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Assessment of Section 404 Wetland Mitigation Compliance and No-Net-Loss in the United States Army Corps of Engineers, Norfolk District

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Assessment of Section 404 Wetland Mitigation Compliance and No-Net-Loss in the United States Army Corps of Engineers, Norfolk District

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University.

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Abstract

ASSESSMENT OF SECTION 404 WETLAND MITIGATION COMPLIANCE AND NO-NET-LOSS IN THE UNITED STATES ARMY CORPS OF ENGINEERS, NORFOLK DISTRICT

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Interdisciplinary Science at Virginia Commonwealth University.

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The United States Corps of Engineers is a federal agency responsible for regulating impacts to wetlands. Permit applications requesting authorization to impact wetlands are reviewed using a three step sequence: avoidance, minimization and compensatory mitigation. A national goal of no net loss of wetland acreage and function in compensatory mitigation has been recommended since 1987.

Thirty Norfolk District projects requiring compensatory wetland mitigation in the permit years 1996-1998 were randomly selected for field review. The results showed that 10% of the projects were never initiated or completed.

Another 19% of the projects showed a net loss of acreage. However, many projects exceeded their required mitigation acreage. The mitigation types included creation/restoration (18 permits), commercial mitigation bank (3 permits), and an in-lieu fee trust fund (9 permits). Overall 1.76 acres were mitigated for every acre of wetlands impacted. Creation/restoration projects had the highest ratio (2 acres mitigated for every acre impacted). The Trust Fund realized 1.5 acres of mitigation for every acre impacted and the mitigation bank realized 1.82 acres for every acre impacted. Therefore, this study indicated that the Norfolk District is gaining more than 1 acre of wetland mitigation for every acre impacted, thus meeting the goal of no net loss of wetland acreage.

I. Statement of the Problem

The United States Army Corps of Engineers is the primary federal agency responsible for regulating impacts to waters of the United States and wetlands (Department of the Army 1997). The Corps of Engineers was originally given authority over navigable waterways under Section 10 of the Rivers & Harbors Act of 1899 (Department of the Army 1997). Then, in 1972 the Federal Water Pollution Control Act (amended and renamed in 1977 the Clean Water Act) was passed, expanding the Corp's jurisdiction to the wetlands adjacent to Waters of the United States and their tributaries (Department of the Army 1997). The Clean Water Act's objective is to "restore, enhance, and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC 1251). Wetlands were included in the Corp's jurisdiction pursuant to the Clean Water Act because wetlands are considered inherently linked to the integrity of our waters (NRC 2001). The authority to regulate discharges of dredged or fill material is through Section 404 of the Clean Water Act, by application of the Section 404(b)(1) Guidelines (Department of the Army 1997) and the associated *Memorandum of Agreement Between the Environmental Protection Agency and* *the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines* (1990). According to Mitsch and Gosselink (2000), "Section 404 of the Clean Water Act, which prohibits the (unauthorized) discharge of dredged or fill material into wetlands, has incorporated the no net loss policy into its regulatory guidelines, and 404 permits have become the most prevalent tool for maintaining the integrity of the nation's waters."

The Corps of Engineers regulates impacts to the aquatic environment through an initial public interest review. Three general criteria must be considered in the evaluation of every permit application: the need for the project, practicable alternatives, and the extent and permanence of the beneficial and detrimental effects (33 CFR 320.4(a)(2)).

If it is deemed that there is a need for the proposal, then a sequencing procedure is followed to decrease the impacts of the project on the aquatic environment. The sequence is set out in the 404(b)(1) guidelines, established at 40 CFR 230 in volume 45, number 249 of the Federal Register (24 December 1980) and reiterated in the Memorandum of Agreement (MOA) between the Corps of Engineers and the Environmental Protection Agency (1990). This section of the regulations "prohibits discharges when a practicable alternative exists which would have less adverse impact on the environment" (Federal Register 1980). This sequencing involves three steps:

1. Is it feasible to modify the proposal in order to avoid impacting the aquatic environment?
2. Is it feasible to modify the plan in order to minimize the impacts?
3. Can the remaining, unavoidable impacts be mitigated in such a way that the impacts to the environment are offset, balancing to no loss of wetlands?

It is important to note that mitigation is meant to be used for water dependant projects and not to be used as a bartering system to justify the needless destruction of productive wetlands (Federal Register 40(231), December 1, 1975).

It is the last step of the sequence – compensatory mitigation - that takes us to the dilemma at hand. Is the Corps of Engineers appropriately offsetting the impacts they are authorizing through the Section 404 permitting process? This has become an important question for many reasons.

