state regulatory and nonregulatory and political levels to coordinate efforts for achieving common wetland goals. On the other hand, states could implement an appraised property value formula, similar to Florida.

A *Pilot Program or "phased" implementation (i.e. Massachusetts) may have merits for identifying and implementing the best compensatory mitigation opportunities for a State.

Currently, wetlands restoration/creation projects have such low success rates that a trial period of incorporating various mitigation practices, bank types and arrangements, methods of assessing, reviewing and developing various types of wetlands for multiple functions and values may be the safest way to implement statewide wetland "improvement" strategies. Through field testing the program in advance as in Massachusetts, rules for banks, in terms of what is best for a particular state's scenario could be implemented, in place of making potentially costly adjustments later. Various types of banks could be permitted on a limited three year basis to test their effectiveness for determining restoration, creation and enhancement success to adequately compensate for permitted impacts. While a three year period may not be enough time for complete restoration of a site, judgments concerning the stages of progress, over this period of time, could adequately be made. Phasing-in such implementation may prevent many problems. While this adaptive management approach offers no guarantees in terms of success rates, it does provide a more accountable record for allocating a large amount of state funding

for a statewide wetlands banking program. Before opening permitting opportunities on a large scale across the state, pilot mitigation banks could be permitted within each riverbasin to test effectiveness of various mitigation options on different wetland types.

This recommendation suggests that a "learning curve" could be established to work out discrepancies in program strategies prior to making legislative and regulatory changes. The legislative process is grueling enough to gain legislative authority and program funds. If further legislative or regulatory changes are needed to accomplish program goals and objectives because of various failures or inadequacies, the entire program could lose credibility or funding.

RECOMMENDATIONS FOR FUTURE RESEARCH AND CONCLUDING REMARKS

Because mitigation banking is such a new technique and state programs are so young, much research is needed in both scientific and administrative arenas. Restoration, creation and enhancement techniques are still being tested on various wetland types to acquire the "perfect" ingredients for building a particular wetland setting. Furthermore, how various states handle these banking entities through permits, banking instruments, scheduling and timing of credit releases and how well sites are monitored for success needs refinement and further research. Assessment techniques utilized to determine wetland values and formulas used to assign credits to bank sponsors are other components yet to be perfected within any state setting. In addition, the Federal government's involvement in setting laws and national standards across all states is another area meriting future examination. Finally, more research is needed on how to prevent duplicative and conflicting efforts among governmental and nongovernmental levels in better promoting wetland and water quality improvements for the maximum ecosystem benefits.

The effectiveness of segregating various "classes" of activities with separate mitigation requirements as Maryland has for agricultural and forestry activities needs further review. Furthermore, the overall effectiveness of assigning mitigation ratios based on wetland type and/or wetland mitigation practice is also an area of inconsistency among states which needs research.

Overall, as with any newly applied science, the merits of mitigation are still being tested and analyzed. Due to widely variable wetland types, hydrological, soil and vegetation conditions, wetland science is difficult to condense into a standardized format. Similarly, due to variable state wetland

acreages and resources and local and state programs and authorities, state wetland programs do not fit into any standardized mold. Because there are so many external factors which influence how government acts and wetlands function, it is difficult to prove any one strategy outside of one specific state or wetland type. Currently, scientific assumptions are a large part of what is expected to succeed. For this reason, wetlands and their mysterious qualities should continue to be studied. Federal and state agencies, universities and research institutions, and private entities are all a part of this effort to master an acceptable level of information so that programs and wetland science can more accurately manipulate sites for success and maximum public and ecosystem benefits.

ATTACHMENT 2

An Analysis of the Costs of Development, Construction, and Operations of a Wetlands Mitigation Bank in North Carolina

Paul C. Voigt
Frederick W. Cubbage

Department of Forestry
North Carolina State University
Box 8008
Raleigh, NC 27695-8008

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

AN ANALYSIS OF THE COSTS OF DEVELOPMENT, CONSTRUCTION, AND OPERATION OF A WETLANDS MITIGATION BANK IN NORTH CAROLINA

PURPOSE

This component of the research project entitled *Forest Wetland Restoration, Enhancement and Protection in North Carolina: Legislation, Economics, and Policy Alternatives* seeks to estimate all costs associated with the development and implementation of an entrepreneurial wetlands mitigation bank in North Carolina. The findings of this research may also be used to examine the costs associated with tools other than entrepreneurial mitigation banking for the restoration of wetlands in North Carolina. These alternate tools for wetlands restoration in North Carolina include the North Carolina Wetlands Restoration Fund (an in-lieu fee system) and, potentially, public-commercial mitigation banks sponsored by the state. As there exist many types of wetland restoration, as well as many variables regarding mitigation banking in general, this analysis has included multiple assumptions regarding these variables in order to estimate the associated costs more accurately. A detailed description of these variables and assumptions is provided in the following discussion.

METHODS AND DATA

At the time of this research, there were no entrepreneurial wetlands mitigation banks in operation in North Carolina. Therefore, cost estimates for the tasks involved in

developing and operating such an enterprise were gathered through personal contact with those in both the private and public sector who have experience in wetlands mitigation and mitigation banking in North Carolina and other states. Costs for a few activities also were obtained from current literature. Since no formal rules have been adopted by North Carolina regarding mitigation banking, the regulatory conditions under which entrepreneurial mitigation banks may operate were estimated through contact with the appropriate federal, state and local regulatory agencies within North Carolina and state agencies and mitigation bankers in states which have mitigation banking rules in effect.

This economic analysis of wetlands mitigation banking in North Carolina is comprised of multiple components. These components include:

(1) a potential timeline for the development and completion of a mitigation bank in North Carolina

(2) line item cost estimates for the tasks involved in the development and operation of a mitigation bank in North Carolina

(3) analysis of the effect of site location on land costs associated with mitigation bank development

(4) analysis of differing performance bonding requirements on mitigation bank development costs

(5) capital budgeting analysis to examine the relationship between mitigation credit price and Internal Rate of Return as well as site acquisition financing decisions (Net Present Value)

(6) a discussion of the potential for economies of scale in North Carolina wetlands restoration projects.

The line item categories and their estimated costs, as well as yearly cash flow estimates for the wetlands mitigation banking project examined here, can be found in Appendix 1. The ranges of the cost estimates compiled for this research can be found in Appendix 2.

Timeline for Development of a Wetlands Mitigation Bank

One of the most important factors in the development of a wetlands mitigation bank is time. While the initial planning and design as well as the physical construction of the bank can be achieved in a matter of months, the time required to obtain all regulatory approvals for the bank significantly extends the date at which income from credit sales will begin.

To assist in the determination of cash flow timing for the capital budgeting component of this analysis, a timeline describing the sequencing of mitigation bank development in North Carolina was constructed (Figure 1). *It must be stressed that this timeline, though realistic and attainable, is considered to be a 'best case scenario'. The time required for completion of any phase of this timeline could be quite variable.* Indeed, many phases of the timeline could easily require much more time than indicated by this timeline. Many factors could lengthen the time required for completion of a particular step in the timeline. Some of these factors include:

- Unexpected findings of site contamination and/or delays in remedial activities during initial site analysis

- Delays in gaining regulatory approval for the bank - this could occur at any time during the negotiation of the banking Memorandum of Agreement/Bank Plan

- Collateral damage to the bank site during earthwork activities - strict supervision of restoration activities is necessary to insure that unintended wetland impacts or site damage do not occur which necessitate remediation

- Failure to achieve the expected increase in wetland function at the restoration site - expected hydrologic or vegetation results may not develop (requiring remedial action) or may be delayed in developing

- Adjustments in the rules or regulations governing mitigation banking - changes in policies regarding mitigation issues such as credit allocation or the use of off-site mitigation

The initial planning and design of a mitigation bank begins with the choice of a bank site. The potential bank site is first narrowed down to a region, then a location, and ultimately to a particular site within the chosen region and location. The choice of the bank site is critical, for more than just the obvious reasons such as the cost of the land and the ease (and thus low cost) of restoration activit. es. The careful choice of a bank

site also is critical since even the best site in terms of suitability for restoration will be an economic failure if the site is not in an area where the demand for mitigation credits will be sufficient to produce the desired return on investment. Therefore, in choosing a bank site, a bank sponsor must consider the potential demand for the type(s) of mitigation credits that will be produced by the potential site.

Once an appropriate site has been chosen, the preliminary site analysis may be undertaken. Delays in this stage can be caused by a finding of contamination during the Phase I Environmental which will require at least an additional Environmental Phase II analysis, and possibly remedial action under an Environmental Phase III. Findings of contamination in the Environmental Phase I analysis of a mitigation bank site can cause a significant delay and cost increase in the development of the mitigation bank, depending on the severity of contamination.

The conceptual design of the mitigation bank site may begin as results of site analysis are obtained. Additionally, the development of the bank's plan of operation and the Memorandum of Agreement (MOA) to be approved by the necessary regulatory agencies may begin at this time. The regulatory agencies often involved in bank plan/MOA negotiations include the US Army Corps of Engineers, the Environmental Protection Agency, and, in North Carolina, the Department of Environment, Health, and Natural Resource's Division of Water Quality. Currently, the North Carolina Division of Water Quality (NCDWQ) is responsible for negotiating the terms and conditions of

mitigation bank MOA's in North Carolina. Other agencies, such as the US Fish and Wildlife Service, also may be included in the review process.

After completion, the conceptual bank design and a draft Memorandum of Agreement are distributed to the relevant regulatory agencies for review. It is this stage of the development of a mitigation bank that often accounts for the majority of the time required until credits from the bank are offered for sale. In general, a bank sponsor should allow up to three months for review of a bank design concept or Memorandum of Agreement by a regulatory agency. Additionally, the bank sponsor should consider that first drafts of bank designs/MOAs are rarely approved. In planning a timeline of bank completion, the bank sponsor should allow for at least two reviews by regulatory agencies of approximately two to three months each.

During this review process, the bank sponsor and the regulatory agencies negotiate the terms and conditions of the Memorandum of Agreement as well as the bank design and plan of operation. The issues involved in these negotiations include: the size of the proposed mitigation bank's credit service area[1], the criteria which will be used to judge whether the bank is deemed 'successful', credit accounting methodology, the timing of credit sales (i.e., whether any credits may be sold before the mitigation bank has met all success criteria), and long-term maintenance and monitoring schedules. As with most negotiations, the negotiation of a mitigation bank MOA can be very time consuming for the bank sponsors and their personnel.

[1] The credit service area refers to the geographical area in which the credits in a mitigation bank are used to satisfy the mitigation requirements of Section 404/401 permit holders.

In addition to a mitigation bank permit, the bank sponsor may be required to obtain other permits. These permits must often be secured to undertake the construction activities at the bank site. These permits may include mining permits for excavation activities and soil/erosion permits for general construction activities. The time required for acquisition of these permits must also be factored into the timeline for development of a wetlands mitigation bank.

Due to weather conditions and the resulting site conditions, the construction and planting phases of a mitigation bank must occur within particular time frames during the year. Generally, site construction and installation activities are undertaken during the autumn, since this is the period when the site is driest. Since the soil moisture content is highest just after the wet winter season, planting occurs during the early spring, usually in February or March.

For baseline site assessment, the site in this analysis is monitored for two years prior to the beginning of official site monitoring. The North Carolina Division of Water Quality (NCDWQ) requires sites to be monitored for five years to track restoration progress and determine whether success criteria are achieved. In North Carolina, official site monitoring may begin in the autumn following a spring site planting. Site planting for this analysis takes place in the early spring of year three, so the first year of the five-year official site monitoring begins in autumn of year three. This analysis assumes early credit sales are approved upon achievement of success criteria for the first year of official

site monitoring. The timeline indicates where deviations in sequencing may occur, and what steps may be required when deviations do occur.

Land Acquisition

Land acquisition is required for establishing a mitigation bank site. For this analysis, we assumed that the project would occur on 500 acres of non-riverine, prior-converted cropland to be restored to non-riverine, bottomland hardwood wetland. For the estimation of restoration costs, we chose 500 acres because: (1) 500 acres would provide sufficient generation of mitigation credits for the economic feasibility of a mitigation banking endeavor[2], (2) sites suitable for restoration larger than 500 acres are a scarce commodity in North Carolina, and 3) a site of this acreage contributes to the goal of achieving a functional ecosystem. The restoration of non-riverine, prior-converted cropland was chosen for analysis due to 1) the often relatively straightforward nature of this type of restoration which lends itself to cost estimation in the absence of actual restoration activities, and 2) the availability of suitable sites in North Carolina for this type of wetland restoration.

The choice of the mitigation bank site is a critical factor in the potential success or failure of a mitigation banking enterprise. In choosing a suitable bank site, a prospective bank sponsor must weigh the following factors that will determine the financial viability of a particular site.

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[2] Mitigation banks of lesser acreage have succeeded in other states. But many larger banks have been established; 500 acres is an approximate "median" area.

Site Characteristics

The degree of wetland function at the potential site will be a factor in determining the cost of restoration. For example, a site which has some substantial degree of hydrologic function in place may require only minimal manipulation such as ditch plugging and crown removal to restore an amount of wetland function necessary for approval and credit by regulators. Alternatively, a more degraded site may require significant earthwork and hydrologic modeling to restore necessary wetland function, thus requiring a more costly restoration effort. Even though a more degraded site will be more costly to restore, it must be considered that this type of site has the potential to earn more credits since the amount of hydrologic function gained after restoration may be higher than a less degraded site. The bank sponsor must analyze these factors in the context of restoration cost versus potential profit from credit sales.

Site Location

The geographical location of the proposed site is important for several reasons. First, the bank site must be located in a geographical area that the bank sponsor determines will possess sufficient demand for mitigation credits, hence profitability. In this vein, the site must be geographically situated such that regulators will allow a credit service area large enough to receive the level of credit demand necessary to generate the bank sponsor's desired rate of return on the project. Additionally, land uses adjacent to the proposed site must be compatible with restoration activities and the long-term

sustainability of the wetland ecosystem. For example, a company specializing in wetlands restoration examined several thousand acres in the coastal plain of North Carolina in their search for a site suitable for riverine wetland restoration. In the vast majority of the sites examined, adjacent land uses made the sites unsuitable for successful riverine restoration.

Land Cost

To illustrate the impact of land cost on total project cost, several counties in North Carolina were chosen as potential locations for the bank site. The land cost estimate for each of these sites is based on the market value of non-irrigated farmland as compiled by the USDA-ASCS 1996 Annual Survey of County Farmland Values. The 'Baseline Scenario' is a 500 acre tract located in a rural, coastal plain county of North Carolina. The 'Rural County 2' estimate for land cost is the farmland value for a county within the same river basin as the 'Baseline Scenario' site. To highlight the differences in land cost between rural and urban counties of North Carolina, two of the most populous counties, Wake and Mecklenburg (Urban County 1 and Urban County 2, respectively), were chosen as alternative site locations. While it is unlikely that a mitigation bank would be developed in these counties, it serves to highlight the effect land cost will have on the choice of a mitigation bank site. The configuration of credit service areas by regulators will have a profound effect on the entry of bank sponsors into mitigation credit markets that service these areas, as well as the price of mitigation credits necessary to achieve desired rates of return by bank sponsors who choose to service the urban areas of North

Carolina. This is directly related to the land costs associated with areas surrounding the urban centers.

The Baseline Scenario (Rural County 1) estimate for land cost is $500,000 ($1,000 per acre) for the restoration project examined in this research. The land cost estimate for this project undertaken in Rural County 2 is $1,450,000. The Urban County 1 site location results in a land cost estimate of $2,500,000. The land cost estimate for the Urban County 2 location is $10,000,000 (Table 1).

As might be expected, the increase in land cost between the alternative site locations results in an increase in land cost as a percentage of total project cost. Land cost is one-third of total project cost in the Baseline Scenario. Land cost increases to 58% of total project cost in the Rural County 2 site location. In the Urban County 1 alternative, land cost is 71% of total project cost. And finally, land cost as a percentage of total project cost increases to 91% in the Urban County 2 site location (Figure 2).

Analysis of Site

Potential bank sites should be analyzed to determine if the site is contaminated with any toxic or hazardous materials such as PCBs or petrochemicals. Aside from the biological and ecological considerations inherent in this type of project, legal/financial issues are an important impetus for screening potential bank sites for contamination. Obtaining a clearance indicating the site is free of any hazardous contamination provides

the land purchaser the 'innocent landowners' defense'. Conducting an Environmental Phase I analysis of the potential site demonstrates that the new landowner took steps to insure that the land was not contaminated, thus limiting the new landowner's liability for clean-up if contamination is found after the land has changed hands. In addition, many lending institutions require site screening before approving loans for land purchase. An Environmental Phase I analysis usually consists of a thorough record search seeking past land uses that may portend site contamination. Environmental Phase I analyses are most often conducted by independent environmental engineering or consulting firms. If the likelihood of hazardous contaminants is indicated upon completion of a Phase I, an Environmental Phase II must be conducted to confirm the physical presence of contamination as well as specify the type and severity of contamination. Depending on the outcome of a Phase II analysis, an Environmental Phase III may be required which determines and conducts remediation for identified contamination. It is upon findings of contamination in Phase I or II that a decision regarding the site's suitability for restoration must be reached, and thus the choice of whether or not to undertake Phase III activities to prepare the site for restoration.

Several private sector companies who provide Environmental Phase I analysis provided cost estimates for performing this service for a site with the characteristics described in the section 'Land Acquisition'. The average estimated cost of Environmental Phase I analysis received from these companies is $3,875. This cost could vary depending on the time required for the Environmental Phase I research which

is dependent on such factors as the number of previous landowners and the number and nature of previous land uses.

Design Development

Design development pertains to the costs associated with pre-construction design for the mitigation bank site. For this analysis, the design development category includes the following tasks:

- Site Assessment - evaluation of pre-restoration site characteristics such as: delineation of site as prior-converted cropland[3], functional assessment of the site including hydrology, vegetation, and the effects of adjacent land uses

- Site Design - water modeling to determine earthwork necessary to restore proper hydrology, landscape design, plant selection and planting scheme (hydrology monitoring layout/installation and tree sample plot layout/installation are covered in the section 'Monitoring')

The site assessment tasks are also important in the ultimate determination of how many credits will be allocated to the bank by the regulatory agencies responsible for bank approval. The site assessment determines the baseline functions and values of the site. It is the difference between the amount of baseline (pre-restoration) function and value and

[3] Most notably, verifying the presence of hydric soils. The Natural Resource Conservation Service is a point of contact for the delineation of prior-converted cropland.

the amount of function and value present after restoration activities that constitutes the number of credits allocated to the bank.

The design development activities promote the successful restoration of appropriate hydrology and vegetation associated with hardwood bottomland per the US Army Corps of Engineers' 'Compensatory Hardwood Mitigation Guidelines'. *It must be stressed that the costs of the tasks within this category are highly variable due to the high degree of variability found between the pre-restoration characteristics of individual sites.* As mentioned previously, this analysis examined the restoration of non-riverine prior-converted cropland due to its relatively straightforward nature and ease of restoration. A site that is to be restored to a riverine wetland type likely will have higher design and construction costs due to the increased complexity of these types of wetland ecosystems. A site that is not prior-converted cropland likely will possess a greater degree of degraded hydrologic function, with a resulting increase in the cost of design and construction.

Another issue related to differences in site characteristics is variance in the amount of credit that may be allocated to mitigation banks of differing types and site characteristics. For example, consider two mitigation bank sites of equal acreage, developed utilizing identical restoration techniques, and located in essentially similar geographical locations. Let it be assumed also that the only difference in the two sites is that site A is restored to non-riverine wetland and site B is restored to riverine wetland. In a scenarios such as this, there may be justification for allocating a greater number of credits to site B than to site A. This stems from ecological considerations which indicate

that a riverine wetland has greater function and value than a non-riverine wetland. Hence, the larger increase in function and value resulting from riverine restoration will be reflected in a greater number of mitigation credits allocated to the bank. This example highlights the possibility that regulatory agencies, in accordance with credit allocation based on increases in wetland function and value, likely will allocate more credit to mitigation banks comprised of wetlands with restored/created/enhanced characteristics considered to provide greater function and value (such as riverine) than other wetlands (such as non-riverine or flat wetlands).