In 1987 the National Wetlands Policy Forum, sponsored by the United States Environmental Protection Agency, promoted a national policy to ensure "no overall net loss of the nation's remaining wetlands base, as defined by acreage and function, and to restore and create wetlands, where feasible, to increase the quantity and quality of the nation's wetlands resource base" (White 2001). President Bush and President Clinton adopted this goal during their administrations (White 2001). In October 1997, Vice President Al Gore announced an initiative called the Clean Water Action Plan (1999). The plan called for a net gain of as many as 40,486 hectares of wetlands annually by the year 2005 (Copeland 1999). The goal of "no net loss" has become a standard in many state and federal regulatory programs. Over 75% of states responding to a national survey had established a no net loss or a net gain program (La Peyre et al. 2001).

At the federal level, the Corps of Engineers Norfolk District has a document entitled "Norfolk District's Branch Guidance for Wetlands Compensation" which states, "The objective of wetlands compensatory mitigation is to provide, at a minimum, one for one functional replacement to achieve no net loss of wetland value" (1995). There are numerous wetland assessment techniques available, however there is much doubt in the environmental field as to whether these assessments are adequate or applicable. In the absence of more definitive information on the functions and values at a specific site, a minimum of 1 to 1 acreage replacement may be used as a reasonable surrogate for no net loss of functions and values" (United States Army Corps of Engineers, Norfolk District, 1995). Regulators are "usually satisfied if the mitigation mimics the vegetative structure and dominant taxonomic composition of the impacted wetland" (Weller et al. 1988). However, there is "much doubt" about whether in-kind replacement is the same as functional replacement (Weller et al. 1988). In fact, many in the field believe that more than pursuing in-kind replacement, a watershed approach should be implemented to ensure that the most heavily impacted wetland types are being mitigated, not necessarily the wetland type being impacted for that particular project (Shabman 2002). This watershed approach will "secure a desired matrix of wetland types and locations to achieve watershed goals" (Shabman 2002).

Most recently, Regulatory Guidance Letter (RGL) 02-2 released in December 2002 is new guidance drafted to help support the national goal of no net loss (United States Army Corps of Engineers, 2002). A bill is currently under House of Representatives review (H.R. 1474 – Water Resources Development Act of 1990) that, if passed, will amend the Clean Water Act to "establish a new interim goal …of no overall net loss of the Nation's remaining wetland base as defined by acreage and function and a long term goal to increase the quantity and quality of the Nation's wetlands" (Fish and Wildlife Service 2002). It is very clear that no net loss is a goal that will be with the regulatory program for a long time to come.

There were several recent reports published that questioned the Corps of Engineers success at meeting no net loss (Barnard 2002). The United States Government Accounting Office (GAO) undertook one study and the other was performed by the National Research Council (NRC). Both were published in 2001. Both criticized the Corps of Engineers for not ensuring applicants' compliance with mitigation requirements. The NRC's report came to several conclusions. These conclusions suggested that nationally the Corps of Engineers was not meeting their goal of overall no net loss of wetlands (NRC 2001). In fact, in a follow up article by three of the NRC committee members, it is estimated that only 10% of the required acreage of mitigation is done successfully (Turner et al. 2001). The NRC asserted that this problem could be attributed to several factors, such as the lack of clear performance expectations and lack of compliance checks and follow-up by the Corps of Engineers (NRC 2001). The GAO study considered lack of monitoring and good monitoring criteria as the biggest issues blocking the goal of no net loss (GAO 2001).

Is this the case in the Norfolk District of the Corps of Engineers? According to a paper published in the summer 2000 edition of Wetland Journal, Norfolk District achieved an overall gain-loss ratio of 1.71:1 for the three-year study period, 1996-1998 (Jones and Boyd 2000). However, the study only evaluated required mitigation as a function of the 404 permit evaluation program and did not evaluate actual on-site compliance or success. The statistics look good on paper, but what happens after the permit is given to the applicant? How much of that required mitigation is completed and how much would be deemed successfully completed? These statistics need to be assessed in order to determine if the Corps of Engineers is doing their job of protecting the nation's wetlands.

Therefore, the primary hypothesis of my thesis is that the Corps of Engineers, Norfolk District, is meeting programmatic no net loss of wetlands. In the process, I will illuminate practices that could help Norfolk District increase their effectiveness and raise their net gain of wetlands.

II. A Review of Wetland Mitigation Literature

Wetlands, according to federal regulations, are defined as areas "inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR 230.3(u)). They serve a multitude of functions and values, including (White 2001, Erwin 1990, USDA 1992):

- Reservoirs for rainwater and runoff (flood control)
- Water quality improvement
- Recreation
- Groundwater discharge and recharge
- Shoreline anchoring / erosion control
- Sediment trapping
- Food chain support
- Wildlife habitat (including threatened and endangered species)
- Fishery habitat
- Flood flow alteration

- Toxicant retention
- Nutrient retention
- Aesthetics
- Historic and cultural resources
- Timber production
- Water supply

Are wetlands, and the functions and values they serve, under threat? The Nation's wetlands are disappearing at an alarming rate. According to the United States Fish and Wildlife Service, there were 90 million hectares of wetlands when European settlement began (Scodari 1997). As of 1985, only 42 million hectares remain (Scodari 1997). It is estimated that only 47 - 53% of the wetlands found in the contiguous United States in the 1780's still exist (Greiner 1994, National Research Council 2001, Scodari 1997). The United States Department of Agriculture estimates that between 1982 and 1992, 28,340 to 36,437 hectares of wetlands are lost per year (Scodari 1997). And between 1992 and 1997, the national loss increased an additional 65,587 hectares, more than half of which occurred on the Atlantic coast (7th Wetland Workshop 2002). In Virginia alone, an average of 140 hectares per year are authorized to be impacted by state and federal agencies (Virginia Institute of Marine Science 2002). There are few indications that this loss trend will slow or reverse (Greiner 1994). Of the remaining wetlands, it is estimated that only half are functioning at a minimal level (Greiner 1994). Wetland losses occur for many reasons, including urban development (30%), agricultural activities (26%), silviculture (23%), and rural development (21%) (Dahl 2000). Without sufficient wetland resources, water quality will decline, additional flora and fauna species will be lost, and flooding will become a dangerous and expensive problem (Young 1996). According to Mitsch et al. (1998), wetlands provide services equivalent to 33 trillion dollars per year worldwide. In order to conserve these critical remaining wetlands, this country must mitigate for unavoidable wetland impacts.

The legal definition of mitigation is "avoiding, minimizing, reducing or compensating for resource losses" (33 CFR 320.4(r)). Therefore, all three steps in the 404 (b)(1) Guidelines are forms of mitigation. This paper will focus on just compensatory mitigation (step 3) that is required after all practicable avoidance and minimization has occurred. Appropriate wetlands compensatory mitigation may be accomplished in a variety of forms, including:

- Creation
- Restoration
- Enhancement
- Preservation
- Purchase of Mitigation Bank Credits
- Contributions to an In-Lieu-Fee Fund

When applying the policy of overall no net loss, not all of these forms of compensatory mitigation will satisfy that goal. Preservation and enhancement provide little credit when calculating programmatic overall no net loss computations since they generally do not increase the net acreage or function of wetlands (Breaux & Serefiddin 1999). However, preservation of rare or unique aquatic resources and essential or critical habitat for threatened or endangered species may provide extremely valuable compensation since replacement of those resources may be impossible to accomplish.

Why has the concept of no net loss become such a hot topic? Achievement of the no net loss policy is critical in order to adequately preserve and maintain wetlands so that they may serve the functions and values listed above. Unfortunately, the Corps of Engineers and other state and federal regulatory agencies have poor rates of compensatory mitigation compliance and success. Scodari (1997) testifies "the record of success for the mitigation measures required by Section 404 permits to compensate for unavoidable wetland impacts is spotty at best." Many studies have been published documenting these poor mitigation compliance rates. Scodari (1997) references a compliance study done by the Florida Department of Environmental Regulation (FDER). The study looked at 119 mitigation sites required under 63 permits issued (Scodari 1997). The study showed that only 27% of the sites were deemed ecologically successful (Scodari 1997). In fact, 60% of the required mitigation sites were never started and 24 were never completed (Scodari 1997). According to a south Florida study, only one half of the required 430 hectares of wetlands promised as compensatory mitigation were constructed and 60% of the projects studied were either incomplete or deemed a failure (Mitsch et al. 1998). Yet another study done in Florida showed only a 12% success rate for freshwater wetland creation sites (Redmond 1992). The overall mitigation success rate found in this study was 27%, the same as the results found by FDER (Redmond 1992). Redmond also found that 34% of the required mitigation sites were never initiated. Only 4 of the 63 permits studied were found to be in complete compliance (Redmond 1992). Along these same lines, studies have found a net loss of wetlands in Oregon, Indiana and Washington (Kentula et al. 1992, Robb 2002, Gwin and Kentula 1990). A study in Massachusetts revealed at least a 36% mitigation site failure rate (Brown & Veneman 2001). Kunz et al. (1988) found that for Section 404 projects in Washington State between 1980 and 1986, there was a net loss of 33% of the state's wetland resources. A random sample of Section 404 permits issued in 1994 and 1996 by the Chicago District of the Corps of Engineers showed an average of only 30% of the mitigation sites were in compliance with their permits (Gallihugh 1998). Eliot (1985) surveyed mitigation sites in San Francisco Bay and found that 44% of the mitigation projects had not even been initiated. In another study of section 404 permits in California, many permits did not even include the acreage of mitigation required, making it impossible to determine compliance (Holland and Kentula 1992). A study of Section 404 mitigation in California showed that only 69% of the required mitigation acreage was even initiated (Allen and Feddema 1996). Morgan and Roberts (1999) studied state and federal mitigation compliance in Tennessee. Sampling 500 projects revealed that 37.8 hectares of wetlands were authorized to be impacted (Morgan and Roberts 1999). The total mitigation required in those permits was 103.9 hectares (Morgan and Roberts 1999). That looks like the state's gain to loss ratio is 2.7:1, a net gain (Morgan and Roberts 1999). However, when you analyze the required mitigation in the forms of creation and restoration, the only options that can apply towards no net loss of acreage, the ratio drops to 0.88:1, a net loss of wetlands (Morgan & Roberts 1999). The New Jersey Department of Environmental Protection completed a study of their mitigation status in 2002. After reviewing 90 freshwater mitigation proposals, the overall acreage of wetlands created was only 45% of the proposed acreage (New Jersey Department of Environmental Quality 2002). Of the study sites, 18% were never initiated (New Jersey Department of Environmental Quality 2002). Of the proposed emergent acreage, 92% was achieved (New Jersey Department of Environmental Quality 2002). Additionally, only 1% of the proposed forested acreage was achieved (New Jersey Department of Environmental Quality 2002). Also, only 48% of the sites concurred with the approved designs and specifications (New Jersey Department of Environmental Quality 2002). In a survey of state wetland managers across the United States, there was a disturbing lack of knowledge of mitigation sites' success or failure due to a lack of compliance tracking after the permit is issued (LaPeyre et al. 2001).Most recently, a study was completed in the Corps of