Site location also may play a role in the allocation of mitigation bank credits. The North Carolina Wetlands Restoration Program's first task is to evaluate the state's 17 major riverbasins in regards to wetlands and water quality. Subsequently, the results of this evaluation will be used to prioritize wetland restoration activities both within each basin and within the state as a whole in accordance with an overall wetlands restoration plan. This opens the possibility that mitigation banks located in 'high priority areas' may be given more generous credit allocations than banks in 'low priority areas'. Sources at the North Carolina Wetlands Restoration Program indicate that wetland type/characteristics, as well as the location of sites in relation to the overall wetlands restoration plan, will likely play a role in the assignment of credits to private mitigation banks.

Firms specializing in the design of wetland restoration projects provided cost estimates for the design activities necessary for a restoration project as described in 'Land

Acquisition'. The average estimated cost of design work for a project of this nature is $105 per acre, with a project total of $52,500.

Construction and Installation

Construction and installation describes the costs incurred from the physical restoration activities associated with the development of a mitigation bank. As with the majority of tasks involved in the development of a wetlands mitigation bank, the cost of construction and installation activities for the wetland restoration will be highly dependent upon site characteristics.

The total estimated cost for construction and installation activities for this restoration project is $312,076, divided as described below.

Earthwork

Earthwork includes the costs incurred for site clearing, earthmoving for the restoration of hydrology and habitat features, and installation of hydraulic structures for the adjustment and maintenance the hydrologic function of the restored wetland. A bank sponsor may encounter significant variances in these costs, especially in the cost of earthmoving. This is due to the different technologies utilized depending on the scale of the earthmoving work. For example, the amount of earth to be moved and the distance it must be moved will dictate the type of equipment used to move the earth. A bulldozer is

used to move relatively small amounts of earth over short distances. When the amount of earth to be moved and the distance of relocation reach a certain amount, front-end loaders and dump trucks are employed to increase efficiency. Additionally, additional permits may be required depending on the nature of the excavation activities and the use of the excavated material. All of these activities are guided by the restoration design produced during the design development phase. The average estimated cost of earthwork was $300 per acre, for a project total of $150,000.

Planting

Vegetation must be purchased and planted for successful restoration. This category also includes herbicide applications that are required to prepare the site for planting and to control noxious vegetation that may compete with the planted vegetation.

The species selected and the composition of the species for this analysis are based on the actual species and composition utilized on an approved wetlands mitigation site (located in the coastal plain of North Carolina) developed through the restoration of prior-converted cropland to bottomland hardwood wetland. The vegetation and composition used for this analysis is in accordance with the United States Army Corps of Engineers' *Compensatory Hardwood Guidelines*. The Hardwood Guidelines call for a minimum of 320 trees per acre surviving for three years with up to 10% of site species allowed to be comprised of softwood species. The *Compensatory Hardwood Guidelines*

also call for a minimum of six hardwood species with no more than 20% of any one species.

There are two basic schemes often utilized to develop a wetlands restoration planting schedule. The first, which was used in the planting scheme for this analysis, involves subdividing the area to be planted into planting zones. The planting zone represents the expected hydrology to be found within the zone after restoration. Then, the mix of tree species most suitable for each planting zone (e.g., for the 'wetness' of each zone) is developed. For example, a 'wet' zone will be planted with species adapted to survival in wet soil conditions. However, the species mix for each zone has a built in margin for error. Since the hydrology of a zone may not develop exactly as predicted, the species mix for each zone includes seedlings from species suitable for the differing levels of moisture which may ultimately occur within a zone. The other type of planting scheme involves utilizing this same type of margin for error. In this planting scheme, the entire site is planted with a mix of species that will insure that no matter what type of hydrology ultimately develops, a sufficient number of suitable species will survive to meet the 'Hardwood Guidelines' requirements.

The total number of trees to be planted was determined by an average of the number of trees planted per acre provided by a wetlands restoration specialist and the North Carolina Department of Transportation (NCDOT) Wetlands Mitigation Manager. The average number of trees per acre was 609, which results in a total planting of 304,500 trees for 500 acres (Table 2).

The costs for the individual tree species are the average price per species in North Carolina as provided by International Paper, Weyerhaeuser, and the North Carolina Division of Forest Resources (Forest Landowner 1996). The total cost for 304,500 varied species tree seedlings is $60,576, or $121 average per acre[4] (Table 2).

The labor cost associated with hand-planting the 304,500 tree seedlings was $144 per acre, resulting in a total project cost of $72,000.

Wetland restoration specialists provided cost estimates for herbicide application necessary as part of this restoration project. The average estimated cost per acre is $59, with a total cost for this project of $29,500.

Monitoring

The 'Monitoring' category consists of the costs incurred from the physical measurement and analysis activities associated with assessing the functional state of the wetland before, during and after restoration activities. As noted previously, monitoring is to occur for a total of 7 years, of which 5 years will be official site monitoring per NCDWQ requirements. This includes tracking the growth of planted vegetation as well as tracking and evaluating the hydrologic functions. Specialists in wetlands restoration provided cost estimates for the monitoring component of this analysis.

[4] Note: Not all species were available from each seedling provider. When only one seedling provider indicated availability of a species, the price from that provider was used as the cost estimate.

Monitoring installation includes the layout design and physical installation of both monitoring wells and tree sampling plots. There is no general rule or requirement for the monitoring layout. The actual number and layout of monitoring wells and tree sampling plots is determined according to particular site characteristics and the type of restoration being undertaken.

The average estimated cost per acre for monitoring installation is $130 per acre, for a total estimated cost of $65,000.

The Monitoring per year category covers the costs for the retrieval of monitoring data and analysis incurred during a year of monitoring. At an average estimated yearly cost of $125 per acre, the average estimated cost for 7 years of monitoring is $437,500.

The average estimated total cost for monitoring activities incurred for this mitigation bank development project is $502,500.

Permitting

For this analysis, the permitting component of mitigation bank development includes the costs of necessary permits associated with the construction and installation activities for the wetland restoration. In North Carolina, construction projects of this nature are required to file a sediment and erosion control plan with the county in which the construction will take place. The fees associated with the sediment and erosion

control plan are specific to each county in the state. The analysis of multiple site locations in North Carolina highlights how fees for the sediment and erosion control plan may vary. The fee structure and resulting fees for each site location in this analysis are summarized in Table 3. Until 1997, a separate fee had been necessary for each project for securing a stormwater control permit. The fees for the stormwater permit are now consolidated into the sediment and erosion control plan fees. In North Carolina, there is no fee associated with the approval of a mitigation bank plan or Memorandum of Agreement. Depending on the nature of excavation activities and the disposition of any excavated material during restoration, applicable Mining permits may be needed. The point of contact for mining permit information is the North Carolina Division of Land Quality (NCDLQ).

Approval and Administration

Approval and administration costs are among the most difficult to quantify. This category includes the following tasks:

- Securing regulatory approval for the mitigation bank - mitigation bank plan/MOA development, meeting with regulators to negotiate bank plan/MOA, on-site meetings with regulators, public hearings on zoning issues, general oversight of construction and installation activities

- Bank administration - general oversight of subcontractors and/or staff, establishment of conservation easement, credit-debit accounting, sale and marketing of credits

As noted in the discussion of the timeline developed for this analysis, there is a high degree of variability in the amount of time required to obtain the necessary regulatory approval of a wetlands mitigation bank. As a result, the costs associated with these tasks, especially bank approval tasks, may be quite variable. For example, the length of negotiations and the number of bank plan drafts developed in securing regulatory approval can significantly affect costs in this category. Additionally, the number of regulatory agencies that are involved in securing bank approval can increase the cost of approval. For example, in some locations only federal and state agencies' involvement will be required in obtaining bank approval. However, in some areas local or municipal rules or ordinances also may require the involvement of municipal or county agencies in securing bank approval.

Since there are no established rules or regulations governing mitigation bank operation in North Carolina, there is no specific list of required tasks for mitigation bank administration. For example, some states require credit-debit accounting to be performed by an independent accounting firm, while other states allow credit-debit accounting and reporting to be performed by the bank sponsor. Thus, the expected administrative tasks, and the time required for these tasks, are estimated for a mitigation bank in North Carolina. The expected tasks and time requirements were developed in consultation with

the NCDWQ and sponsors of operational mitigation banks in Virginia and South Carolina.

Given that the costs of approval and administration will vary depending on the tasks undertaken during a particular year of bank development, the estimated costs for this category are listed (by year) in Appendix 1. The estimated cost per year is generated using the estimated number of hours per year and the estimated cost per hour of the mitigation bank sponsor's time.

Year 1 and Year 2 have the highest estimated number of hours due to the time-intensive nature of the development and approval of the mitigation bank plan, as well as site selection, site assessment, and construction. Year 3 has the next highest estimated number of hours since in addition to final bank approval tasks, site planting will occur in this year. Costs in Years 4 through 7 account for the time that may be required for remedial actions at the site as well as time for bank administration such as the oversight of monitoring activities. Currently there are no requirements in North Carolina for long-term monitoring or maintenance of the bank site. Therefore, costs for approval and administration beyond Year 7 are not considered in this analysis.

Performance Bond

The North Carolina Division of Water Quality has indicated that financial assurances will be required of bank sponsors in order to obtain the Division's approval

for a wetlands mitigation bank. In general, this financial assurance is required of the bank sponsor for two purposes: (1) to ensure that in the case of incomplete or unsatisfactory restoration by the bank sponsor, sufficient financial resources will be available to complete the wetlands restoration activities to the satisfaction of the regulatory agencies, and (2) to serve as an incentive for the bank sponsor to produce wetland credits of appropriate ecological quality. There are many tools for the provision of this financial assurance, including surety bonds, trust funds, escrow accounts, sinking funds, and corporate guarantees (ELI 1994). However, the performance bond is one of the more common types of financial assurance for wetlands mitigation banks. A performance bond used for these purposes consists of a premium paid by the bank sponsor to the surety company who issues the bond. From an informal survey of surety companies in North Carolina, the estimated premium for this type of bond would be between 2% and 5% of the estimated restoration costs[5]. If restoration costs come in under the estimated amount, some portion of the premium may be refunded upon completion of the restoration. The issuer of the bond is liable for the bonded restoration costs should the bank sponsor default. However, the issuer of the bond may seek to recoup all or a portion of the bond amount upon default. Depending on the bank sponsor's financial state and experience in wetlands restoration, the bank sponsor also may be required to post collateral for the bond amount in addition to payment of the bond premium.

[5] In almost all performance bonding of this nature, restoration costs exclude the cost of land. This is because in most instances of bank sponsor default, the ownership of the land will still revert to a state or non-profit agency. Thus, no funds will be needed for land acquisition to complete the restoration.

The amount of the performance bond as required by regulatory agencies also may vary, depending on the method used for calculation. This analysis examines two different bond cases. In Bonding Case 1, the required bond amount is calculated as the present value of project costs multiplied by 1.5. The bond premium is determined by multiplying the bond amount by 2%. In Bonding Case 2, the bond premium is calculated by multiplying project costs by 2%. In all bonding cases, project cost excludes the cost of land. Table 4 summarizes performance bond cost under the different bonding cases and site location scenarios. As illustrated by Table 4, the estimated cost for performance bonds in all scenarios is less than 2% of total project cost.

Capital Budgeting Analysis

Developing a timeline for the completion of a wetlands mitigation bank is important due to the significant amount of investment required for such an endeavor and the length of time this investment will be tied up until cash flows from credit sales begin. The majority of the financial investment required for the start-up of a mitigation bank will be 'up-front' outlays, that is, there will be significant outlays of financial resources many months (or even years) prior to the receipt of cash inflows from the sale of mitigation credits. Even if early credit sales are allowed under the terms of the bank plan/MOA, these early sales are usually only a fraction of the total credits expected to be generated by the bank. Any cash inflows received from early credit sales are often used to recoup initial investment and to finance the completion of the bank.

To assist in the capital budgeting analysis of this project, the estimated expenditures for bank development are listed, by year, in the 'Performance Bond' section of Appendix 1. To estimate potential cash inflows from the sale of mitigation credits in the bank, there must be an assumption regarding the timing of credit sales and the number of credits sold in each year of the bank's life.

Since in many cases the credits allocated to mitigation banks are a currency representing a combination of restored, created, enhanced, and/or preserved wetland acreage, often there is not a 1 to 1 correspondence of restored, created, enhanced, and/or preserved acres to credits[6]. In some cases the number of mitigation credits (in acres) allocated to a bank is less than the total acreage of the mitigation bank. However, for simplification of analysis, it is assumed that the 500-acre mitigation bank examined here will generate 500 credits. An informal survey of mitigation bank sponsors in other states indicates that the allowance of early credit sales is a reasonable assumption. For this analysis, it is assumed that 30% of the total credits generated by the restoration activities are made available for sale upon the achievement of success criteria in Year 3 (i.e., upon achieving site success criteria in Year 1 of official monitoring). This results in the availability of 150 credits for sale beginning in Year 3 of bank development. An informal examination of historical wetland impacts requiring mitigation in North Carolina indicates an assumption of 75 credits sold in both Year 3 and Year 4 of bank development is reasonable. Further, it is assumed that the remaining credits (350 credits)

[6] For example, per the NC Wetlands and 401 Certification Procedures (NCEMC 1996), in each compensation ratio, at least one acre of the replacement wetland acreage must be provided through restoration or creation activities. The remaining replacement acreage in the compensation ratio may be achieved through preservation, enhancement, creation and/or restoration.

are available for sale beginning in Year 5 and are sold uniformly from Year 5 through Year 11. These assumptions regarding the number of credits sold each year is based upon: (1) expected demand for mitigation credits within the framework of this analysis, and (2) clarity of analysis.

The expected price per credit charged by the bank sponsor can be examined now that the expenditures per year and the number of credits sold each year is established. Several methods for the determination of credit price by the bank sponsor have been encountered in discussions with bank sponsors in other states. The primary methods are: (1) setting a fixed credit price necessary to achieve an internal rate of return (IRR) on investment as desired by the bank sponsor, and (2) determining credit price on a case by case basis (i.e., permit holder by permit holder basis), where the full willingness-to-pay is extracted from the permit holder seeking mitigation credits. For simplicity, the internal rate of return method is utilized to estimate price per mitigation credit for each of the site location scenarios. Since the effect of the different bond cases is established as having negligible impact on total project cost for this analysis, the estimation of credit price is conducted under Bond Case 1 only. However, this capital budgeting analysis also will conduct an examination of net present value of investment under alternative financing decisions regarding site acquisition.

Internal Rate of Return - Price per Credit

For the internal rate of return analysis, a real discount rate of 6% is assumed. It is assumed also that period C_0 represents a cash outflow corresponding to the estimated cost of land acquisition, which is not financed. Periods C_1 through C_{11} consist of the net cash flow resulting from the estimated expenditures and inflows from credit sales (Appendix 1). For illustrative purposes, a minimum target IRR of 10% and a maximum target IRR of 20% are utilized. The internal rate of return that results from differing price per credit in each of the site location scenarios is displayed in Figures 3-6. While the target IRR for a business investment may vary, a baseline IRR of 10% is often utilized as a target. However, due to the unique nature of wetlands mitigation banking, most notably the extreme policy risk associated with such a venture, many mitigation banks sponsors consider an IRR of 20% the minimum. Therefore, the necessary credit price to achieve a 20% IRR is computed in Table 5. The credit prices depicted in this table are considered the most realistic minimum levels of credit price within the framework of this analysis. It must be stressed that the specialists in wetlands mitigation contacted as part of this research consider a 20% rate of return minimal. The actual price per credit in a free market for mitigation credits could easily be double the figures generated here. In addition to the production cost of mitigation credits, factors that will affect the price per mitigation credit include:

- The method of credit price calculation used by the bank sponsor

- The degree of competition within a particular market

- The regulatory environment

The method used to calculate the price per credit to be charged by the credit producer (i.e., bank sponsor) will affect credit price as the use of the target IRR method, in most cases, may likely result in a lower overall rate of return on investment. This is due to the fact that the full amount of willingness-to-pay may not be extracted from some credit purchasers under the target IRR method.

The lack of competition within a market for mitigation credits may lead to higher per credit prices. Due to policy risk, expected policies regarding the configuration of credit service areas, and the large amount of capital and expertise required for mitigation bank development, the majority of mitigation credit markets will develop, at least initially, as monopolistic or oligopolistic markets (Voigt 1996). These markets with only a single or few credit producer(s) could result in a higher target IRR or an enhanced ability to extract the maximum credit price from a permit holder.

The overall regulatory environment concerning wetlands mitigation, and more specifically wetlands mitigation banking, will affect all mitigation credit markets. The regulatory environment encompasses federal, state, and local rules regarding wetland uses and mitigation requirements. The configuration of credit service areas, potential adjustment of compensation ratios relative to mitigation banking transactions, the

presence of mitigation credits produced by public entities, and the promotion of competition by regulatory agencies are just some of the issues which will affect the entry into, and ultimate operation of, markets for wetland mitigation credits.

Net Present Value - Financing Decision

Since in most cases the development of a wetlands mitigation bank will require an initial capital outlay for the acquisition of the mitigation site, the net present value of this project in the alternative site locations is estimated under three scenarios. The first scenario estimates net present value of the project with no financing of land cost, the second scenario estimates net present value with the cost of land financed through a traditional lending institution and an associated market finance rate, and the third scenario estimates net present value with land cost financed with venture capital (Appendix 1). Cash flows under each scenario are estimated using the different prices per credit utilized in the target IRR method of credit price calculation. A discount rate of 6% (real) is utilized as the base discount rate.

The 'No Financing' scenario specifies the initial outlay for land cost in time period C_0 as a negative cash outflow in the amount of the land cost. The 'Land Cost Financed' scenario provides for a positive cash flow in time period C_0 corresponding to the loan amount received for land purchase minus the down payment. The loan terms under this scenario are assumed to be 10% down, 6% real interest rate, and a loan period of 5 years. Table 6 summarizes the increase in net present value of the project when land cost is financed, under the price per credit estimated to achieve a 20% IRR. Figure 7 illustrates the differences in net present value under the 'No Financing' and the

traditional 'Land Cost Financed' options for each site location. Overall, the financing of land cost for a mitigation banking project substantially increases the net present value of the project.

The effects of a decrease in the discount rate on net present value under the 'No Financing' and traditional 'Land Cost Financed' options are summarized in Table 7. Figures 8-9 graphically depict the increase in net present value of these two options resulting from a 1% and 2% decrease in the base discount rate of 6%. All effects of changes in the discount rate assume a credit price necessary for a 20% internal rate of return under the 'No Financing' scenario. The use of 6% real as the base discount rate, as well as the utilization of 4% and 5% real as alternative discount rates, is discussed in the next section, 'Discount Rates'.

The risk associated with mitigation bank development is a significant factor in financing decisions faced by bank sponsors. In North Carolina, the cost of land suitable for a wetland mitigation bank often will be the greatest cost incurred in mitigation bank development. Due to the inherent risk (both policy and ecological risk) involved in mitigation bank development, traditional lending institutions usually are unwilling to lend for such a project and alternative forms of financing are required. Therefore, some mitigation bank sponsors seek financial resources from venture capitalists. The rate of return required by venture capitalists investing in a wetland mitigation bank is reported to be between 50% and 80%. This high rate of return required by venture capitalists reflects the high degree of risk associated with mitigation bank development.

To analyze the effects of this realistic form of financing associated with mitigation bank development, changes in net present value under the traditional 'Land Cost Financed' and the 'Venture Capital Financed' options are calculated. The cash flows for this analysis are generated using the credit price necessary for a 20% IRR under the 'No Financing' option. The loan terms for the utilization of venture capital financing are 10% down, 5-year term, and a 50% (real) finance rate. Figures 10-12 depict the differences in net present value between these financing options under real discount rates of 4%, 5%, and 6%. However, note that the net present value of the venture capital option is generated using discount rates of 4%, 5%, and 6% while the loan payments are calculated using a 50% (real) finance rate for the financing of land cost. Table 8 summarizes the decrease in net present value of the project, at each site location, when land cost is financed through the use of venture capital.