Engineers New England District that showed 67% permit compliance, but only 17% functional compliance (Minkin and Ladd, 2003).

There are very few studies that look at mitigation compliance in the Commonwealth of Virginia. Maguire (1985) did a study on 26 sites in Norfolk and found that 27% of the sites had not been started, 23% of the sites were partially successful or not successful, and 50% of the sites were successful or likely to be successful over time. Race and Fonesca (1996) performed a literature review of compliance rate studies and found results that agree with those listed above.

But, what is success? How can success be determined? This is a question that all regulators struggle with. There is no single, universally accepted method to assess wetland functions and values (Breaux and Serefiddin 1999). It is difficult to require applicants to replace the functions and acreage of wetlands (as required by no net loss) that they are proposing to impact when there is no one agreed upon method to assess the functions and values lost and mitigated. There are many functional assessments circulating, however wetland scientists disagree on which ones are most appropriate, based on time required to perform the assessment and based on geographic applicability of the assessment. So, what can be used in place of functional assessments? Regulators use acreage and/or ecological criteria such as vegetation type, vegetation cover, soil characteristics, and hydrology. But is there one answer to what should be used to determine mitigation success? This answer is met with a resounding "no" in the regulatory field (Greiner 1984). Therefore, most regulators agree that there is "no ultimate meaning (of success) except by those specific goals expressed in permits to help meet no net loss" (Breaux and Serefiddin 1999). There are obviously some inconsistencies in the Section 404 program since there is no specific, standardized methodology to determine mitigation success or failure that is applicable to all wetland types across the United States. Representative Sherwood Boehlert of New York (R), the Chair of the House Science Committee, believes "the Corps and Environmental Protection Agency (EPA) should establish criteria and standards for ecological success, monitor restoration, enhancement, creation and preservation efforts to ensure such success and hold the proper parties legally responsible when expectations are not met" (Bruninga 2001).

There are several reasons for a mitigation site's lack of success. Failures can be due to poor planning and site design, lack of mitigation site monitoring, high rates of noncompliance with mitigation requirements, lack of clearly articulated mitigation goals, no corrective measures included in permits, and onsite preferences limit possibility of successful mitigation planning (Kusler 1986, Quammen 1986, Scodari 1997, Gallihugh 1998, Rolband 2002). Other potential problems include invasive species, destructive wildlife, salt build-up in soils, incorrect hydrology, planting at incorrect elevations, planting the wrong species for the site's hydrological regime, unsuccessful seeding or planting, unsuitable soils, poor soil handling, unsuitable site grades, erosion and sedimentation problems, lack of flexibility, not built per plan specifications, or just that the mitigation site was never initiated (Garbisch 1992, D'Avanzo 1990, Kusler 1986, Rolband 2002, Cristol 2002, Gallihugh 1998). Some of these avoidable problems can be attributed to the original mitigation designer not following through the entire project (Munro 1991). Some of the blame must lie with the regulatory agencies, as well. Expectations of complete and sound mitigation plans and contingency plans, careful mid and post construction compliance, and specific permit conditions are all important factors for a successful mitigation project (Reimold and Cobler 1986). There are also several unavoidable problems that may have to be addressed, such as unusual meteorological conditions, litter, plant disease, vandalism, and pests (Garbisch 1992, Gallihugh 1998). Munro (1991) claims that "the regulatory structure that surrounds and permeates the wetland mitigation process is so bulky, so beaurocratic, and so loosely enforced that much of the land altering work undertaken to mitigate the losses of wetlands falls considerably short of real restoration."

The Corps of Engineers is also criticized for not following through and enforcing permit conditions. According to Munro (1991), "Most regulatory agencies focus their attention on permitting rather than on enforcing permits and permit conditions after they are issued."

Munro (1991) claims, "In most cases they are neither the carrot or the stick that might encourage compliance." The Corps of Engineers' official response to that criticism is that "current funding levels in the Corps Regulatory Program restrict our efforts in monitoring compliance and evaluating mitigation success" (United States Army Corps of Engineers 2001). Munro (1991) also cites the lack of a national, cohesive and well-maintained database as being a roadblock to good mitigation compliance. If such a system was available, the database could be searched for all projects needing follow up work, regardless of project managers coming and going. LaPeyre et al. (2001) found in a fifty state survey of wetland managers that "few states track mitigation actions relevant to wetlands and fewer have any idea of the successor impact of past mitigation actions." Only three of the states surveyed indicated they had any routine compliance and enforcement program (LaPeyre et al. 2001).

In order for a mitigation site to be evaluated, goals must be determined based on the functions lost due to the impacts on the aquatic environment, performance standards related to those goals must be generated by studying the form and function of the natural system, and performance standards must be included in the permit when it is issued (Erwin 1990, USDA 1992, Streever 1999). Performance standards are "observable or measurable attributes that can be used to determine if a compensatory mitigation project meets its objectives" (Streever 1999). These performance standards or success criteria must be included as special conditions of the permit (Streever 1999). In a review of 300 permits from various Corps of Engineers District offices, Streever (1999) found that many did not include any performance standards. In cases where performance standards are included in the permits, most focused primarily on variables that signify a wetland is present, not specific wetland functions (Kentula et al. 1993). Kusler (1986) estimates that approximately one half of all projects ultimately failed to meet specified project goals. Utilization of a reference wetland can help determine potential success criteria (Greiner 1984, Kentula 2000).

As part of permit required performance standards, monitoring plans must be included and complied with, in order to assess whether the site is meeting the pre-established performance standards (Pierce 1994). The monitoring plan should include an as-built survey (in order to determine if the size and elevations were constructed as specified in the permit), data to support that the entire site meets the three wetland parameters as specified in the 1987 Corps of Engineers Wetland Delineation Manual, woody vegetation counts or density, herbaceous vegetation percent cover, hydrologic monitoring and photographs from a standard location (Pierce 1994, Erwin 1990, Brown and Veneman 2001). Monitoring should be required for a minimum of 2-3 years for herbaceous mitigation areas and a minimum of 5 years for forested mitigation sites (Pierce 1994, Society of Wetland Scientists 2001). These minimums should be increased if there are any impediments discovered that might impede success of the site (Pierce 1994). A bond should also be required to ensure that the mitigation and monitoring are conducted (Pierce 1994). If the mitigation site is determined by the Corps of Engineers project manager to be a complete failure, a new mitigation site may have to be selected in order to correct the problem (Garbisch 1992).

It is important for the applicant to submit complete and well-developed mitigation plans at the beginning of the permitting process. The mitigation plans should "include the characteristics and functions of the wetland proposed to be impacted, the likely direct and indirect impacts of the project on that wetland, the specifications of all aspects of the mitigation construction or restoration, the probable success of that mitigation in reducing the aquatic impacts of the project or restoring certain functions, and the probability that those functions will persist" (Kusler 1986). Without this important start, the rest of the mitigation process is sure to fail.

III. Research Methodology

The hypothesis for this project is that the Norfolk District Corps of Engineers Regulatory Branch is meeting the goal of overall no net loss of Section 404 jurisdictional wetlands. Although evidence (Jones and Boyd 2000) suggests that the District is requiring sufficient mitigation to meet their goal of no overall net loss of wetland resources through the 404 permit program, there is no documentation that on-site mitigation is being initiated or completed per the special conditions established in the Section 404 permits. The lack of a comprehensive mitigation compliance program questions the effectiveness of the compensatory mitigation components of the issued 404 permits.

Because this study was ignited by the research of Jones and Boyd (2000), their data was used as a springboard to further investigate the mitigation compliance efficiency of the Norfolk District Regulatory Branch. The original Microsoft Excel spreadsheets formulated by Jones and Boyd were recovered and used as the preliminary database for this study. The spreadsheets were originally formulated by querying the District database, Tracker, for all Section 404 wetland permits received in the calendar years 1996 - 1998 that required some form of mitigation. Then, specific types of projects were removed from the resulting list, including Virginia Department of Transportation projects, projects impacting open water, submerged aquatic vegetation or non-vegetated wetlands, and enforcement actions that did not result in the issuance of an after-the-fact permit. These projects are handled as special cases and therefore may skew the results due to different compliance trends. Jones and Boyd's final list was composed of 410 projects. When I ran this same query in the database, I also received the same 410 projects.