Discount Rates

For the calculation of net present value, it is acceptable to utilize either a real interest rate, which is unadjusted for inflation or risk, or a nominal interest rate, which is the real rate + expected inflation + a risk premium. In lending, the risk premium accounts for such factors as the risk of default on the loan and error in the expected inflation rate. *However, it must be stressed that in the calculation of net present value, nominal cash flows must be discounted at a nominal rate and real cash flows must be discounted at a real rate.* Significant discrepancies may occur in the calculation of net present value if real cash flows are discounted at a nominal rate, or vice versa.

Consistency requires that if a nominal rate is used to discount, then the cash flows also must be estimated in nominal terms. For the net present value calculations undertaken in this examination of wetlands mitigation banking in North Carolina, a real discount rate is used throughout. This is because the cash flows generated by this research are in real terms, i.e., in today's dollars. The adjustment of the myriad costs associated with development of a wetlands mitigation bank, as well as the cash inflows from credit sales, to nominal terms is beyond the scope of this research. Adjusting cash flows to nominal terms requires more than uniformly applying an expected rate of inflation and risk premium to all cash flows. This is due to the different rates at which the cost of labor, for example, may rise compared to inflation indices such as the consumer or producer price index. Different components of the costs associated with mitigation bank development may increase at differing rates relative to inflation. Therefore, net present value calculations in this research are estimated in real terms (Brealey and Myers 1991). Generally, a rate between 4% and 6% is used when estimating net present value in real terms. Due to the unique and risky nature of the wetlands mitigation banking enterprise, a base discount rate of 6% is utilized to account for the inherent risk associated with these ventures. Since the real discount rate often utilized for project evaluation is between 4% and 6%, the real values of 4% and 5% are used to illustrate effects of variance in discount rate on net present value.

APPLICATIONS

Economies of Scale

King and Bohlen (1994) examined wetland restoration costs (excluding land cost) for two sets of cost data. The costs for the primary data were based on input requirements and associated unit costs needed to complete specific tasks during pre-construction, construction, and post-construction stages of restoration/creation projects. The costs for the secondary data were gathered from cost information on wetland creation, restoration, or enhancement projects in published and unpublished reports, the general trade literature, as well as county, state, and federal databases.

Through statistical analysis of their data, King and Bohlen developed estimates of economies of scale associated with the projects comprising their primary and secondary databases. The authors, noting significant fixed costs associated with all but the most straightforward types of restoration projects, found that the cost per acre for relatively small restoration projects can be quite high whereas large-scale projects may have relatively low costs per acre. But the authors note that, in addition to economies of scale, in many cases differences in the types of projects undertaken may account for differences in per acre costs of large and small-scale projects.

King and Bohlen's data depict the expected inverse relationship between cost per acre and project size. The authors reported that the primary database indicated "...that for each 10% increase in project size, costs per acre for non-agricultural projects decline by

3.5%", and "the larger secondary database revealed a remarkably similar decline of 3.1% in costs per acre for each 10% increase in project size." (King and Bohlen 1994, pp. 7-8)

This type of analysis is not adequate for this examination of wetlands mitigation banking in North Carolina. King and Bohlen used cost data on many types of wetlands projects, the vast majority of which are of a type not undertaken in North Carolina. The variances in the type of wetland project (restoration, creation, enhancement), and the associated variances in costs associated with projects of differing wetland types as well as differing geographical locations, preclude any extrapolation of economy of scale results from the King and Bohlen work onto the cost data developed in this research. Instead, our research examined a specific type of wetland project (restoration of prior-converted cropland) in specific locations within North Carolina.

However, we found anecdotal evidence that fairly significant economies of scale may exist for restoration projects in North Carolina. These economies of scale were indicated to be mostly associated with the cost of transporting heavy equipment for use in the earthwork component of wetlands restoration, and to a lesser degree with quantity discounts on the purchase of tree seedlings. Approval and administration costs also have large "fixed" components.

Earthmoving technology dictates that certain types of equipment are most efficient for moving certain amounts of earth over certain distances. If earth is to be moved less than approximately 75 feet, a bulldozer is the most efficient (and cost

effective) means of transportation. However, above 75 feet, it is more cost effective to move the earth by means of large dump trucks. Once the threshold for the use of a bulldozer is crossed, the optimally efficient means of earthmoving is the dump truck. The use of a bulldozer to move earth at its most efficient distance is less efficient and cost effective than moving earth by means of dump truck at its minimal distance of effective employment. A large-scale restoration project is more likely to require the transportation of earth over greater distances, and hence the employment of a more efficient technology for earthmoving. Further, the limits of potential economies of scale can be illustrated using the example of earthmoving. At some point, the limits of earthmoving technology will limit the economy of scale associated with earthmoving. Once the 'dump truck technology' is employed to its maximum efficiency, there is no better earthmoving technology with which to make the jump to a greater economy of scale. At this point, there is no further earthmoving economy to be gained from a restoration project of greater acreage.

Public-Commercial Mitigation Banking

This research examined the development, construction, and operation of a privately funded and executed wetlands mitigation bank in North Carolina. Furthermore, this analysis assumed that the mitigation banking project is a for-profit endeavor. Application of the results of this research to the examination of a public-commercial banking enterprise in North Carolina may be reasonable. But, in any such application of these results, the inherent differences in the development and operation between a

private, for-profit bank and a public-commercial bank must be taken into consideration. While the ecological goals of both bank types should be essentially the same, the economics of the bank types are significantly different. In general, these economic differences may be examined in the context of debates over the provision of goods and services by the public sector versus the private sector.

One of the differences that may be pointed out as unique to the examination of public versus private sector mitigation banking is overall project evaluation. The private sector banking project must be evaluated from both an ecological and economic standpoint. That is, the private mitigation bank must produce both an ecologically valuable good (represented by bank credits) as well as an economically valuable good (bank credits that may generate profit for the bank sponsor). The private sector project is evaluated by regulators to insure the ecological worth of the bank credits. In addition, the private sector project is evaluated by the bank sponsor from a financial viewpoint with internal rate of return and net present value analysis. However, it must be noted that some private sector mitigation banks are undertaken with profitability as a secondary, if not insignificant, factor in project evaluation.

Another aspect of the private mitigation bank to be considered is that of cost minimization. At a given level of production, a private firm operating in a competitive free market will seek to minimize cost. The minimization of costs helps to insure the economic survival of the firm, in addition to fostering the goal of profit maximization.

Arguably, the role of cost minimization in the operation of a public-commercial mitigation bank may be less compelling than in the private firm.

While the public-commercial mitigation bank sponsored by a governmental entity will have the same basic ecological goals as the privately sponsored mitigation bank, the additional goal of profitability is usually absent in the public-commercial endeavor[7]. Credit price determination and general financial analysis regarding profitability will not be required. However, some form of financial analysis will be required of the public-commercial enterprise. This is necessary to establish appropriate credit prices for meeting the fiduciary goals of the public-commercial bank, be they a 'break-even' philosophy or the generation of funds for further wetlands restoration projects. In addition, there may be fairly significant differences in costs incurred by the privately sponsored bank versus the public-commercial bank. Most notably, there may be significant differences in the 'Approval and Administration' cost category. The public-commercial bank will be required to meet the same permitting requirements as the private mitigation bank. However, the apparatus involved in meeting these permit requirements for the public-commercial bank may drive the implicit budget costs of approval and administration higher than in the private endeavor.

The preceding examples serve to illustrate the differences in privately and publicly sponsored mitigation banks, and thus highlight the caution required when applying the results of this research. Nevertheless, the costs estimated in this research

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[7] However, the public-commercial bank sponsor still will want to ensure the project will not lose money, i.e., a break-even endeavor.

should be useful in examining potential costs associated with state-sponsored restoration projects or public-commercial banking in North Carolina.

The costs estimates regarding site acquisition and restoration activities generated by this research may be useful in estimating costs expected to be incurred by the state in developing public-commercial mitigation banking enterprises. In addition, these costs may be representative of the costs to be expected by the state of North Carolina in restoration activities associated with the North Carolina Wetlands Restoration Fund. It must be stressed that the costs generated by this research which may be applicable to state-sponsored wetlands projects are limited to site acquisition costs and the costs associated with physical restoration activities.

CONCLUSIONS

This research provides insight into the time, money, and regulatory requirements that are likely to be necessary for the establishment of an entrepreneurial wetlands mitigation bank in North Carolina. Due to limitations on suitable data for this analysis, all estimates regarding these factors necessary for mitigation bank development in North Carolina must be treated as just that, estimates. However, all estimates were provided by knowledgeable sources involved in wetlands mitigation banking both within North Carolina and in other states.

Our analysis examined alternatives for both the location of the mitigation bank site and bonding requirements. The alternative site locations consist of two rural and two urban counties of North Carolina. Also, total cost estimates were computed using two different methods of bond calculation, both of which have been utilized in actual cases of mitigation bank development in other states.

Data were collected for all categories of cost identified by this research as typically being associated with the development, construction, and operation of a wetlands mitigation bank. In addition, capital budgeting techniques were employed to examine financial issues associated with a project of this type. The results of this analysis follows.

The time required for the complete execution of the mitigation banking project examined here is estimated under ideal conditions. Figure 1 outlines the sequence of various stages of bank development, and provides insight into potential delaying factors in the bank completion. As noted, the estimate of 11 years for bank completion from the planning through the monitoring stages was estimated to be a 'best case scenario' due to the inherent variability of the actual time required for completion of any stage of bank development.

Appendices 1 and 2 annotate the various costs that could be expected in the development of a privately sponsored mitigation bank in North Carolina. The projected total cost per acre for bank development ranges from a low of $3,052 in the Rural County

1, Bonding Case 2 scenario, to a high of $22,076 for the Urban County 2, Bonding Case 1 scenario (Table 9).

Formal statistical analysis of cost estimates was not performed in our research because there were few samples for cost estimates. This is due to: (1) a lack of historical data on wetland restoration costs in North Carolina, (2) the reluctance of the private sector to divulge cost information, which is considered proprietary, and (3) the difficulty in projecting cost estimates for a restoration project which, although based on historical restoration projects, is still a 'theoretical' project. This third difficulty relates to the inherent differences in physical characteristics found among potential restoration sites.

To obtain insight into the potential accuracy of these cost figures, it may be helpful to compare the estimates generated by this research with estimates generated for a project of similar scope and type. As part of the mitigation plan for the construction of the North Carolina Global TransPark (NCGTP), an independent environmental consulting firm compiled preliminary cost estimates for wetlands replacement necessary to fulfill the mitigation requirements for wetland impacts resulting from NCGTP activities. The mitigation plan calls for the restoration of 4,360 acres (294 acres riverine, 4,066 non-riverine). The restoration site is in Lenoir County, a rural county of eastern North Carolina. The total project cost is estimated to be $9,610,000. This results in a total project cost per acre of $2,204 and a project cost per acre excluding land cost of $1,208 (FAA 1997). These figures fall below the lower bound of the cost estimates generated through our research.

The project examined in this research consists of essentially the same type of wetlands restoration proposed for the NCGTP. Our cost estimates were similar. Differences may be due to: (1) economies of scale associated with the NCGTP project, which consists of restoring 3,860 more acres than the 500 acre project examined here, and (2) a slight portion of the higher NCGTP cost per acre could be attributed to the small portion of riverine restoration which is generally held to be a significantly more expensive type of wetlands replacement activity.

The cost of land suitable for a mitigation bank site varies according to location in North Carolina. Land prices are higher in the more urban counties. Since land cost is a significant portion of total project cost, the purchase price of a potential mitigation site must be considered when evaluating alternate mitigation bank site locations. For the alternate site locations considered for this research, estimated land values ranged from a low of $1,000 per acre in Rural County 1, to a high of $20,000 per acre in Urban County 2.

Two different methods for calculating the cost of performance bonds necessary for mitigation bank development were employed. The cost per acre for performance bonds ranged from $40 in Urban County 1, Bonding Case 2, to $51 in Urban County 2, Bonding Case 1. In all scenarios, performance bond cost is projected to be only a fraction of total project cost.

In projecting expected price per credit for each scenario, the credit price necessary for obtaining an internal rate of return (IRR) ranging from 10% to 20% was calculated. Anecdotal evidence shows that a 20% rate of return on a private mitigation banking enterprise is considered minimal. Price per credit necessary to achieve a 20% IRR ranged from $6,800 in Rural County 1 to $64,000 in Urban County 2.

Land cost finance options for the mitigation bank project were evaluated by calculating the net present value of the project under three alternatives. For all site locations, the greatest net present value was achieved under the traditional financing option. The option of not financing land cost generated the second greatest net present value, and the venture capital financing resulted in the lowest net present value for the project.

The potential for economies of scale in the development of a wetlands mitigation bank located in North Carolina was examined. While research concerning wetlands restoration/creation/enhancement costs in the southeastern United States suggests that economies of scale may exist, we could not apply the results of that research to the cost data generated during this research. However, during the course of this research, anecdotal evidence was found indicating the potential for economies of scale in the development of a wetlands mitigation bank in North Carolina.

The costs associated with the development, construction, and operation of a wetlands mitigation bank as calculated by this research are intended to be specific to

North Carolina. Comparison of these estimated costs with those to be expected for similar projects in other states is difficult. In addition to differing regulatory requirements, variances in the prices of labor, material and land in other regions of the country likely will result in potentially significant differences in the cost of this type of project.

Using the results of our research to forecast costs to be expected as part of projects consisting of differing wetland types than the one examined here should be done with caution. For example, projects involving the restoration, creation, and/or enhancement of a wetland type such as a riverine wetland can expect higher design development and construction and installation costs. This is due to the more complex hydrology associated with a riverine wetland as opposed to a 'flat' wetland which was used for this analysis. It follows that the more complex the hydrologic system to be restored, created, or enhanced, the higher the cost of such an undertaking. However, the results of this research may be useful in examining expected cost associated with a different wetland type such as a tidal salt marsh typical to North Carolina. Some sources reported that the restoration of a tidal salt marsh is similar in complexity and scope to that of restoring a bottomland hardwood from prior-converted cropland. In this comparison, the significant differences in cost would be in expenditures for site acquisition. Generally, land prices in the coastal region of North Carolina are much higher than the highest land cost scenario found among the site locations examined here.

The fact that certain wetland types are found only in certain regions of the state will also contribute to differences in restoration costs. For example, a mountain bog cannot be successfully restored, created, or enhanced in the coastal plain. As a result, the higher average land prices found in the mountain region of the state as compared to the coastal plain likely will drive up the cost of a mountain bog project as compared to a project in the coastal plain, notwithstanding any differences in design and construction costs.

From a purely economic perspective, the configuration of mitigation bank credit service areas and the distance from impact for which mitigation is approved for all projects requiring mitigation will play an important role in the ultimate cost of mitigation projects in North Carolina. This is because the land cost component of a mitigation project may vary significantly depending on how close the mitigating wetland must be to the impact site. The farther away a mitigation site is allowed from the impact site, the more opportunity there is for minimization of land cost through placement of the mitigation site on 'low cost' land. Taking the example of the mountain bog, land prices within the mountain region and even within specific river basins of the region vary significantly. Thus, the total cost for mitigation of a mountain bog also may vary significantly. However, it is noted that this analysis ignores the ecological considerations that must be an equal part of examining wetland mitigation issues. Valuation of the wetland functions and values associated with mitigation sites of differing distances from the impact site should be considered when evaluating mitigation sites of differing distance from the impact site.

The results of this research may be of great value to those involved in wetland issues within North Carolina. For example, officials of the North Carolina Department of Transportation and the North Carolina Wetlands Restoration Program, as well as entrepreneurs interested in the potential for business opportunities may utilize the results of this research for both policy-making and financial decisions. But, to obtain the maximum benefit, these results must be applied in the context in which they were generated. The specific parameters and assumptions under which these results were calculated must be considered when applying the results to policy and financial decisions. When utilizing these results to evaluate projects of differing type or scope than the scenarios examined here, decision-makers must use these results as a framework for wetlands restoration in North Carolina and adjust all parameters and assumptions as necessary to fit the particular wetland project being evaluated.

For example, officials of agencies involved in wetland restoration in North Carolina could utilize these results as follows:

(1) The North Carolina Wetlands Restoration Program may employ these cost estimates in the adjustment of the fee structure for the North Carolina Wetlands Restoration Trust Fund. This could assist in assuring that fees paid by permit holders reflect the true cost of restoration within the alternative site locations examined here. In addition, this could insure an equitable pay-in by those utilizing the Fund in different regions of the state.

(2) The North Carolina Department of Environment, Health, and Natural Resources may use these capital budgeting techniques for the calculation of credit price in evaluating the potential for the establishment of a state-sponsored, public-commercial mitigation bank in North Carolina. This would help officials estimate the economic viability of public-commercial banking in North Carolina.

(3) Due to the scope of its construction activities, the North Carolina Department of Transportation (NCDOT) impacts many acres of wetlands each year. For the years 1996-2004, the Department estimates that it will be required to mitigate for 18,000 acres of wetland impacts. The NCDOT may utilize the capital budgeting techniques to evaluate mitigation project alternatives relating to Department of Transportation construction activities. This would assist the NCDOT in determining the most cost-effective method for meeting mitigation requirements. Alternatives to be evaluated include paying a fee to the Wetlands Restoration Fund, undertaking mitigation themselves, or purchasing credits from private mitigation banks[8].

In addition, these results may be helpful to the North Carolina Wetlands Restoration Program as restoration projects are undertaken. It would be expected that subcontractors for the Program would complete these projects. Furthermore, it would be expected that restoration contracts would be awarded through a competitive bid process.

[8] This is assuming that the alternative of private mitigation banking does develop in North Carolina.

The cost analysis undertaken as part of this research will be a helpful guide in evaluating the tasks and associated costs submitted with the bids.

FURTHER RESEARCH

Since wetlands mitigation banking is just beginning to develop in North Carolina, much more analysis is needed to determine how this tool for meeting the compensatory mitigation requirements of Section 404 permit holders may further the goals of basinwide and watershed management in North Carolina. Issues worthy of further examination include:

(1) Compilation of more robust data on the costs of wetlands restoration/creation/enhancement in North Carolina.

(2) Empirical analysis of the potential for economies of scale in wetlands restoration/creation/enhancement activities in North Carolina.

(3) Economic analysis of public and private restoration/creation/enhancement activities, including efficiencies of the public and private sector provision of mitigation credits and their effects on the mitigation credit market in North Carolina.

(4) Cost analysis of activities associated with the restoration, creation, and enhancement of wetland types typically not associated with prior-converted cropland. Examples include mountain bogs and tidal wetlands.

(5) Cost analysis of activities associated with the restoration, creation, and enhancement of wetlands located in the mountain and piedmont regions of the state. This analysis would focus on potential cost increases associated with such region-specific factors as difficulties associated with construction on a mountainous site and the scarcity of suitable sites in the more urbanized piedmont region.