For the purposes of this study, a randomized block design was performed by geographically restricting the projects analyzed. There are numerous geomorphological differences in wetland types across the state that would make a comprehensive state-wide analysis difficult to interpret. Also, there are time and financial constraints that make state-wide field work impracticable. The Norfolk District is broken up into territories that are regulated by a particular field office or by the District office. All impacts located within field office territories have been removed from the database and this study will analyze mitigation compliance trends only within the territory regulated by the District Office project managers. This territory is often referred to as the Tidewater, Virginia area and includes the following localities: Chesapeake, Hampton, Hopewell, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg, Charles City County, Gloucester County, Greensville County, Isle of Wight County, James City County, King and Queen County, King William County, New

Kent County, Prince George County, Southampton County, Surry County, Sussex County, and York County.

After limiting the data set to a smaller geographic range, 204 projects were left. In order to analyze compliance for the three-year data set, an on-site inspection and data collection was performed on a random sampling of those 204 projects. Using randomly generated numbers between 0 and 1 in a Microsoft Excel worksheet, the lowest 10 randomly generated numbers of each year's projects were sampled. Consequently, field review was done on 30 projects, or 15% of the data set (see Figures 3,4, and 5 for project locations).

The fieldwork was completed by the end of October 2002 with little to no funding necessary.

Project files were collected for the randomly selected subset of 30. Information collected from each file (as appropriate and available) included a hardcopy of the database entry, the final permit letter, the joint permit application, the final mitigation proposal, vicinity maps showing the location of the impacts and the mitigation, monitoring reports, compliance inspection memos and pictures, and proof of purchase of mitigation bank payment, in-lieu-fee payment, or proof of recordation of restrictive covenants. The projects were then be grouped by the responsible Corps of Engineers project manager. Each of these project managers were sent questionnaires to be filled out for their projects. These questionnaires generated responses concerning the special conditions of each permit and the current status of the projects' mitigation requirements. Once the responses were received from the project managers, the data was added to the spreadsheet (see Table 2).

A site visit was also be done for each of these 30 projects selected. Data collected at each site included qualitative and quantitative descriptions of the site's vegetation, hydrology and soils to keep consistent with the Corps of Engineers 1987 Wetland Delineation Manual. All three criteria were analyzed despite the fact that many consider hydrology to be the "single most important factor to consider" (Erwin 1990). The supplies necessary for the field work included:

- 100-foot measuring tape
- bucket augers
- sharp shooter
- Munsell color book
- Wetland flagging – rolls and ground flags
- Clipboard
- Markers
- Digital camera
- 1 meter X 1 meter PVC square
- list of indicators status of Virginia flora

Using a global positioning unit (GPS) supplied by the Norfolk District Corps of Engineers (Trimble GeoXT), points of interest, such as the mitigation area boundaries and data points, were collected in the field. The GPS data were postprocessed and corrected to submeter accuracy using Pathfinder Office software on a desktop computer. A mitigation site compliance form (see Appendix C) was generated for each site, detailing the information collected from the file and the site visit. The data form queries information such as wetland location, dates of work done on the mitigation site, Cowardin classification, acreage achieved, hydrological descriptions, vegetation percent survival, vigor, undesirable species and treatment, mapped and field verified soil series, wildlife use, and mitigation goals and permit conditions.

In order to assess whether the site meets the Corps of Engineers 1987 Wetland Delineation Manual's wetland criteria and/or the permit letter requirements, the data collection methods were taken from the Norfolk District's Branch Guidance for Wetlands Compensation (1995). This document establishes field methods for mitigation monitoring report requirements. It recommends woody vegetation sampling plots at a ratio of 5 per acre of mitigation (or 12 per hectare). The suggested plot size is 30-foot radius or a 20-foot by 20 foot square. For this study, the 20 X 20 foot square plot was generally used. For herbaceous plants, the document recommends 20 plots per acre of mitigation (or 49 per hectare). Herbaceous sampling plots should have an 18-inch (0.46 meters) radius or be a 1 meter by 1 meter square. For this study, 1 meter square PVC was generally used. However, if the sites were very homogenous without any topographic variances, the number of data points done was representative of the number of different communities present. The soils were profiled and classified as hydric or non-hydric. If monitoring wells were present on site, the soils were analyzed within 30 feet (9 meters) of each well. If no monitoring wells were found on site, the soils were analyzed within each woody vegetation sampling plot. Also, the site hydrology and hydrologic indicators were described at each woody vegetation sampling site.

All of the data collected were entered into an Excel spreadsheet and general descriptive statistics were generated, including mean, median, minimum and maximum.

IV. Results

The selected data set included 30 projects with mitigation in 13 localities: James City County, Charles City County, Prince George County, New Kent County, York County, City of Poquoson, Suffolk, Chesapeake, Norfolk, Virginia Bea ch, Isle of Wight, Portsmouth, and Southampton. See Table 1, below, for the short form of the study results. See Table 2 in the appendices for the long form of the results.