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Figure 1.
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 1

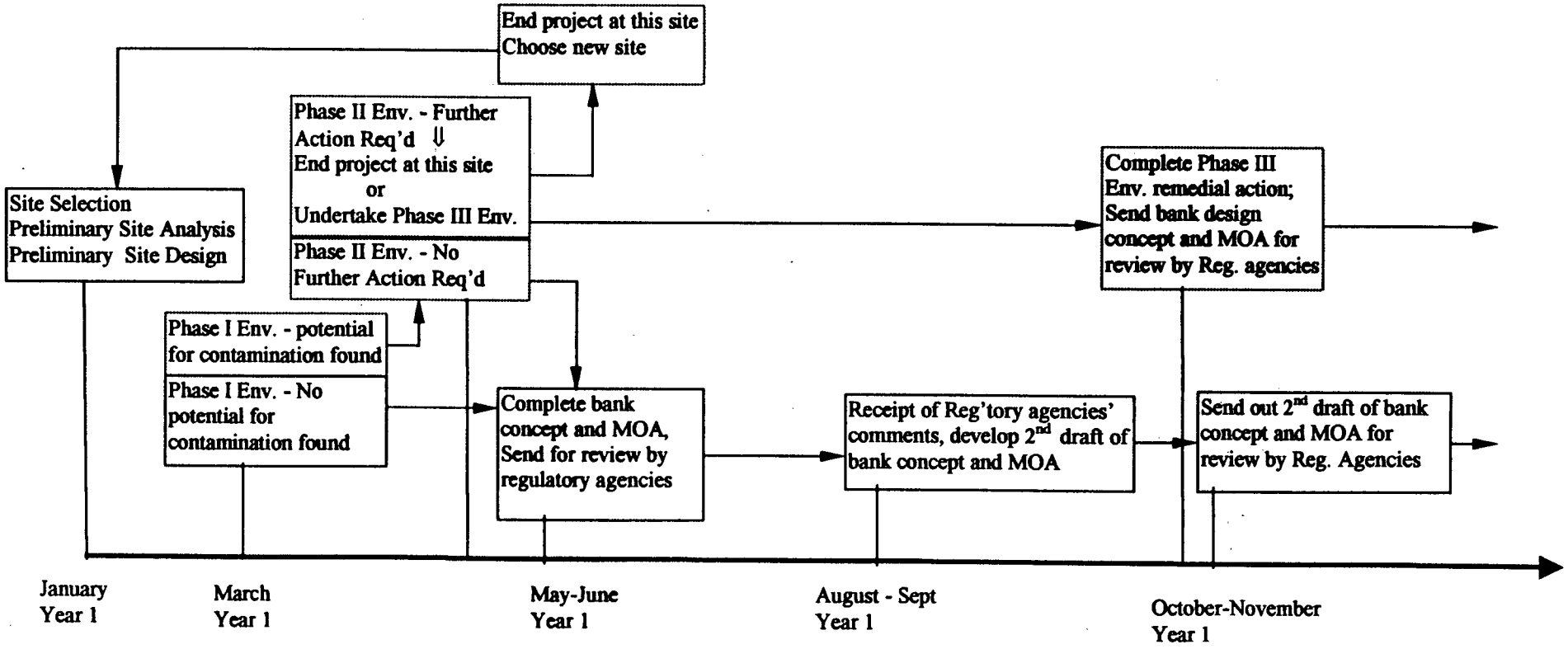

Figure 1. (continued)
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 2

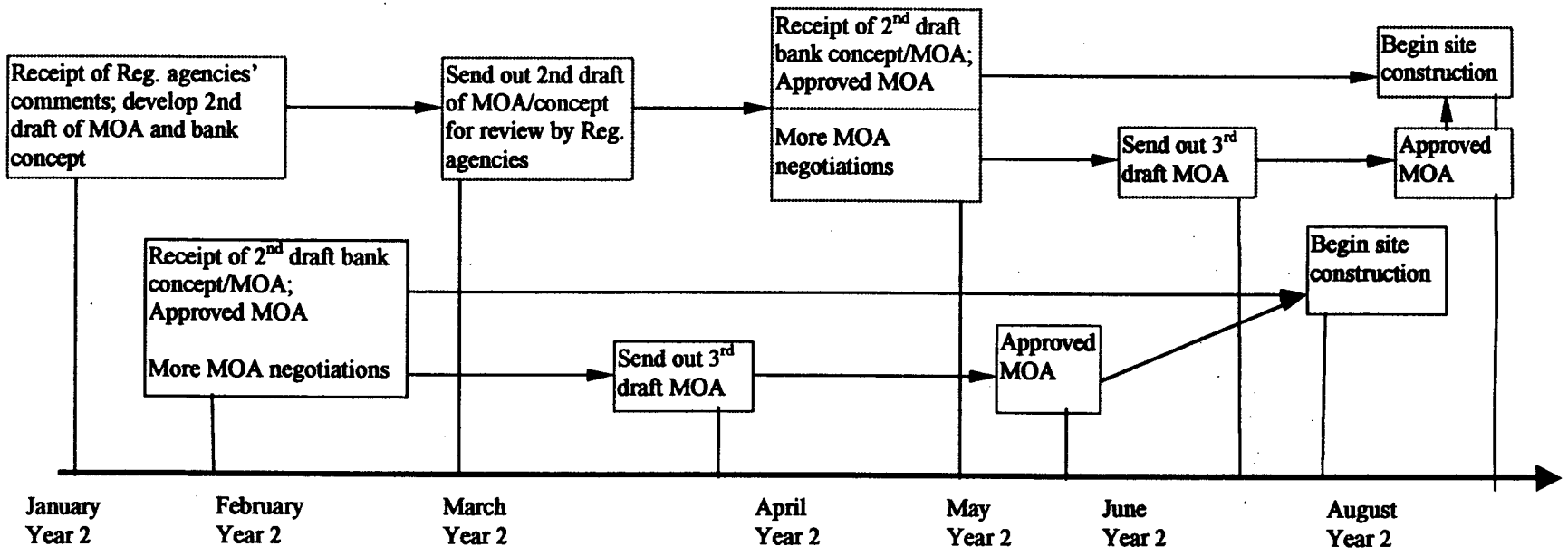

Figure 1. (continued)
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 2 (continued)

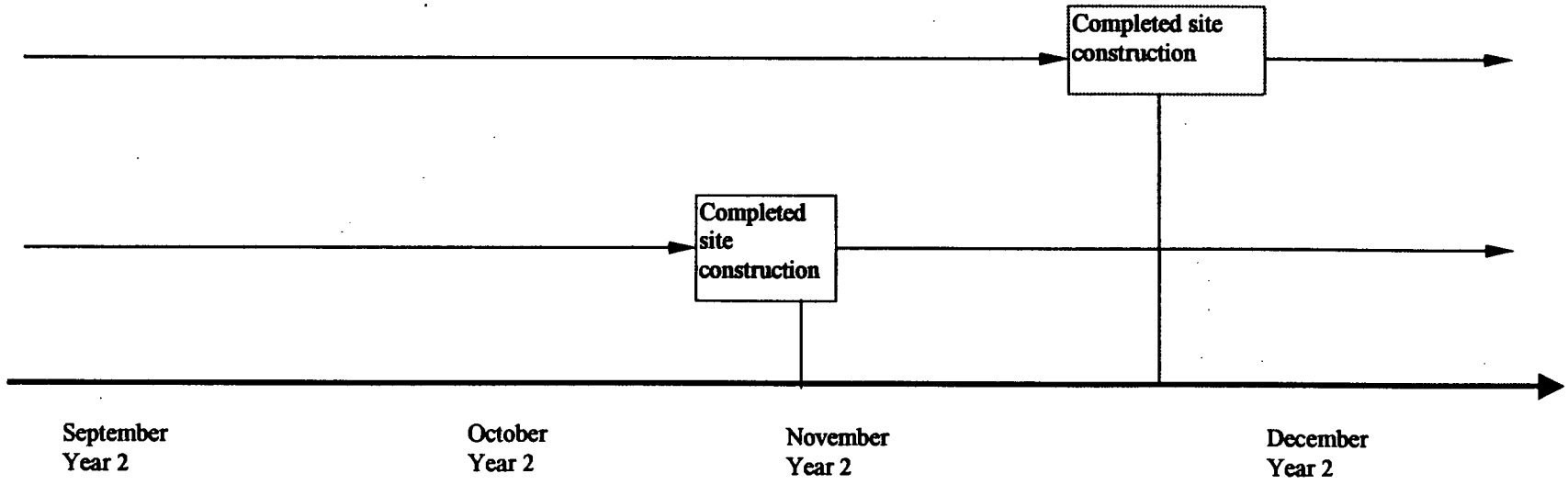

Figure 1. (continued)
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 3

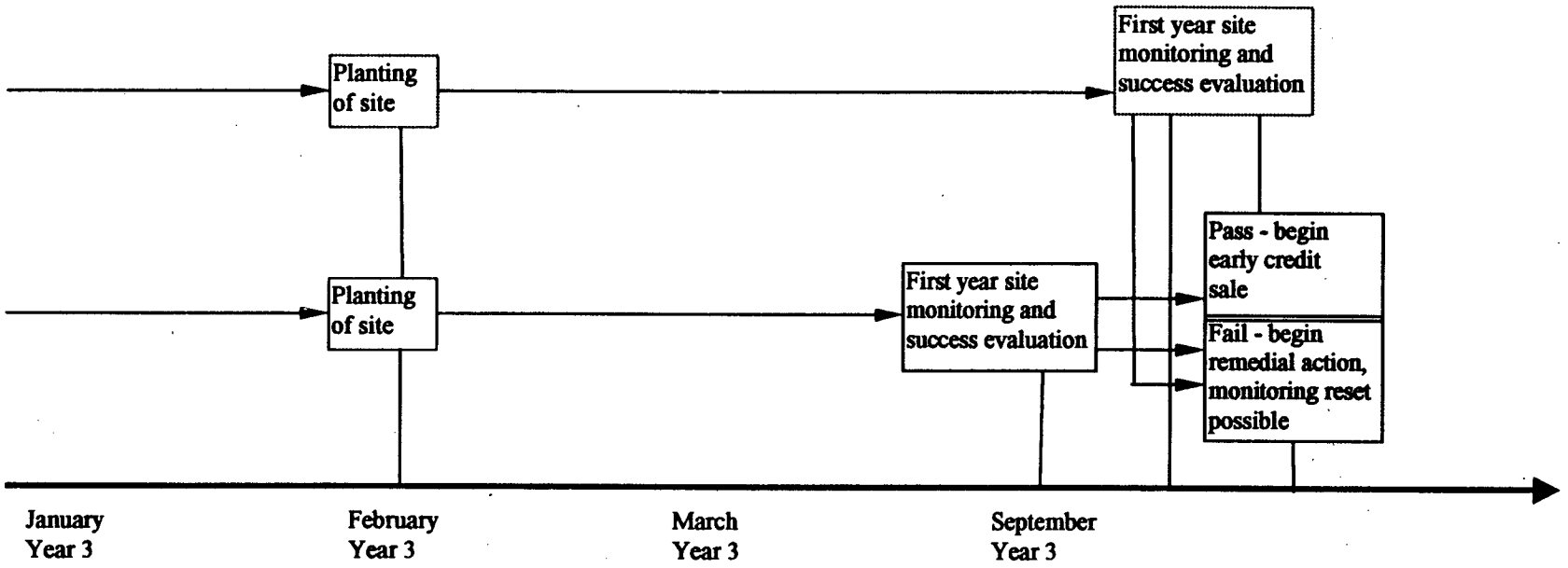

Figure 1. (continued)
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 5

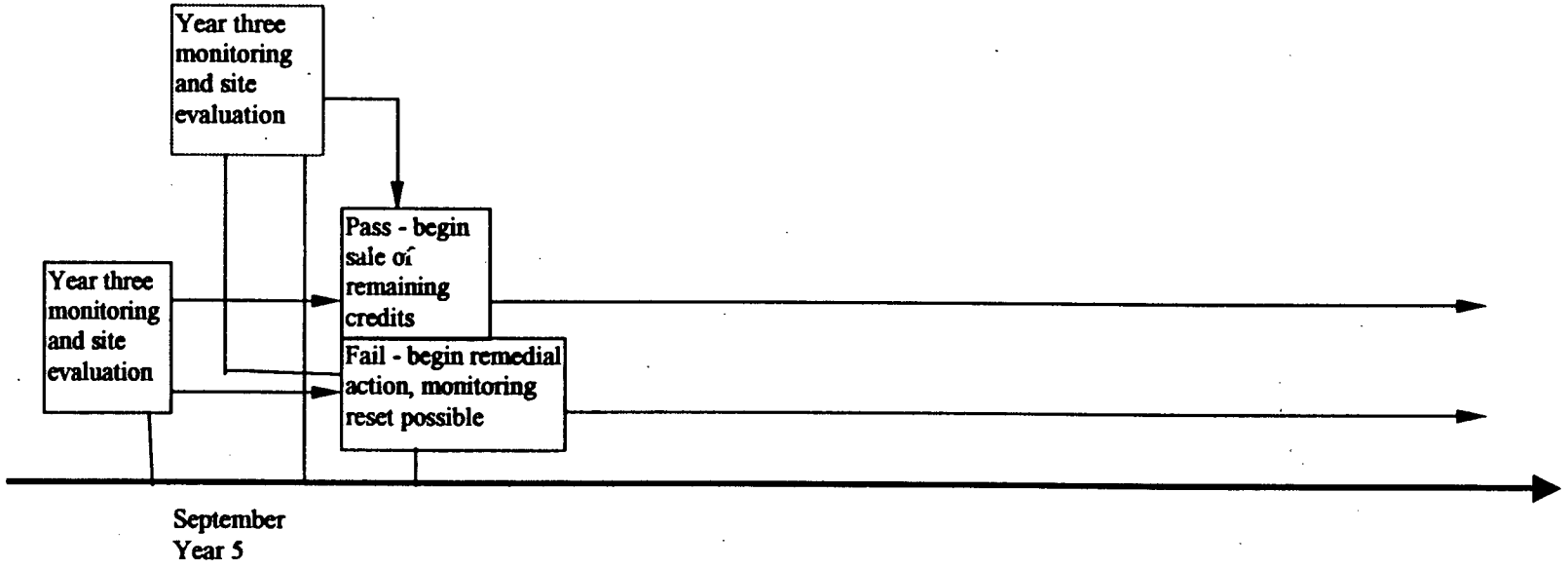

Figure 1. (continued)
Potential Timeline for the Development of a Wetlands Mitigation Bank
(under ideal conditions)
Year 7