These 30 projects required 31 mitigation sites counting towards no net loss, including 11 creation sites (35%), 8 restoration sites (26%), 9 trust fund payments (29%) and 3 commercial mitigation bank transactions (10%). The permits also required 3 preservation sites. Out of the 30 permits issued, 53% required the mitigation to occur on-site.

Table 1

Study Results (Short Form)

Project ID	Project Name	Impacts (Acres)	Mitigation Required (acres)	Trust Fund acreage	Wetland Creation Acreage	Wetland Restoration Acreage	Mitigation Bank Acreage	Mitigation: Impacts Ratio
97-R5077	Suffolk Indust.Park	0.717	0.99		0.65			0.91
96-V0590	Centex Homes	0.06	0.06			0.06		1
96-V0034	Kingsmill	0.16	1.72		1.8			11.25
97-V0001	Colonial Downs	0.31	0.62		0.882			2.85
98-R5605	Fort Lee	0.053	8			6.5		122.64
98-V0532	Pretty Lake	0.027	0.03			0		0
97-V0560	Beamon Farm	2.87	3.8			3.8		1.32
98-V0058	Monkey Bottom	0.27	0.23		0.01			0.04
97-V1975	Sentara	7.6	13.3				13.3	1.75
98-V0971	Espejo	0.008	0.008	0.008				1
96-V0349	Bennett Creek	0.213	0.02			0.213		1
97-V1152	Fords Colony	1.93	2.2		2.22			1.15
98-V1341	Pocohontas Village	0.31	1.16		0.4	0.08		1.55
96-V0527	Olmstead	0.03	0.03		0.03			1
96-V0468	Route 5	2.789	0.14	0.14				0.05
97-V0212	Smithfield Foods	0.05	0.07			0.17		3.4
98-R5148	Lowes	0.02	0.85		0.15			7.5
98-V1727	Governor's Land	0.142	0.256	0.256				1.8
96-V1805	Bishops Green	0.13	0.26	0.26				2
96-R5769	Harbourview	0.014	0.014	0.014				1
98-R5055	Geico	0.41	0.82	0.82				2
96-V0929	Estella Drive	2.5	5				5	2
97-R5392	Quail Ridge	0.797	0.8	0.8				1
98-R5646	BECO	0.81	1.62	1.62				2
98-R5530	Riddicks Quay	0.63	1.26				1.26	2
96-R5756	Cavalier Park	9.17	18.34	18.34				2
97-V1295	Rubette Land Trust	0.044	0.03		0			0
97-R5517	New Life Church	0	0.93		0			-
97-R5302	Burroughs	0.289	0.289			0.289		1
96-R5375	Warhill Tract	1.22	2.4		0			0

After reviewing all 30 projects, it was found that only 4 were never completed (13%). One of these, however, was never completed because the wetland impacts never occurred. Therefore, 10% of the projects are out of compliance because they were never initiated or completed.

The remaining 27 mitigation sites that were completed included 8 wetland creation sites, 7 wetland restoration sites, 3 commercial mitigation bank transactions, and 9 trust fund payments. The following sections will detail the results within each of these 4 groups.

Creation and Restoration

Out of the 18 permits that required mitigation in these two categories, 1 permit was nullified (the impacts were never realized), 2 mitigation sites were never completed, and the other 15 permits had at least initiated their mitigation.

Creation and Restoration Sites	
# permits requiring creation or restoration	18
# permits never realizing impacts (invalid)	1
# Permits analyzed	17
# permits with mitigation initiated	15
# permits without any mitigation initiated	2

Table 2
Creation and Restoration Projects Summary

The total mitigation generated was 17.25 acres of wetlands , including 6.14 acres of creation and 11.11 acres of restoration. The total impacts for all valid creation and restoration permits is 8.57 acres. Therefore, there was a net increase in wetland acreage of 8.68 ± 1.63 acres (approximately a 2:1 replacement ratio). The required acreage for these permits was 22 acres (13.63 creation, 8.37 restoration). The overall required mitigation ratio was 2.57:1.

These 15 mitigation initiated sites were planted, on average, 2.7 ± 1.73 years after the permit was issued.

Out of the 15 project files found for these sites, only 5 (33%) required monitoring of the mitigation site as a permit condition. Out of those 5 project files, 4 contained the required monitoring reports. Only 3 permits required well data as part of the monitoring reports, but there was no evidence of any well data in the files.

During field review of these 15 initiated creation and restoration sites, it was noted that 6 of the 15 valid mitigation sites (40%) had invasive species present. Five of the sites had *Typha lattifolia* present and 1 site had *Phragmites autralis* present. According to the project files, 50% of these site required planting instead of seeding or natural re-vegetation. Field review documented an average of 83% (±18%) ground cover on all 15 mitigation sites. Soil manipulation during construction was required for 6 (40%) of the sites. Water control structures were present on 44% of the sites. Saturation was present in 8 sites. Tidal hydrology was present in 7 sites. Both tidal and nontidal hydrology factored into one of the sites. Open water was found only on 1 site. Of these 15 initiated sites, only 3 (20%) specified some sort of contingency plan. High levels of disturbance were found on 12% of the sites; medium levels of disturbance were found on 31% of the sites.