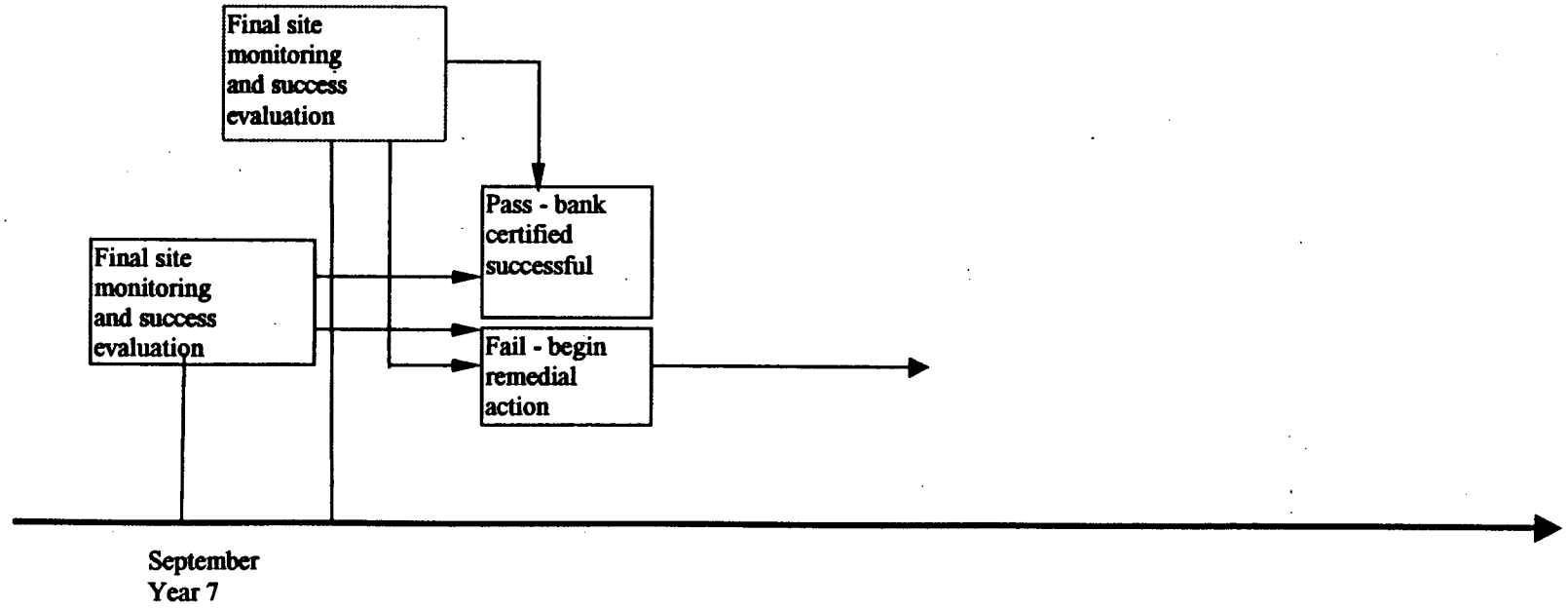

Figure 2.
Site Acquisition Cost
as Percentage of Project Cost

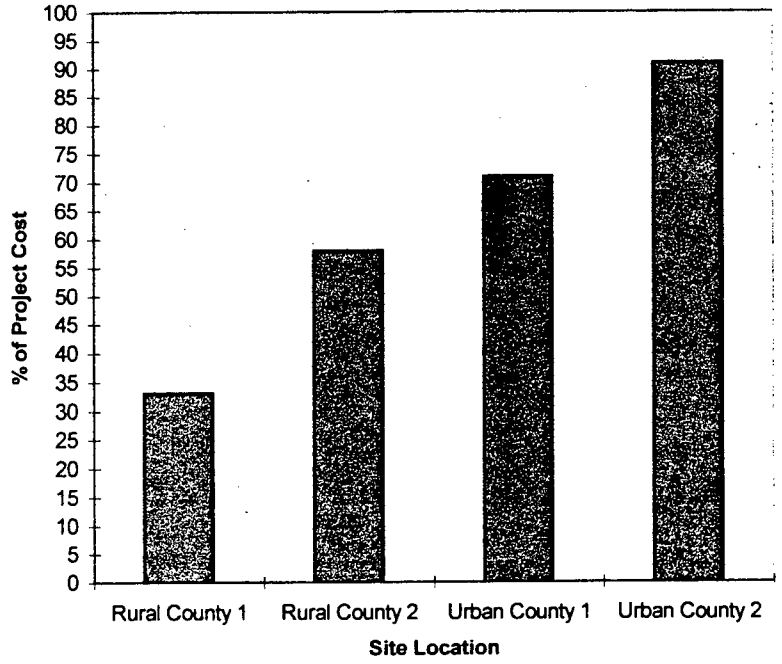

Figure 3.
Internal Rate of Return vs. Credit Price

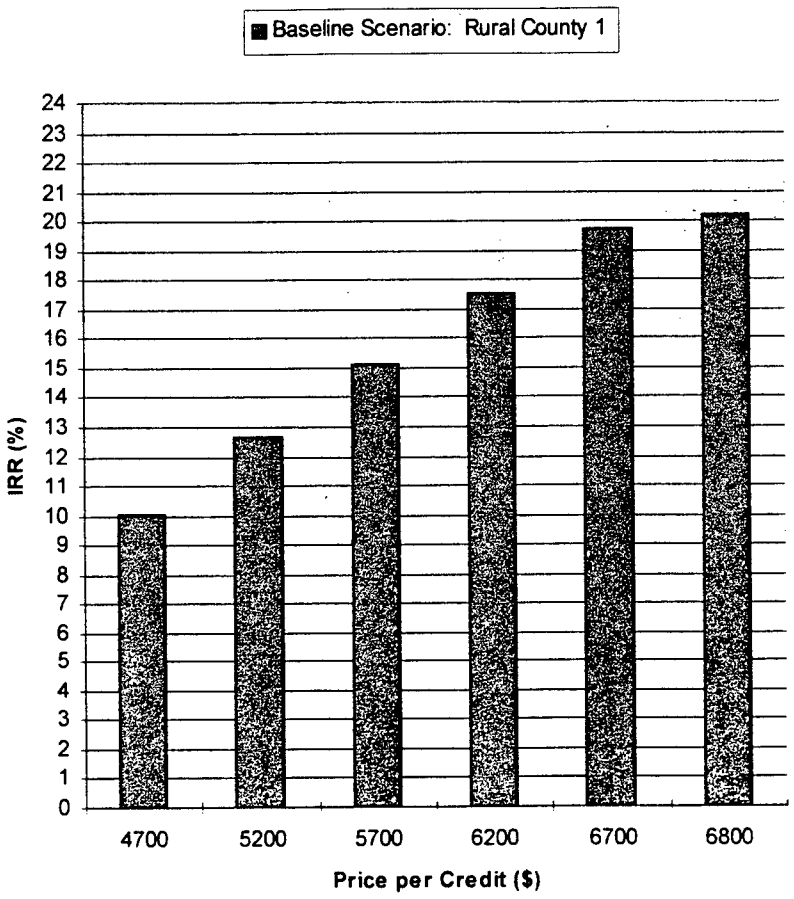

Figure 4.
Internal Rate of Return vs. Credit Price

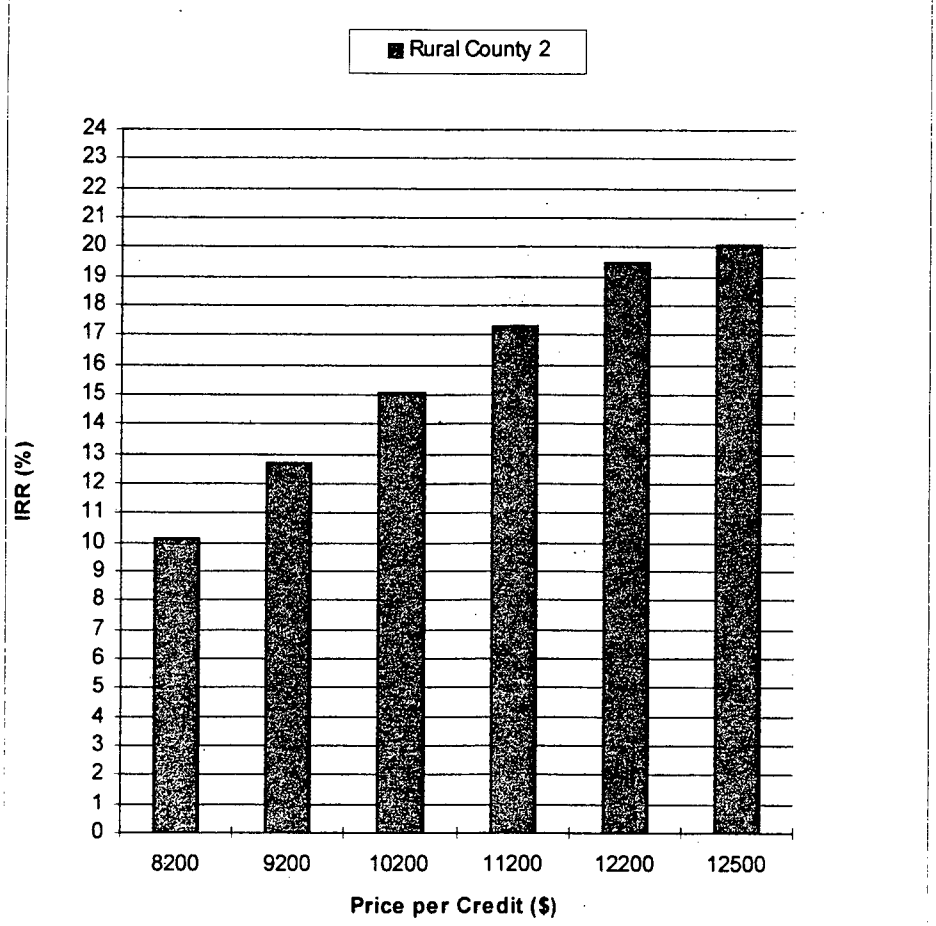

Figure 5.
Internal Rate of Return vs. Credit Price

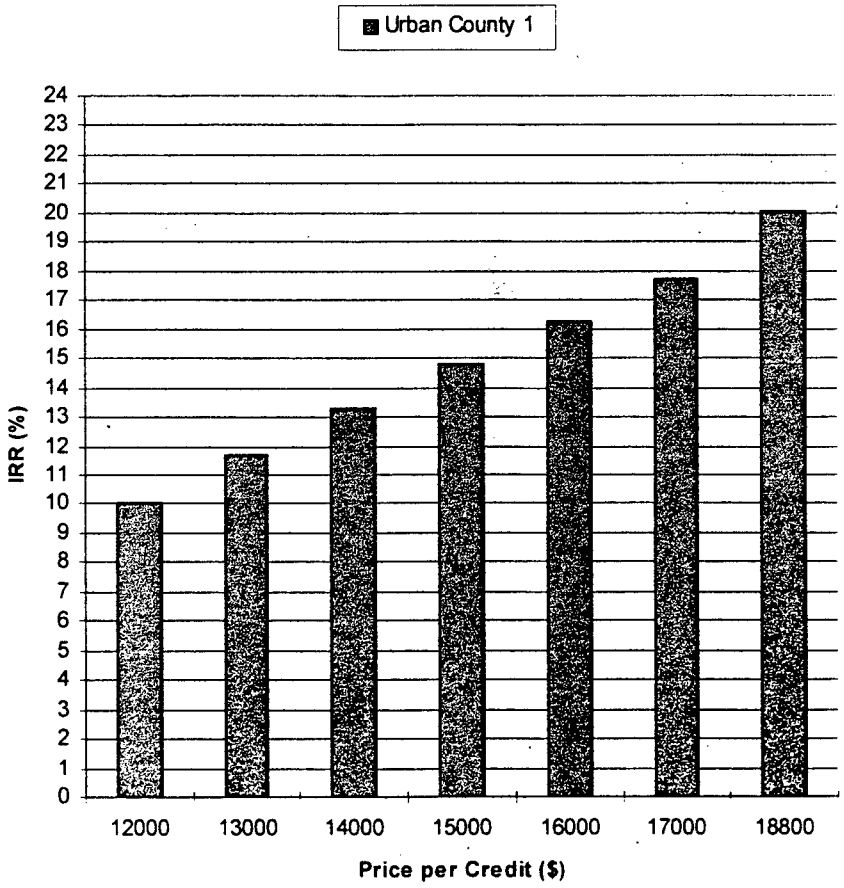

Figure 6.
Internal Rate of Return vs. Credit Price

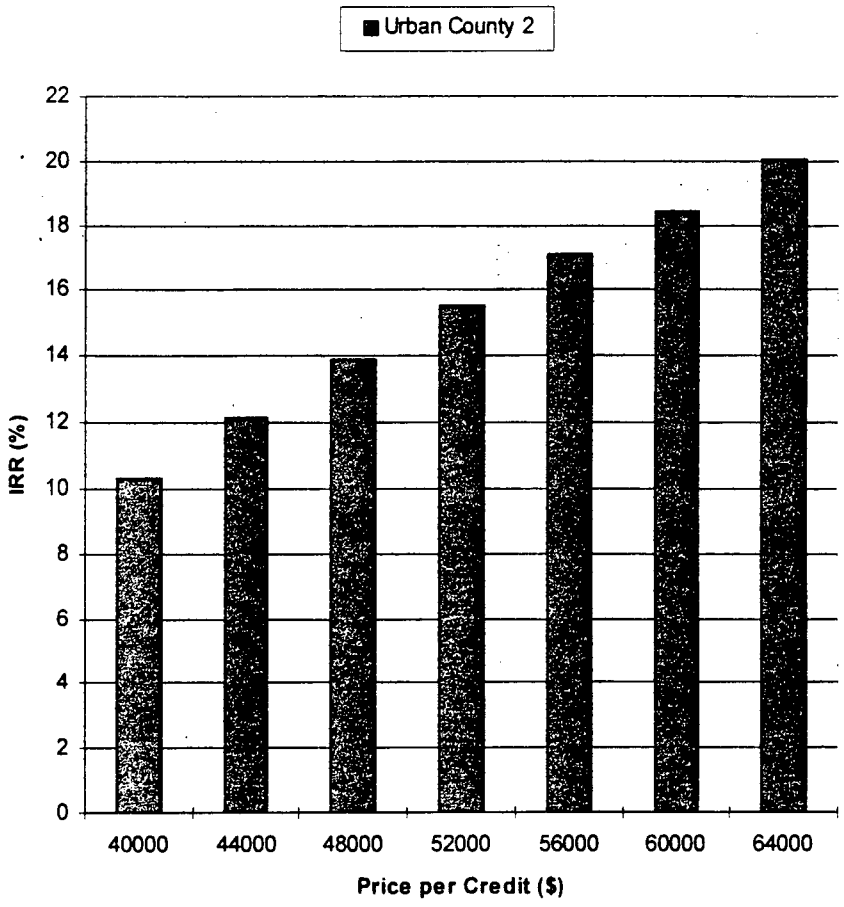

Figure 7.
Net Present Value - Financing

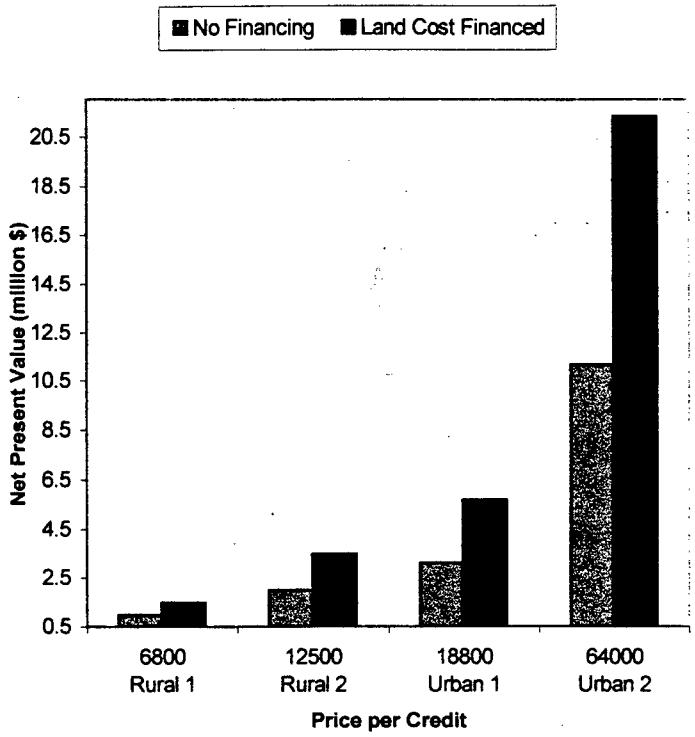

Figure 8.
NPV- Variance in Discount Rate
No Financing

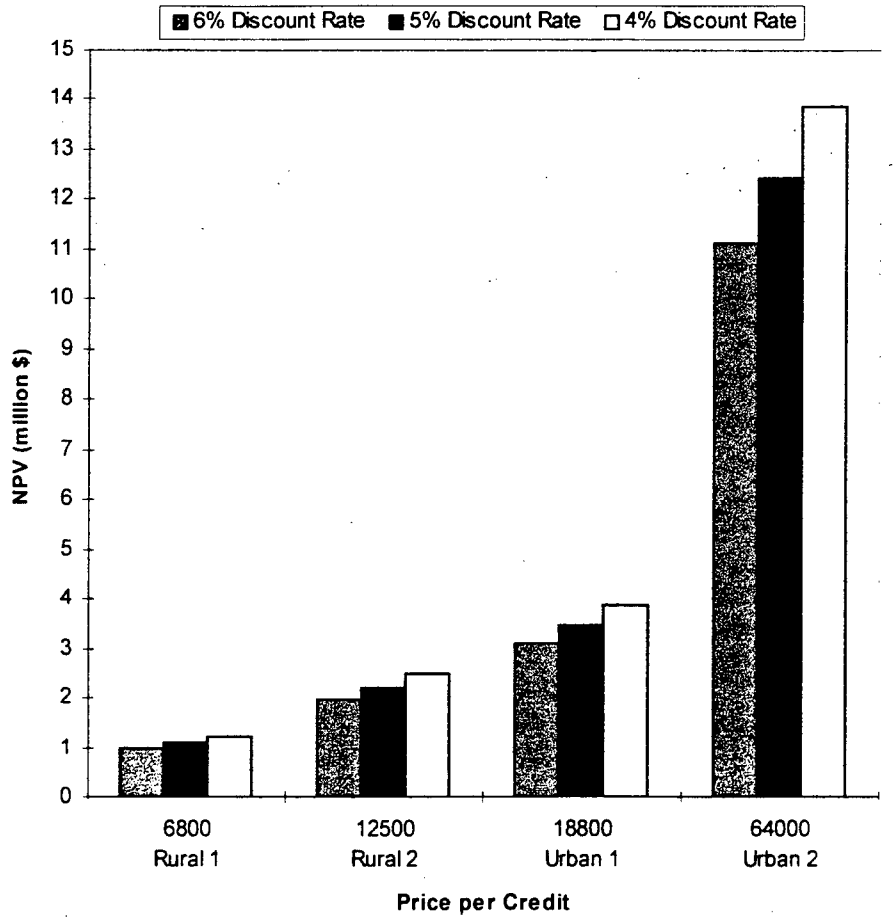

Figure 9.
NPV - Variance in Discount Rates
Land Cost Financed

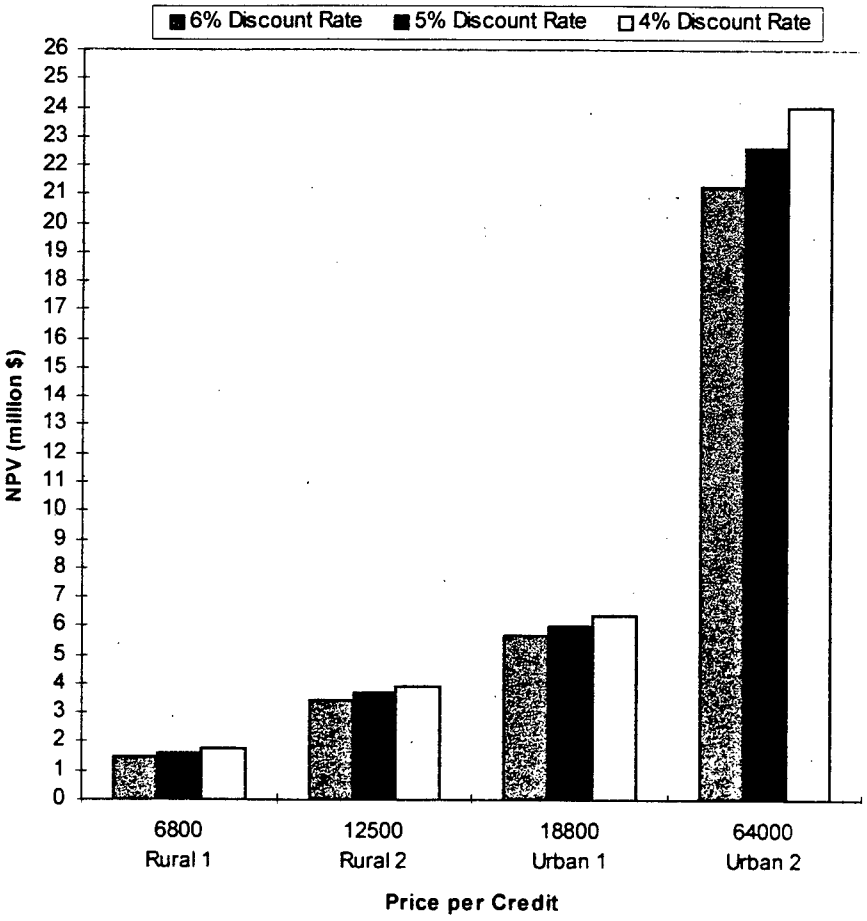

Figure 10.
Venture Capital Financing
4% Discount Rate

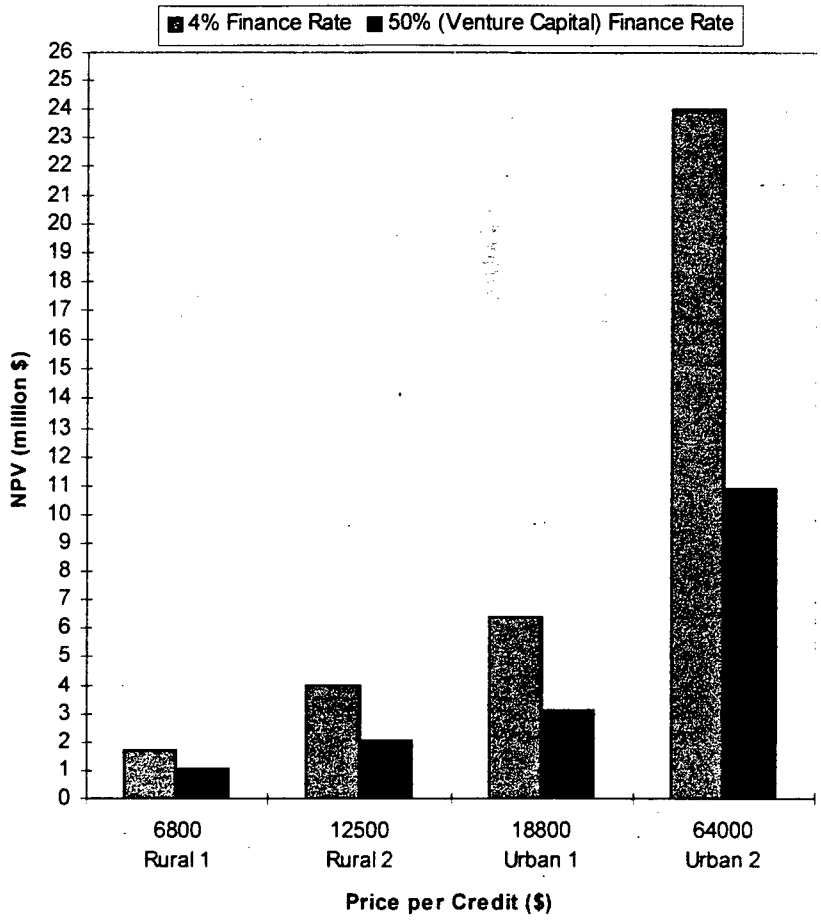

Figure 11.
Venture Capital Financing
5% Discount Rate

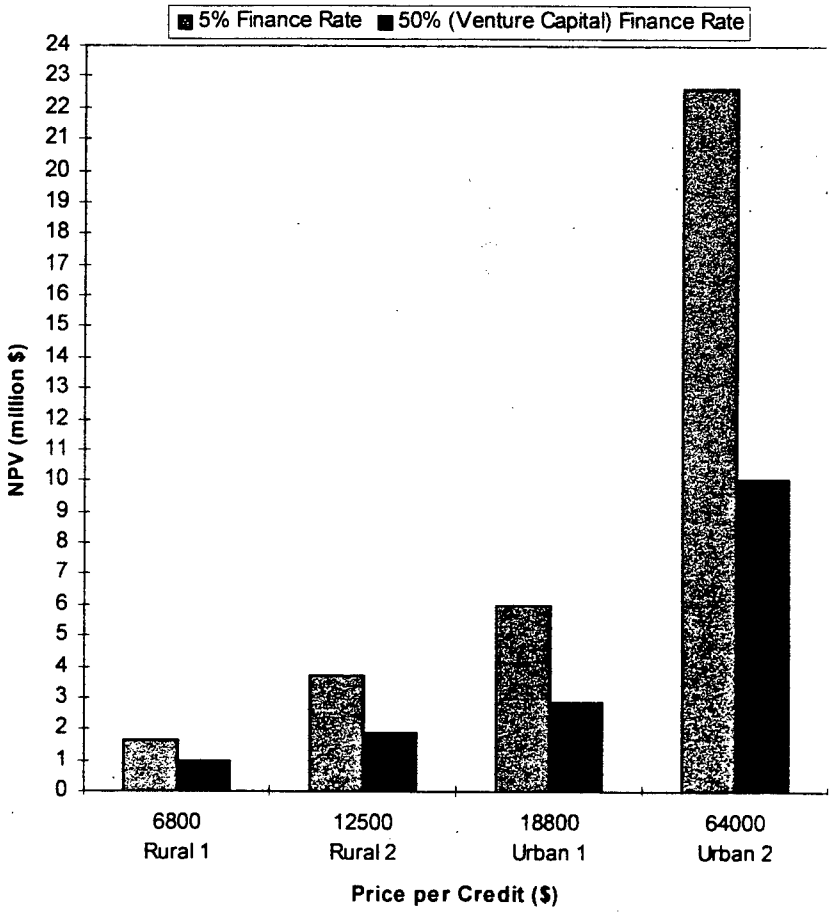

Figure 12.
Venture Capital Financing
6% Discount Rate

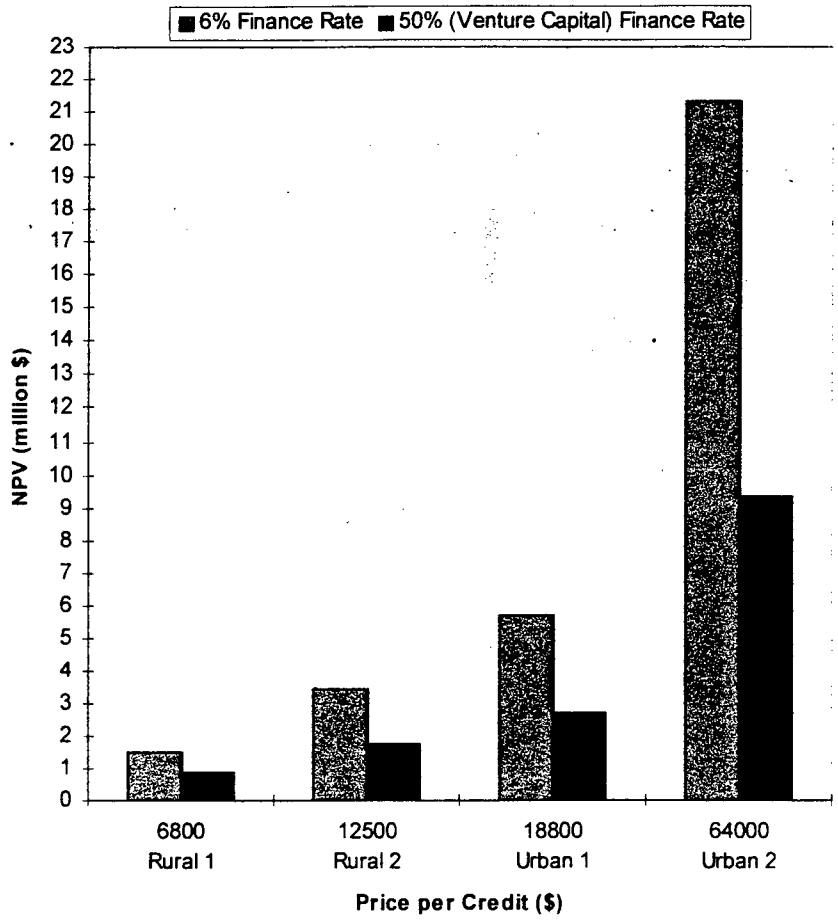

Table 1. Variance in Land Cost			
Location	*Acres*	*$ per Acre*	*Total Land Cost*
Baseline Scenario: Rural County 1	500	$1,000	$500,000
Rural County 2	500	$2,900	$1,450,000
Urban County 1	500	$5,000	$2,500,000
Urban County 2	500	$20,000	$10,000,000

Table 2. Seedling Cost			
Composition and Average Cost			
Specie	*% of Total*	*Number of Seedlings*	*Average Cost*
Atlantic White Cedar	1%	3,045	$487
Bald Cypress	11%	33,495	$6,340
Black Gum	5%	15,225	$2,817
Cherrybark Oak	11%	33,495	$7,233
Green Ash	11%	33,495	$6,197
Overcup Oak	13%	39,585	$7,917
Red Maple	9%	27,405	$5,070
Swamp Chestnut Oak	11%	33,495	$7,499
Tulip Poplar	9%	27,405	$5,643
Water Oak	6%	18,270	$3,945
Water Tupelo	8%	24,360	$4,141
Willow Oak	5%	15,225	$3,288
Total	100%	304,500	$60,576

Table 3. Soil and Erosion Control Plan Fees for Alternate Site Locations		
Location	*Fee Structure*	*Fee for 500 acre project*
Baseline: Rural County 1	$30 for first acre, $20 for each additional and/or partial acre after first acre (NCDLQ 1997)	$10,010
Rural County 2	$30 for first acre, $20 for each additional and/or partial acre after first acre (NCDLQ 1997)	$10,010
Urban County 1: Wake	$175 per acre plus $250 permit fee, maximum 10 acres or $4,250 (WCCS 1997)	$4,250
Urban County 2: Mecklenburg	0-10 acres: $1000 plus $50 for each acre (MCEBSD 1997) >10 acres: $1500 plus $30 for each acre	$16,500

Table 4. Performance Bond						
	Bonding Case 1			Bonding Case 2		
Location	*Project cost excluding land*	*Bond Premium*	*Premium as % of Total Project Cost*	*Project cost excluding land*	*Bond Premium*	*Premium as % of Total Project Cost*
Baseline Scenario: Rural County 1	$1,005,961	$25,409	1.7%	$1,005,961	$20,119	1.3%
Rural County 2	$1,005,961	$25,409	1%	$1,005,961	$20,119	<1%
Urban County 1	$1,000,201	$25,256	<1%	$1,000,201	$20,004	<1%
Urban County 2	$1,012,451	$25,583	<1%	$1,012,451	$20,249	<1%

Table 5. Price per Credit - Internal Rate of Return	
Location	*Credit Price to achieve 20% IRR*
Baseline Scenario: Rural County 1	$6,800 per credit
Rural County 2	$12,500 per credit
Urban County 1	$18,800 per credit
Urban County 2	$64,000 per credit

Table 6. Net Present Value - Financing Land Cost					
Discount Rate- 6% Real					
Location	*Price per Credit to achieve 20% IRR*	*NPV - Land Cost Not Financed*	*NPV - Land Cost Financed*	*Increase in NPV*	*% Increase in NPV*
Baseline Scenario: Rural County 1	$6,800	$965,981	$1,476,223	$510,242	53%
Rural County 2	$12,500	$1,973,743	$3,453,445	$1,479,702	75%
Urban County 1	$18,800	$3,092,847	$5,644,056	$2,551,209	82%
Urban County 2	$64,000	$11,106,358	$21,311,187	$10,204,829	92%

Table 7. Variance in Discount Rate							
		Net Present Value with Discount Rate of:					
		6%		5%		4%	
Location	*Credit Price to Achieve 20% IRR*	*Land Cost Not Financed*	*Land Cost Financed*	*Land Cost Not Financed*	*Land Cost Financed*	*Land Cost Not Financed*	*Land Cost Financed*
Baseline Scenario: Rural County 1	$6,800	$965,981	$1,476,223	$1,085,252	$1,594,061	$1,215,308	$1,722,579
Rural County 2	$12,500	$1,973,743	$3,453,445	$2,212,980	$3,688,520	$2,472,999	$3,944,084
Urban County 1	$18,800	$3,092,847	$5,644,056	$3,464,780	$6,008,812	$3,868,544	$6,404,894
Urban County 2	$64,000	$11,106,358	$21,311,187	$12,429,391	$22,605,515	$13,863,514	$24,008,911

Table 8. Venture Capital Financing						
	Net Present Value with Discount Rate of:					
	6%		*5%*		*4%*	
Location	Venture Capital Financing (50%)	Traditional Financing (6%)	Venture Capital Financing (50%)	Traditional Financing (5%)	Venture Capital Financing (50%)	Traditional Financing (4%)
Rural County 1	$878,623	$1.476 million	$969,054	$1.594 million	$1.069 million	$1.723 million
Rural County 2	$1.720 million	$3.453 million	$1.876 million	$3.689 million	$2.049 million	$3.944 million
Urban County 1	$2.656 million	$5.644 million	$2.884 million	$6.009 million	$3.137 million	$6.405 million
Urban County 2	$9.359 million	$21.311 million	$10.105 million	$22.606 million	$10.937 million	$24.009 million

Table 9. Summary of Total Project Costs				
Location	*Total Project Cost per Acre*		*Project Cost per Acre Excluding Land Cost*	
	Bond Case 1	*Bond Case 2*	*Bond Case 1*	*Bond Case 2*
Baseline Scenario: Rural County 1	$3,063	$3,052	$2,063	$2,052
Rural County 2	$4,963	$4,952	$2,063	$2,052
Urban County 1	$7,051	$7,040	$2,051	$2,040
Urban County 2	$22,076	$$22,065	$2,076	$2,065

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Baseline Scenario: Rural County 1 Bonding Case 1

I. Land Cost

A. Land			
	acres		500
	$ per acre		$1,000
		$	500,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials			
1. Phase I Environmental		$	3,875

III. Design Development

	acres		500
	$ per acre	$	105
		$	52,500

IV. Construction and Installation

A. Earthwork	acres		500
	$ per acre	$	300
		$	150,000
B. Planting			
1. Seedlings		$	60,576
2. Labor	acres		500
	$ per acre	$	144
		$	72,000
3. Herbicide	acres		500
	$ per acre	$	59
		$	29,500
Planting cost		$	162,076
Total C & I costs		$	312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	10,010
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	10,010

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000
Year 5	hours		100
	$ per hour	$	100
		$	10,000

Year 6	hours		100
	$ per hour	$	100
		$	10,000
Year 7	hours		100
	$ per hour	$	100
		$	10,000
Total A & A cost		$	125,000
Project Cost (excluding perf. bond)		$	1,505,961

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$	30,000
Screening		$3,875
Design		$52,500
Mon. layout		$65,000
Base Mon.		$62,500
	$	213,875

b. Year 2 costs

A & A	$	30,000
Monitoring	$	62,500
Permits	$	10,010
Earthwork	$	150,000
	$	252,510

c. Year 3 costs

A & A	$	25,000.00
Year 1 Mon.	$	62,500
Herbicide	$	29,500
Planting	$	132,576
	$	249,576

d. Year 4 costs

A & A	$	10,000
Year 2 Monitoring	$	62,500
	$	72,500

e. Year 5 costs

A & A	$	10,000
Year 3 Monitoring	$	62,500
	$	72,500

f. Year 6 costs

A & A	$	10,000
Year 4 Monitoring	$	62,500
	$	72,500

g. Year 7 costs

A & A	$	10,000
Year 5 Monitoring	$	62,500
	$	72,500

Total (excluding land cost) $ 1,005,961

B. Performance Bond

PV of project costs		$846,980
PV of project costs x 1.5	$	1,270,470
Bond amount	$	1,270,470
Bond premium		0.02
Total Bond cost	$	25,409

IX. Totals

	%		
Land Cost	32.7%	$	500,000
Analysis of Site	0.3%	$	3,875
Design Development	3.4%	$	52,500
Construction and Installation	20.4%	$	312,076
Monitoring	32.8%	$	502,500
Permits	0.7%	$	10,010
Approval and Administration	8.2%	$	125,000
Performance Bond	1.7%	$	25,409

Total Project Cost	$	1,531,370
Total Project Cost per Acre	$	3,063
Total Project Cost per Acre excluding land cost	$	2,063

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Rural Scenario - County 2 Bonding Case 1

I. Land Cost

A. Land			
	acres		500
	$ per acre		$2,900
		$	1,450,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials			
1. Phase I Environmental		$	3,875

III. Design Development

	acres		500
	$ per acre	$	105
		$	52,500

IV. Construction and Installation

A. Earthwork	acres		500
	$ per acre	$	300
		$	150,000
B. Planting			
1. Seedlings		$	60,576
2. Labor	acres		500
	$ per acre	$	144
		$	72,000
3. Herbicide	acres		500
	$ per acre	$	59
		$	29,500
Planting cost		$	162,076
Total C & I costs		$	312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	10,010
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	10,010

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000
Year 5	hours		100
	$ per hour	$	100
		$	10,000

Year 6	hours		100
	$ per hour	$	100
		$	10,000
Year 7	hours		100
	$ per hour	$	100
		$	10,000
Total A & A cost		$	125,000
Project Cost		$	2,455,961

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$	30,000
Screening		$3,875
Design		$52,500
Mon. layout		$65,000
Base Mon.		$62,500
	$	213,875

b. Year 2 costs

A & A	$	30,000
Monitoring	$	62,500
Permits	$	10,010
Earthwork	$	150,000
	$	252,510

c. Year 3 costs

A & A	$	25,000.00
Year 1 Mon.	$	62,500
Herbicide	$	29,500
Planting	$	132,576
	$	249,576

d. Year 4 costs

A & A	$	10,000
Year 2 Monitoring	$	62,500
	$	72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost) $ 1,005,961

B. Performance Bond

PV of project costs	$846,980
PV of project costs x 1.5	$ 1,270,470
Bond amount	$ 1,270,470
Bond premium	0.02
Total Bond cost	$ 25,409

IX. Totals

	%	
Land Cost	58.4%	$ 1,450,000
Analysis of Site	0.2%	$ 3,875
Design Development	2.1%	$ 52,500
Construction and Installation	12.6%	$ 312,076
Monitoring	20.3%	$ 502,500
Permits	0.4%	$ 10,010
Approval and Administration	5.0%	$ 125,000
Performance Bond	1.0%	$ 25,409

Total Project Cost	$ 2,481,370
Total Project Cost per Acre	$ 4,963
Total Project Cost per Acre excluding land cost	$ 2,063

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Urban Scenario - County 1 Bonding Case 1

I. Land Cost

A. Land

acres		500
$ per acre		$5,000
		$ 2,500,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials

1. Phase I Environmental $ 3,875

III. Design Development

acres		500
$ per acre	$	105
	$	52,500

IV. Construction and Installation

A. Earthwork

acres		500
$ per acre	$	300
	$	150,000

B. Planting

1. Seedlings $ 60,576

2. Labor

acres		500
$ per acre	$	144
	$	72,000

3. Herbicide

acres		500
$ per acre	$	59
	$	29,500

Planting cost $ 162,076

Total C & I costs $ 312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre		$ 130
			$ 65,000
B. Monitoring - per year	acres		500
	$ per acre		$ 125
			$ 62,500
C. Monitoring - 7 years			$ 437,500
	Total Monitoring Cost		$ 502,500

VI. Permits

A. Soil and Erosion Plan		$ 4,250
B. Stormwater permit		$ -
C. Mitigation Bank Permit		$ -
	Total Cost of Permits	$ 4,250

VII. Approval and Administration

Year 1	hours		300
	$ per hour		$ 100
			$ 30,000
Year 2	hours		300
	$ per hour		$ 100
			$ 30,000
Year 3	hours		250
	$ per hour		$ 100
			$ 25,000
Year 4	hours		100
	$ per hour		$ 100
			$ 10,000
Year 5	hours		100
	$ per hour		$ 100
			$ 10,000

Year 6	hours	100
	$ per hour	$ 100
		$ 10,000
Year 7	hours	100
	$ per hour	$ 100
		$ 10,000
Total A & A cost		$ 125,000
Project Cost		$ 3,500,201

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$ 30,000
Screening	$3,875
Design	$52,500
Mon. layout	$65,000
Base Mon.	$62,500
	$ 213,875

b. Year 2 costs

A & A	$ 30,000
Monitoring	$ 62,500
Permits	$ 4,250
Earthwork	$ 150,000
	$ 246,750

c. Year 3 costs

A & A	$ 25,000
Year 1 Mon.	$ 62,500
Herbicide	$ 29,500
Planting	$ 132,576
	$ 249,576

d. Year 4 costs

A & A	$ 10,000
Year 2 Monitoring	$ 62,500
	$ 72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost) $ 1,000,201

B. Performance Bond

PV of project costs	$841,854
PV of project costs x 1.5	$ 1,262,780
Bond amount	$ 1,262,780
Bond premium	0.02
Total Bond cost	$ 25,256

IX. Totals

	%	
Land Cost	70.9%	$ 2,500,000
Analysis of Site	0.1%	$ 3,875
Design Development	1.5%	$ 52,500
Construction and Installation	8.9%	$ 312,076
Monitoring	14.3%	$ 502,500
Permits	0.1%	$ 4,250
Approval and Administration	3.5%	$ 125,000
Performance Bond	0.7%	$ 25,256

Total Project Cost	$ 3,525,457
Total Project Cost per Acre	$ 7,051
Total Project Cost per Acre excluding land cost	$ 2,051

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Urban Scenario - County 2 Bonding Case 1

I. Land Cost

A. Land			
	acres		500
	$ per acre		$20,000
		$	10,000,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials			
1. Phase I Environmental		$	3,875

III. Design Development

	acres		500
	$ per acre	$	105
		$	52,500

IV. Construction and Installation

A. Earthwork	acres		500
	$ per acre	$	300
		$	150,000
B. Planting			
1. Seedlings		$	60,576
2. Labor	acres		500
	$ per acre	$	144
		$	72,000
3. Herbicide	acres		500
	$ per acre	$	59
		$	29,500
Planting cost		$	162,076
Total C & I costs		$	312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	16,500
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	16,500

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000

Year 5	hours		100
	$ per hour	$	100
		$	10,000
Year 6	hours		100
	$ per hour	$	100
		$	10,000
Year 7	hours		100
	$ per hour	$	100
		$	10,000
Total A & A cost		$	125,000
Project Cost		$	11,012,451

VIII. Banking Agreement

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$	30,000
Screening		$3,875
Design		$52,500
Mon. layout		$65,000
Base Mon.		$62,500
	$	213,875

b. Year 2 costs

A & A	$	30,000
Monitoring	$	62,500
Permits	$	16,500
Earthwork	$	150,000
	$	259,000

c. Year 3 costs

A & A	$	25,000
Year 1 Mon.	$	62,500
Herbicide	$	29,500
Planting	$	132,576
	$	249,576

d. Year 4 costs

A & A	$	10,000
Year 2 Monitoring	$	62,500
	$	72,500

e. Year 5 costs

A & A	$	10,000
Year 3 Monitoring	$	62,500
	$	72,500

f. Year 6 costs

A & A	$	10,000
Year 4 Monitoring	$	62,500
	$	72,500

g. Year 7 costs

A & A	$	10,000
Year 5 Monitoring	$	62,500
	$	72,500

Total (excluding land cost)	$	1,012,451

B. Performance Bond

PV of project costs		$852,756
PV of project costs x 1.5	$	1,279,134
Bond amount	$	1,279,134
Bond premium		0.02
Total Bond cost	$	25,583

IX. Totals

	%		
Land Cost	90.6%	$	10,000,000
Analysis of Site	0.04%	$	3,875
Design Development	0.5%	$	52,500
Construction and Installation	2.8%	$	312,076
Monitoring	4.6%	$	502,500
Permits	0.1%	$	16,500

Approval and Administration	1.1%	$ 125,000
Performance Bond	0.2%	$ 25,583
Total Project Cost		$ 11,038,034
Total Project Cost per Acre		$ 22,076
Total Project Cost per Acre, excluding land cost		$ 2,076

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Baseline Scenario: Rural County 1 Bonding Case 2

I. Land Cost

A. Land

acres		500
$ per acre		$1,000
	$	500,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials

1. Phase I Environmental	$	3,875

III. Design Development

acres		500
$ per acre	$	105
	$	52,500

IV. Construction and Installation

A. Earthwork

acres		500
$ per acre	$	300
	$	150,000

B. Planting

1. Seedlings	$	60,576
2. Labor		
acres		500
$ per acre	$	144
	$	72,000
3. Herbicide		
acres		500
$ per acre	$	59
	$	29,500
Planting cost	$	162,076
Total C & I costs	$	312,076

V. Monitoring

A. Monitoring Layout	acres	500
	$ per acre	$ 130
		$ 65,000
B. Monitoring - per year	acres	500
	$ per acre	$ 125
		$ 62,500
C. Monitoring - 7 years		$ 437,500
Total Monitoring Cost		$ 502,500

VI. Permits

A. Soil and Erosion Plan	$ 10,010
B. Stormwater permit	$ -
C. Mitigation Bank Permit	$ -
Total Cost of Permits	$ 10,010

VII. Approval and Administration

Year 1	hours	300
	$ per hour	$ 100
		$ 30,000
Year 2	hours	300
	$ per hour	$ 100
		$ 30,000
Year 3	hours	250
	$ per hour	$ 100
		$ 25,000
Year 4	hours	100
	$ per hour	$ 100
		$ 10,000
Year 5	hours	100
	$ per hour	$ 100
		$ 10,000

Year 6	hours	100
	$ per hour	$ 100
		$ 10,000
Year 7	hours	100
	$ per hour	$ 100
		$ 10,000
Total A & A cost		$ 125,000
Total (excluding land cost)		$ 1,505,961

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$ 30,000
Screening	$3,875
Design	$52,500
Mon. layout	$65,000
Base Mon.	$62,500
	$ 213,875

b. Year 2 costs

A & A	$ 30,000
Monitoring	$ 62,500
Permits	$ 10,010
Earthwork	$ 150,000
	$ 252,510

c. Year 3 costs

A & A	$ 25,000.00
Year 1 Mon.	$ 62,500
Herbicide	$ 29,500
Planting	$ 132,576
	$ 249,576

d. Year 4 costs

A & A	$ 10,000
Year 2 Monitoring	$ 62,500

	$ 72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost)	$ 1,005,961

B. Performance Bond

Total (excluding land cost)	$ 1,005,961
Bond amount	$ 1,005,961
Bond premium	0.02
Total Bond cost	$ 20,119

IX. Totals

	%	
Land Cost	32.8%	$ 500,000
Analysis of Site	0.3%	$ 3,875
Design Development	3.4%	$ 52,500
Construction and Installation	20.4%	$ 312,076
Monitoring	32.9%	$ 502,500
Permits	0.7%	$ 10,010
Approval and Administration	8.2%	$ 125,000

Performance Bond	1.3%	$ 20,119
Total Project Cost		$ 1,526,080
Total Project Cost per Acre		$ 3,052
Total Project Cost per Acre, excluding land cost		$ 2,052

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Rural Scenario - County 2 Bonding Case 2

I. Land Cost

A. Land

acres		500
$ per acre		$2,900
		$ 1,450,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials

1. Phase I Environmental		$ 3,875

III. Design Development

acres		500
$ per acre		$ 105
		$ 52,500

IV. Construction and Installation

A. Earthwork	acres	500
	$ per acre	$ 300
		$ 150,000

B. Planting

1. Seedlings		$ 60,576
2. Labor	acres	500
	$ per acre	$ 144
		$ 72,000
3. Herbicide	acres	500
	$ per acre	$ 59
		$ 29,500
Planting cost		$ 162,076
Total C & I costs		$ 312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	10,010
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	10,010

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000

Year 5	hours	100
	$ per hour	$ 100
		$ 10,000
Year 6	hours	100
	$ per hour	$ 100
		$ 10,000
Year 7	hours	100
	$ per hour	$ 100
		$ 10,000
Total A & A cost		$ 125,000
Project Cost		$ 2,455,961

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$ 30,000
Screening	$3,875
Design	$52,500
Mon. layout	$65,000
Base Mon.	$62,500
	$ 213,875

b. Year 2 costs

A & A	$ 30,000
Monitoring	$ 62,500
Permits	$ 10,010
Earthwork	$ 150,000
	$ 252,510

c. Year 3 costs

A & A	$ 25,000.00
Year 1 Mon.	$ 62,500
Herbicide	$ 29,500
Planting	$ 132,576
	$ 249,576

d. Year 4 costs

A & A	$ 10,000
Year 2 Monitoring	$ 62,500
	$ 72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost) $ 1,005,961

B. Performance Bond

Total (excluding land cost) $ 1,005,961

Bond amount	$ 1,005,961
Bond premium	0.02
Total Bond cost	$ 20,119

IX. Totals

	%	
Land Cost	58.6%	$ 1,450,000
Analysis of Site	0.2%	$ 3,875
Design Development	2.1%	$ 52,500
Construction and Installation	12.6%	$ 312,076
Monitoring	20.3%	$ 502,500

Permits	0.4%	$ 10,010
Approval and Administration	5.0%	$ 125,000
Performance Bond	0.8%	$ 20,119
Total Project Cost		$ 2,476,080
Total Project Cost per Acre		$ 4,952
Total Project Cost per Acre, excluding land cost		$ 2,052

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Urban Scenario - County 1 Bonding Case 2

I. Land Cost

A. Land

	acres	500
	$ per acre	$5,000
		$ 2,500,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials

1. Phase I Environmental		$ 3,875

III. Design Development

	acres	500
	$ per acre	$ 105
		$ 52,500

IV. Construction and Installation

A. Earthwork	acres	500
	$ per acre	$ 300
		$ 150,000
B. Planting		
1. Seedlings		$ 60,576
2. Labor	acres	500
	$ per acre	$ 144
		$ 72,000
3. Herbicide	acres	500
	$ per acre	$ 59
		$ 29,500
Planting cost		$ 162,076
Total C & I costs		$ 312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	4,250
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	4,250

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000

Year 5	hours	100
	$ per hour	$ 100
		$ 10,000
Year 6	hours	100
	$ per hour	$ 100
		$ 10,000
Year 7	hours	100
	$ per hour	$ 100
		$ 10,000
Total A & A cost		$ 125,000
Project Cost		$ 3,500,201

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$ 30,000
Screening	$3,875
Design	$52,500
Mon. layout	$65,000
Base Mon.	$62,500
	$213,875.00

b. Year 2 costs

A & A	$ 30,000
Monitoring	$ 62,500
Permits	$ 4,250
Earthwork	$ 150,000
	$ 246,750

c. Year 3 costs

A & A	$ 25,000
Year 1 Mon.	$ 62,500
Herbicide	$ 29,500
Planting	$ 132,576
	$ 249,576

d. Year 4 costs

A & A	$ 10,000
Year 2 Monitoring	$ 62,500
	$ 72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost) $ 1,000,201

B. Performance Bond

Total (excluding land cost)	$ 1,000,201
Bond amount	$ 1,000,201
Bond premium	0.02
Total Bond cost	$ 20,004

IX. Totals

	%	
Land Cost	71.0%	$ 2,500,000
Analysis of Site	0.1%	$ 3,875
Design Development	1.5%	$ 52,500
Construction and Installation	8.9%	$ 312,076
Monitoring	14.3%	$ 502,500

Permits	0.1%	$ 4,250
Approval and Administration	3.6%	$ 125,000
Performance Bond	0.6%	$ 20,004
Total Project Cost		$ 3,520,205
Total Project Cost per Acre		$ 7,040
Total Project Cost per Acre, excluding land cost		$ 2,040

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina: Urban Scenario - County 2 Bonding Case 2

I. Land Cost

A. Land

acres		500
$ per acre		$20,000
		$ 10,000,000

II. Analysis of Site (or proposed site)

A. Screening for Toxic or Hazardous Materials

1. Phase I Environmental		$ 3,875

III. Design Development

acres		500
$ per acre		$ 105
		$ 52,500

IV. Construction and Installation

A. Earthwork	acres		500
	$ per acre		$ 300
			$ 150,000
B. Planting			
1. Seedlings			$ 60,576
2. Labor	acres		500
	$ per acre		$ 144
			$ 72,000
3. Herbicide	acres		500
	$ per acre		$ 59
			$ 29,500
Planting cost			$ 162,076
Total C & I costs			$ 312,076

V. Monitoring

A. Monitoring Layout	acres		500
	$ per acre	$	130
		$	65,000
B. Monitoring - per year	acres		500
	$ per acre	$	125
		$	62,500
C. Monitoring - 7 years		$	437,500
Total Monitoring Cost		$	502,500

VI. Permits

A. Soil and Erosion Plan	$	16,500
B. Stormwater permit	$	-
C. Mitigation Bank Permit	$	-
Total Cost of Permits	$	16,500

VII. Approval and Administration

Year 1	hours		300
	$ per hour	$	100
		$	30,000
Year 2	hours		300
	$ per hour	$	100
		$	30,000
Year 3	hours		250
	$ per hour	$	100
		$	25,000
Year 4	hours		100
	$ per hour	$	100
		$	10,000

Year 5	hours	100
	$ per hour	$ 100
		$ 10,000
Year 6	hours	100
	$ per hour	$ 100
		$ 10,000
Year 7	hours	100
	$ per hour	$ 100
		$ 10,000
Total A & A cost		$ 125,000
Project Cost		$ 11,012,451

VIII. Distribution of Costs - Performance Bond

A. Distribution of project cost, by year

a. Year 1 costs

A & A	$ 30,000
Screening	$3,875
Design	$52,500
Mon. layout	$65,000
Base Mon.	$62,500
	$ 213,875

b. Year 2 costs

A & A	$ 30,000
Monitoring	$ 62,500
Permits	$ 16,500
Earthwork	$ 150,000
	$ 259,000

c. Year 3 costs

A & A	$ 25,000
Year 1 Mon.	$ 62,500
Herbicide	$ 29,500
Planting	$ 132,576
	$ 249,576

d. Year 4 costs

A & A	$ 10,000
Year 2 Monitoring	$ 62,500
	$ 72,500

e. Year 5 costs

A & A	$ 10,000
Year 3 Monitoring	$ 62,500
	$ 72,500

f. Year 6 costs

A & A	$ 10,000
Year 4 Monitoring	$ 62,500
	$ 72,500

g. Year 7 costs

A & A	$ 10,000
Year 5 Monitoring	$ 62,500
	$ 72,500

Total (excluding land cost) $ 1,012,451

B. Performance Bond

Total (excluding land cost) $ 1,012,451

Bond amount	$ 1,012,451
Bond premium	0.02
Total Bond cost	$ 20,249

IX. Totals

	%	
Land Cost	90.6%	$ 10,000,000
Analysis of Site	0.0%	$ 3,875
Design Development	0.5%	$ 52,500
Construction and Installation	2.8%	$ 312,076
Monitoring	4.6%	$ 502,500

Permits	0.1%	$	16,500
Approval and Administration	1.1%	$	125,000
Performance Bond	0.2%	$	20,249
Total Project Cost		$	11,032,700
Total Project Cost per Acre		$	22,065
Total Project Cost per Acre, excluding land cost		$	2,065

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina

Bonding Case 1

Internal Rate of Return - Net Present Value (6% real)

Credit sales of: 75 yr. 3, 75 yr. 4, 50 each yrs. 5-11

Rural County 1

Cash Flows - $4,700 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-500000		C_0	450000	
C_1	-213875		C_1	-318272	
C_2	-277919		C_2	-382316	
C_3	102924		C_3	-1473	
C_4	280000	IRR	C_4	175603	
C_5	162500	10.05%	C_5	58103	
C_6	162500		C_6	162500	
C_7	162500	NPV	C_7	162500	NPV
C_8	235000	$244,701	C_8	235000	$754,942
C_9	235000		C_9	235000	
C_{10}	235000		C_{10}	235000	
C_{11}	235000		C_{11}	235000	

Cash Flows - $5,200 per credit

C_0	-500000		C_0	450000	
C_1	-213875		C_1	-318272	
C_2	-277919		C_2	-382316	
C_3	140424		C_3	36027	
C_4	317500	IRR	C_4	213103	
C_5	187500	12.68%	C_5	83103	
C_6	187500		C_6	187500	
C_7	187500	NPV	C_7	187500	NPV
C_8	260000	$416,434	C_8	260000	$926,676
C_9	260000		C_9	260000	
C_{10}	260000		C_{10}	260000	
C_{11}	260000		C_{11}	260000	

Cash Flows - $5,700 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-500000		C_0	450000	
C_1	-213875		C_1	-318272	
C_2	-277919		C_2	-382316	
C_3	177924		C_3	73527	
C_4	355000	IRR	C_4	250603	
C_5	212500	15.16%	C_5	108103	
C_6	212500		C_6	212500	
C_7	212500	NPV	C_7	212500	NPV
C_8	285000	$588,168	C_8	285000	$1,098,409
C_9	285000		C_9	285000	
C_{10}	285000		C_{10}	285000	
C_{11}	285000		C_{11}	285000	

Cash Flows - $6,200 per credit

C_0	-500000		C_0	450000	
C_1	-213875		C_1	-318272	
C_2	-277919		C_2	-382316	
C_3	215424		C_3	111027	
C_4	392500	IRR	C_4	288103	
C_5	237500	17.52%	C_5	133103	
C_6	237500		C_6	237500	
C_7	237500	NPV	C_7	237500	NPV
C_8	310000	$759,901	C_8	310000	$1,270,143
C_9	310000		C_9	310000	
C_{10}	310000		C_{10}	310000	
C_{11}	310000		C_{11}	310000	

Cash Flows - $6,700 per credit

	No Financing			Land	Financed (10% down, 6%, 5 yr.s)	
C_0	-500000			C_0	450000	
C_1	-213875			C_1	-318272	
C_2	-277919			C_2	-382316	
C_3	252924			C_3	148527	
C_4	430000	IRR		C_4	325603	
C_5	262500	19.77%		C_5	158103	
C_6	262500			C_6	262500	
C_7	262500	NPV		C_7	262500	NPV
C_8	335000	$931,634		C_8	335000	$1,441,876
C_9	335000			C_9	335000	
C_{10}	335000			C_{10}	335000	
C_{11}	335000			C_{11}	335000	

Cash Flows - $6,800 per credit

	No Financing			Land	Financed (10% down, 6%, 5 yr.s)	
C_0	-500000			C_0	450000	
C_1	-213875			C_1	-318272	
C_2	-277919			C_2	-382316	
C_3	260424			C_3	156027	
C_4	437500	IRR		C_4	333103	
C_5	267500	20.21%		C_5	163103	
C_6	267500			C_6	267500	
C_7	267500	NPV		C_7	267500	NPV
C_8	340000	$965,981		C_8	340000	$1,476,223
C_9	340000			C_9	340000	
C_{10}	340000			C_{10}	340000	
C_{11}	340000			C_{11}	340000	

Alternate Site Scenario: Rural-County 2

Cash Flows - $8,200 per credit

	No Financing		Land	Financed (10% down, 6%, 5 yr.s)	
C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	365424		C_3	62673	
C_4	542500	IRR	C_4	239749	
C_5	337500	10.11%	C_5	34749	
C_6	337500		C_6	337500	
C_7	337500	NPV	C_7	337500	NPV
C_8	410000	$496,835	C_8	410000	$1,976,537
C_9	410000		C_9	410000	
C_{10}	410000		C_{10}	410000	
C_{11}	410000		C_{11}	410000	

Cash Flows - $9,200 per credit

C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	440424		C_3	137673	
C_4	617500	IRR	C_4	314749	
C_5	387500	12.68%	C_5	84749	
C_6	387500		C_6	387500	
C_7	387500	NPV	C_7	387500	NPV
C_8	460000	$840,302	C_8	460000	$2,320,004
C_9	460000		C_9	460000	
C_{10}	460000		C_{10}	460000	
C_{11}	460000		C_{11}	460000	

Cash Flows - $10,200 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	515424		C_3	212673	
C_4	692500	IRR	C_4	389749	
C_5	437500	15.08%	C_5	134749	
C_6	437500		C_6	437500	
C_7	437500	NPV	C_7	437500	NPV
C_8	510000	$1,183,769	C_8	510000	$2,663,471
C_9	510000		C_9	510000	
C_{10}	510000		C_{10}	510000	
C_{11}	510000		C_{11}	510000	

Cash Flows - $11,200 per credit

C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	590424		C_3	287673	
C_4	767500	IRR	C_4	464749	
C_5	487500	17.33%	C_5	184749	
C_6	487500		C_6	487500	
C_7	487500	NPV	C_7	487500	NPV
C_8	560000	$1,527,236	C_8	560000	$3,006,938
C_9	560000		C_9	560000	
C_{10}	560000		C_{10}	560000	
C_{11}	560000		C_{11}	560000	

Cash Flows - $12,200 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	665424		C_3	362673	
C_4	842500	IRR	C_4	539749	
C_5	537500	19.47%	C_5	234749	
C_6	537500		C_6	537500	
C_7	537500	NPV	C_7	537500	NPV
C_8	610000	$1,870,703	C_8	610000	$3,350,405
C_9	610000		C_9	610000	
C_{10}	610000		C_{10}	610000	
C_{11}	610000		C_{11}	610000	

Cash Flows - $12,500 per credit

C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-516626	
C_2	-277919		C_2	-580670	
C_3	687924		C_3	385173	
C_4	865000	IRR	C_4	562249	
C_5	552500	20.08%	C_5	249749	
C_6	552500		C_6	552500	
C_7	552500	NPV	C_7	552500	NPV
C_8	625000	$1,973,743	C_8	625000	$3,453,445
C_9	625000		C_9	625000	
C_{10}	625000		C_{10}	625000	
C_{11}	625000		C_{11}	625000	

Alternate Site Scenario: Urban-County 1

Cash Flows - $12,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	650424		C_3	128439	
C_4	827500	IRR	C_4	305515	
C_5	527500	10.04%	C_5	5515	
C_6	527500		C_6	527500	
C_7	527500	NPV	C_7	527500	NPV
C_8	600000	$757,272	C_8	600000	$3,308,481
C_9	600000		C_9	600000	
C_{10}	600000		C_{10}	600000	
C_{11}	600000		C_{11}	600000	

Cash Flows - $13,000 per credit

C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	725424		C_3	203439	
C_4	902500	IRR	C_4	380515	
C_5	577500	11.71%	C_5	55515	
C_6	577500		C_6	577500	
C_7	577500	NPV	C_7	577500	NPV
C_8	650000	$1,100,739	C_8	650000	$3,651,948
C_9	650000		C_9	650000	
C_{10}	650000		C_{10}	650000	
C_{11}	650000		C_{11}	650000	

Cash Flows - $14,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	800424		C_3	278439	
C_4	977500	IRR	C_4	455515	
C_5	627500	13.31%	C_5	105515	
C_6	627500		C_6	627500	
C_7	627500	NPV	C_7	627500	NPV
C_8	700000	$1,444,206	C_8	700000	$3,995,415
C_9	700000		C_9	700000	
C_{10}	700000		C_{10}	700000	
C_{11}	700000		C_{11}	700000	

Cash Flows - $15,000 per credit

C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	875424		C_3	353439	
C_4	1052500	IRR	C_4	530515	
C_5	677500	14.83%	C_5	155515	
C_6	677500		C_6	677500	
C_7	677500	NPV	C_7	677500	NPV
C_8	750000	$1,787,672	C_8	750000	$4,338,882
C_9	750000		C_9	750000	
C_{10}	750000		C_{10}	750000	
C_{11}	750000		C_{11}	750000	

Cash Flows - $16,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	950424		C_3	428439	
C_4	1127500	IRR	C_4	605515	
C_5	727500	16.28%	C_5	205515	
C_6	727500		C_6	727500	
C_7	727500	NPV	C_7	727500	NPV
C_8	800000	$2,131,139	C_8	800000	$4,682,349
C_9	800000		C_9	800000	
C_{10}	800000		C_{10}	800000	
C_{11}	800000		C_{11}	800000	

Cash Flows - $17,000 per credit

C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	1025424		C_3	503439	
C_4	1202500	IRR	C_4	680515	
C_5	777500	17.68%	C_5	255515	
C_6	777500		C_6	777500	
C_7	777500	NPV	C_7	777500	NPV
C_8	850000	$2,474,606	C_8	850000	$5,025,816
C_9	850000		C_9	850000	
C_{10}	850000		C_{10}	850000	
C_{11}	850000		C_{11}	850000	

Cash Flows - $18,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	1100424		C_3	578439	
C_4	1277500	IRR	C_4	755515	
C_5	827500	19.03%	C_5	305515	
C_6	827500		C_6	827500	
C_7	827500	NPV	C_7	827500	NPV
C_8	900000	$2,818,073	C_8	900000	$5,369,282
C_9	900000		C_9	900000	
C_{10}	900000		C_{10}	900000	
C_{11}	900000		C_{11}	900000	

Cash Flows - $18,800 per credit

C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-735860	
C_2	-272006		C_2	-793991	
C_3	1160424		C_3	638439	
C_4	1337500	IRR	C_4	815515	
C_5	867500	20.08%	C_5	345515	
C_6	867500		C_6	867500	
C_7	867500	NPV	C_7	867500	NPV
C_8	940000	$3,092,847	C_8	940000	$5,644,056
C_9	940000		C_9	940000	
C_{10}	940000		C_{10}	940000	
C_{11}	940000		C_{11}	940000	

Alternate Site Scenario: Urban-County 2

Cash Flows - $40,000 per credit

	No Financing		Land	Financed (10% down, 6%, 5 yr.s	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	2750424		C_3	662482	
C_4	2927500	IRR	C_4	839558	
C_5	1927500	10.29%	C_5	-160442	
C_6	1927500		C_6	1927500	
C_7	1927500	NPV	C_7	1927500	NPV
C_8	2000000	$2,863,152	C_8	2000000	$13,067,981
C_9	2000000		C_9	2000000	
C_{10}	2000000		C_{10}	2000000	
C_{11}	2000000		C_{11}	2000000	

Cash Flows - $44,000 per credit

C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	3050424		C_3	962482	
C_4	3227500	IRR	C_4	1139558	
C_5	2127500	12.14%	C_5	39558	
C_6	2127500		C_6	2127500	
C_7	2127500	NPV	C_7	2127500	NPV
C_8	2200000	$4,237,020	C_8	2200000	$14,441,848
C_9	2200000		C_9	2200000	
C_{10}	2200000		C_{10}	2200000	
C_{11}	2200000		C_{11}	2200000	

Cash Flows - $48,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	3350424		C_3	1262482	
C_4	3527500	IRR	C_4	1439558	
C_5	2327500	13.88%	C_5	239558	
C_6	2327500		C_6	2327500	
C_7	2327500	NPV	C_7	2327500	NPV
C_8	2400000	$5,610,887	C_8	2400000	$15,815,716
C_9	2400000		C_9	2400000	
C_{10}	2400000		C_{10}	2400000	
C_{11}	2400000		C_{11}	2400000	

Cash Flows - $52,000 per credit

C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	3650424		C_3	1562482	
C_4	3827500	IRR	C_4	1739558	
C_5	2527500	15.53%	C_5	439558	
C_6	2527500		C_6	2527500	
C_7	2527500	NPV	C_7	2527500	NPV
C_8	2600000	$6,984,755	C_8	2600000	$17,189,584
C_9	2600000		C_9	2600000	
C_{10}	2600000		C_{10}	2600000	
C_{11}	2600000		C_{11}	2600000	

Cash Flows - $56,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	3950424		C_3	1862482	
C_4	4127500	IRR	C_4	2039558	
C_5	2727500	17.11%	C_5	639558	
C_6	2727500		C_6	2727500	
C_7	2727500	NPV	C_7	2727500	NPV
C_8	2800000	$8,358,623	C_8	2800000	$18,563,451
C_9	2800000		C_9	2800000	
C_{10}	2800000		C_{10}	2800000	
C_{11}	2800000		C_{11}	2800000	

Cash Flows - $60,000 per credit

C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	4250424		C_3	2162482	
C_4	4427500	IRR	C_4	2339558	
C_5	2927500	18.61%	C_5	839558	
C_6	2927500		C_6	2927500	
C_7	2927500	NPV	C_7	2927500	NPV
C_8	3000000	$9,732,490	C_8	3000000	$19,937,319
C_9	3000000		C_9	3000000	
C_{10}	3000000		C_{10}	3000000	
C_{11}	3000000		C_{11}	3000000	

Cash Flows - $64,000 per credit

	No Financing			Land Financed (10% down, 6%, 5 yr.s)	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2301817	
C_2	-284583		C_2	-2372525	
C_3	4550424		C_3	2462482	
C_4	4727500	IRR	C_4	2639558	
C_5	3127500	20.06%	C_5	1039558	
C_6	3127500		C_6	3127500	
C_7	3127500	NPV	C_7	3127500	NPV
C_8	3200000	$11,106,358	C_8	3200000	$21,311,187
C_9	3200000		C_9	3200000	
C_{10}	3200000		C_{10}	3200000	
C_{11}	3200000		C_{11}	3200000	

Internal Rate of Return - Net Present Value (4% real)

Baseline Scenario: Rural County 1

Cash Flows - $6,800 per credit

	No Financing		Land Financed (10% down, 4%, 5 yr.s)	
C_0	-500000		C_0 450000	
C_1	-213875		C_1 -313324	
C_2	-277919		C_2 -377368	
C_3	260424		C_3 160975	
C_4	437500	IRR	C_4 338051	
C_5	267500	20.21%	C_5 168051	
C_6	267500		C_6 267500	
C_7	267500	NPV	C_7 267500	NPV
C_8	340000	$1,215,308	C_8 340000	$1,722,579
C_9	340000		C_9 340000	
C_{10}	340000		C_{10} 340000	
C_{11}	340000		C_{11} 340000	

Rural County 2

Cash Flows - $12,500 per credit

	No Financing		Land Financed (10% down, 4%, 5 yr.s)	
C_0	-1450000		C_0 1305000	
C_1	-213875		C_1 -502277	
C_2	-277919		C_2 -566321	
C_3	687924		C_3 399522	
C_4	865000	IRR	C_4 576598	
C_5	552500	20.08%	C_5 264098	
C_6	552500		C_6 552500	
C_7	552500	NPV	C_7 552500	NPV
C_8	625000	$2,472,999	C_8 625000	$3,944,084
C_9	625000		C_9 625000	
C_{10}	625000		C_{10} 625000	
C_{11}	625000		C_{11} 625000	

Urban County 1

Cash Flows - $18,800 per credit

	No Financing		Land	Financed (10% down, 4%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-711121	
C_2	-272006		C_2	-769252	
C_3	1160424		C_3	663178	
C_4	1337500	IRR	C_4	840254	
C_5	867500	20.08%	C_5	370254	
C_6	867500		C_6	867500	
C_7	867500	NPV	C_7	867500	NPV
C_8	940000	$3,868,544	C_8	940000	$6,404,894
C_9	940000		C_9	940000	
C_{10}	940000		C_{10}	940000	
C_{11}	940000		C_{11}	940000	

Urban County 2

Cash Flows - $64,000 per credit

	No Financing		Land	Financed (10% down, 4%, 5 yr.s)	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2202859	
C_2	-284583		C_2	-2273567	
C_3	4550424		C_3	2561440	
C_4	4727500	IRR	C_4	2738516	
C_5	3127500	20.06%	C_5	1138516	
C_6	3127500		C_6	3127500	
C_7	3127500	NPV	C_7	3127500	NPV
C_8	3200000	$13,863,514	C_8	3200000	$24,008,911
C_9	3200000		C_9	3200000	
C_{10}	3200000		C_{10}	3200000	
C_{11}	3200000		C_{11}	3200000	

Internal Rate of Return - Net Present Value (5% real)

Baseline Scenario: Rural County 1

Cash Flows - $6,800 per credit

	No Financing		Land	Financed (10% down, 5%, 5 yr.s)	
C_0	-500000		C_0	450000	
C_1	-213875		C_1	-315779	
C_2	-277919		C_2	-379823	
C_3	260424		C_3	158520	
C_4	437500	IRR	C_4	335596	
C_5	267500	20.21%	C_5	165596	
C_6	267500		C_6	267500	
C_7	267500	NPV	C_7	267500	NPV
C_8	340000	$1,085,252	C_8	340000	$1,594,061
C_9	340000		C_9	340000	
C_{10}	340000		C_{10}	340000	
C_{11}	340000		C_{11}	340000	

Rural County 2

Cash Flows - $12,500 per credit

	No Financing		Land	Financed (10% down, 5%, 5 yr.s)	
C_0	-1450000		C_0	1305000	
C_1	-213875		C_1	-509398	
C_2	-277919		C_2	-573442	
C_3	687924		C_3	392401	
C_4	865000	IRR	C_4	569477	
C_5	552500	20.08%	C_5	256977	
C_6	552500		C_6	552500	
C_7	552500	NPV	C_7	552500	NPV
C_8	625000	$2,212,980	C_8	625000	$3,688,520
C_9	625000		C_9	625000	
C_{10}	625000		C_{10}	625000	
C_{11}	625000		C_{11}	625000	

Urban County 1

Cash Flows - $18,800 per credit

	No Financing		Land	Financed (10% down, 5%, 5 yr.s)	
C_0	-2500000		C_0	2250000	
C_1	-213875		C_1	-723398	
C_2	-272006		C_2	-781529	
C_3	1160424		C_3	650901	
C_4	1337500	IRR	C_4	827977	
C_5	867500	20.08%	C_5	357977	
C_6	867500		C_6	867500	
C_7	867500	NPV	C_7	867500	NPV
C_8	940000	$3,464,780	C_8	940000	$6,008,812
C_9	940000		C_9	940000	
C_{10}	940000		C_{10}	940000	
C_{11}	940000		C_{11}	940000	

Urban County 2

Cash Flows - $64,000 per credit

	No Financing		Land	Financed (10% down, 5%, 5 yr.s)	
C_0	-10000000		C_0	9000000	
C_1	-213875		C_1	-2251968	
C_2	-284583		C_2	-2322676	
C_3	4550424		C_3	2512331	
C_4	4727500	IRR	C_4	2689407	
C_5	3127500	20.06%	C_5	1089407	
C_6	3127500		C_6	3127500	
C_7	3127500	NPV	C_7	3127500	NPV
C_8	3200000	$12,429,391	C_8	3200000	$22,605,515
C_9	3200000		C_9	3200000	
C_{10}	3200000		C_{10}	3200000	
C_{11}	3200000		C_{11}	3200000	

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina

Venture Capital Financing: 50% loan rate, 4% discount rate

Baseline Scenario: Rural County 1

Cash Flows - $6,800 per credit

Land	Financed (10% down, 4%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0	450000		C_0	450000	
C_1	-313324		C_1	-460140	
C_2	-377368		C_2	-524184	
C_3	160975		C_3	14159	
C_4	338051		C_4	191235	
C_5	168051		C_5	21235	
C_6	267500		C_6	267500	
C_7	267500	NPV	C_7	267500	NPV
C_8	340000	$1,722,579	C_8	340000	$1,068,980
C_9	340000		C_9	340000	
C_{10}	340000		C_{10}	340000	
C_{11}	340000		C_{11}	340000	

Rural County 2

Cash Flows - $12,500 per credit

Land	Financed (10% down, 4%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0	1305000		C_0	1305000	
C_1	-502277		C_1	-928045	
C_2	-566321		C_2	-992089	
C_3	399522		C_3	-26246	
C_4	576598		C_4	150830	
C_5	264098		C_5	-161670	
C_6	552500		C_6	552500	
C_7	552500	NPV	C_7	552500	NPV
C_8	625000	$3,944,084	C_8	625000	$2,048,641
C_9	625000		C_9	625000	
C_{10}	625000		C_{10}	625000	
C_{11}	625000		C_{11}	625000	

Urban County 1

Cash Flows - $18,800 per credit

Land	Financed (10% down, 4%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0	2250000		C_0	2250000	
C_1	-711121		C_1	-1445203	
C_2	-769252		C_2	-1503334	
C_3	663178		C_3	-70904	
C_4	840254		C_4	106172	
C_5	370254		C_5	-363828	
C_6	867500		C_6	867500	
C_7	867500	NPV	C_7	867500	NPV
C_8	940000	$6,404,894	C_8	940000	$3,136,891
C_9	940000		C_9	940000	
C_{10}	940000		C_{10}	940000	
C_{11}	940000		C_{11}	940000	

Urban County 2

Cash Flows - $64,000 per credit

Land	Financed (10% down, 4%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0	9000000		C_0	9000000	
C_1	-2202859		C_1	-5139187	
C_2	-2273567		C_2	-5209895	
C_3	2561440		C_3	-374888	
C_4	2738516		C_4	-197812	
C_5	1138516		C_5	-1797812	
C_6	3127500		C_6	3127500	
C_7	3127500	NPV	C_7	3127500	NPV
C_8	3200000	$24,008,911	C_8	3200000	$10,936,900
C_9	3200000		C_9	3200000	
C_{10}	3200000		C_{10}	3200000	
C_{11}	3200000		C_{11}	3200000	

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina

Venture Capital Financing: 50% loan rate, 5% discount rate

Baseline Scenario: Rural County 1

Cash Flows - $6,800 per credit

	Land Financed (10% down, 5%, 5 yr.s)		Land Financed (10% down, 50%, 5 yr.s)	
C_0	450000		450000	
C_1	-315779		-460140	
C_2	-379823		-524184	
C_3	158520		14159	
C_4	335596		191235	
C_5	165596		21235	
C_6	267500		267500	
C_7	267500	NPV	267500	NPV
C_8	340000	$1,594,061	340000	$969,054
C_9	340000		340000	
C_{10}	340000		340000	
C_{11}	340000		340000	

Rural County 2

Cash Flows - $12,500 per credit

	Land Financed (10% down, 5%, 5 yr.s)		Land Financed (10% down, 50%, 5 yr.s)	
C_0	1305000		1305000	
C_1	-509398		-928045	
C_2	-573442		-992089	
C_3	392401		-26246	
C_4	569477		150830	
C_5	256977		-161670	
C_6	552500		552500	
C_7	552500	NPV	552500	NPV
C_8	625000	$3,688,520	625000	$1,875,998
C_9	625000		625000	
C_{10}	625000		625000	
C_{11}	625000		625000	

Urban County 1

Cash Flows - $18,800 per credit

	Land	Financed (10% down, 5%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0		2250000			2250000	
C_1		-723398			-1445203	
C_2		-781529			-1503334	
C_3		650901			-70904	
C_4		827977			106172	
C_5		357977			-363828	
C_6		867500			867500	
C_7		867500	NPV		867500	NPV
C_8		940000	$6,008,812		940000	$2,883,774
C_9		940000			940000	
C_{10}		940000			940000	
C_{11}		940000			940000	

Urban County 2

Cash Flows - $64,000 per credit

	Land	Financed (10% down, 5%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0		9000000			9000000	
C_1		-2251968			-5139187	
C_2		-2322676			-5209895	
C_3		2512331			-374888	
C_4		2689407			-197812	
C_5		1089407			-1797812	
C_6		3127500			3127500	
C_7		3127500	NPV		3127500	NPV
C_8		3200000	$22,605,515		3200000	$10,105,367
C_9		3200000			3200000	
C_{10}		3200000			3200000	
C_{11}		3200000			3200000	

An Analysis of the Costs of Development, Construction, and Operation of a Wetlands Mitigation Bank in North Carolina

Venture Capital Financing: 50% loan rate, 6% discount rate

Baseline Scenario: Rural County 1

Cash Flows - $6,800 per credit

	Land	Financed (10% down, 6%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0		450000			450000	
C_1		-318272			-460140	
C_2		-382316			-524184	
C_3		156027			14159	
C_4		333103			191235	
C_5		163103			21235	
C_6		267500			267500	
C_7		267500	NPV		267500	NPV
C_8		340000	$1,476,223		340000	$878,623
C_9		340000			340000	
C_{10}		340000			340000	
C_{11}		340000			340000	

Rural County 2

Cash Flows - $12,500 per credit

	Land	Financed (10% down, 6%, 5 yr.s)		Land	Financed (10% down, 50%, 5 yr.s)	
C_0		1305000			1305000	
C_1		-516626			-928045	
C_2		-580670			-992089	
C_3		385173			-26246	
C_4		562249			150830	
C_5		249749			-161670	
C_6		552500			552500	
C_7		552500	NPV		552500	NPV
C_8		625000	$3,453,445		625000	$1,720,399
C_9		625000			625000	
C_{10}		625000			625000	
C_{11}		625000			625000	

Urban County 1

Cash Flows - $18,800 per credit

	Land	Financed (10% down, 6%, 5 yr.s)	
C_0		2250000	
C_1		-735860	
C_2		-793991	
C_3		638439	
C_4		815515	
C_5		345515	
C_6		867500	
C_7		867500	NPV
C_8		940000	$5,644,056
C_9		940000	
C_{10}		940000	
C_{11}		940000	

	Land	Financed (10% down, 50%, 5 yr.s)	
C_0		2250000	
C_1		-1445203	
C_2		-1503334	
C_3		-70904	
C_4		106172	
C_5		-363828	
C_6		867500	
C_7		867500	NPV
C_8		940000	$2,656,045
C_9		940000	
C_{10}		940000	
C_{11}		940000	

Urban County 2

Cash Flows - $64,000 per credit

	Land	Financed (10% down, 6%, 5 yr.s)	
C_0		9000000	
C_1		-2301817	
C_2		-2372525	
C_3		2462482	
C_4		2639558	
C_5		1039558	
C_6		3127500	
C_7		3127500	NPV
C_8		3200000	$21,311,187
C_9		3200000	
C_{10}		3200000	
C_{11}		3200000	

	Land	Financed (10% down, 50%, 5 yr.s)	
C_0		9000000	
C_1		-5139187	
C_2		-5209895	
C_3		-374888	
C_4		-197812	
C_5		-1797812	
C_6		3127500	
C_7		3127500	NPV
C_8		3200000	$9,359,152
C_9		3200000	
C_{10}		3200000	
C_{11}		3200000	

Appendix 2.

Reported Estimates of Wetland Restoration Costs-500 acre site

Category	Low per acre cost	High per acre cost	Average cost per acre
Land[1]			
Site Screening	$3	$14	$ 7.75
Site Design	$60	$150	$105.00
Earthwork[2]	$300	$300	$300.00
Herbicide[3]	$58	$60	$ 59.00
Seedlings[4]			$121.15
Planting	$138	$150	$144.00
Monitoring Layout	$130	$130	$130.00
Monitoring-per yr.	$120	$130	$125.00

[1] See 'Land Cost and Population Estimates'
[2] Such as: ditch plugging, crown removal, excavation, plugging tile drains, installing hydraulic structures.
[3] For control of noxious weeds.
[4] See 'Estimated Seedling Costs-Hardwood Species Mix'

Appendix 2.

Reported Estimates of Environmental Phase I and II-500 acre site

Category	Lowest cost	Highest cost	Average Cost
Environmental Phase I	$ 1,500	$ 7,000	$ 3,875
Environmental Phase II[5]	$12,500	$20,000	$14,167

[5] Not necessary unless contamination suspected due to findings of Phase I.

Appendix 2.

Estimated Seedling Costs-Hardwood Species Mix

	Cost per Seedling			
Specie	Range	Average	Number of Seedlings	Total Cost[6]
Atlantic white cedar	$0.12-0.20	$0.16	3,045	$ 487.20
Bald Cypress	$0.12-0.24	$0.18926	33,495	$6339.50
Water Tupelo/gum[7]			24,360	$4141.20
Green Ash	$0.17-0.20	$0.185	33,495	$6196.58
Overcup Oak			39,585	$7917.00
Black Gum	$0.17-0.20	$0.185	15,225	$2816.63
Red maple	$0.17-0.20	$0.185	27,405	$5069.93
Water Oak	$0.20-0.2477	$0.2159	18,270	$3945.00
Willow Oak	$0.20-0.2477	$0.2159	15,225	$3287.50
Cherrybark Oak	$0.20-0.2477	$0.2159	33,495	$7232.50
Swamp Chestnut Oak	$0.20-0.2477	$0.2238	33,495	$7499.25
Tulip Poplar	$0.17-0.2477	$0.2059	27,405	$5643.45
			304,500	$60,575.74

[6] Due to rounding in 'Average Cost per Seedling', Total Cost may not equal 'Average x Number of Seedlings'.
[7] For a species having blank range and average, only one company was listed as providing this specie.

Land Cost and Population Estimates (USDA-ASCS , NCOSPL)

		Population (thousands)	Land and Market Value (per acre): Non-irrigated cropland		
			Low	High	Average
Baseline Scenario:	Rural-County 1	40-50	$ 600	$ 1,296	$ 1,000
Alternate Site:	Rural-County 2	50-60	$ 800	$ 5,000	$ 2,900
Alternate Site:	Urban-County 1	518	$ 2,500	$25,000	$ 5,000
Alternate Site:	Urban-County 2	577	$10,000	$50,000	$20,000

Appendix 2.

Estimated Planting (labor) Costs

	Per Acre		500 Acres
	Range	Average	Total Cost
Hand Planting of Bare Root Seedlings	$138-150	$144	$72,000

Estimated Design Costs

500 acres of prior-converted cropland for restoration to bottomland hardwood wetland

High	Low	Average
$75,000	$30,000	$52,500