The 15 permits where mitigation was initiated required 10 emergent wetland mitigation areas and 4 forested wetland areas and 1 permit required emergent and forested wetland mitigation. The field review showed 9 emergent areas, 2 scrub/shrub areas, 3 sites with emergent and scrub/shrub wetlands, and 1 site with emergent and forested wetlands (see Figure 2). The permits authorized impacts to 10 emergent wetlands and 5 forested wetlands (see Figure 1).

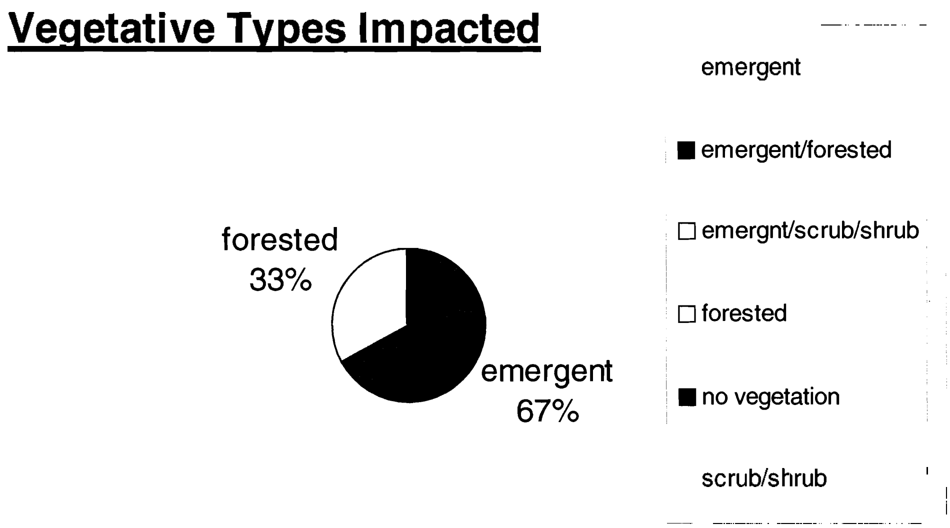

Figure1
Vegetative Wetland Types Impacted

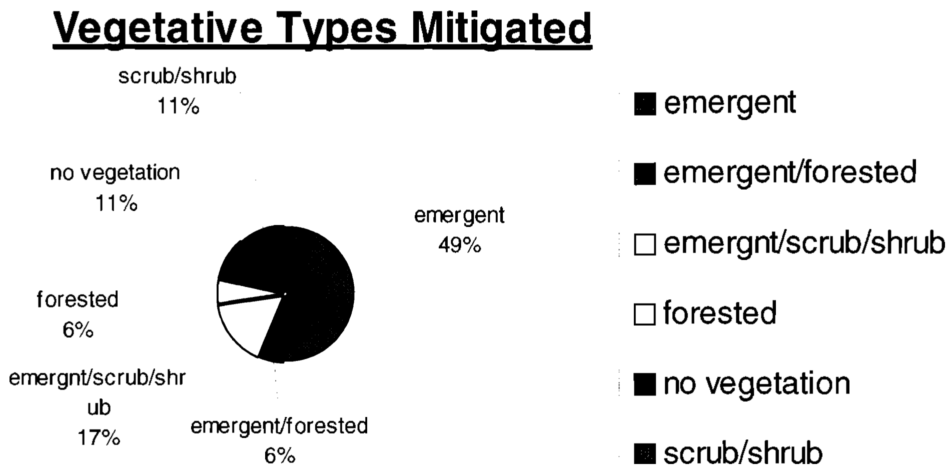

Figure 2
Vegetative Wetland Types Mitigated

Out of the 15 mitigation sites initiated, 2 showed poor vigor, 3 showed moderate vigor, and 10 showed good vigor. Only 1 of those sites shows indications of not being self-sustaining, a tidal beach area that shows signs of potentially washing out. Species diversity on these 15 sites averages out to 9.5 ± 3.6 species per site, with a minimum of 1 and a maximum of 27 species. The FAC-neutral test, where 50% or more of the vegetation is classified as FACW or OBL, was passed on all but 4 sites. Those 4 sites varied from 26% to 37%. On 7 sites, all vegetation was FACW or OBL. Soil compaction is a large problem at one site and may potentially be limiting the vegetation advancement at 7 sites.

The overall technical compliance of these 17 valid permits was 133% of the required mitigation. Individually, 2 sites achieved 0% of the required mitigation acreage, 4 sites achieved 100% of the required mitigation acreage, and 5 sites achieved more than 100% of the required acreage. One site achieved 242.86% of its required acreage and another achieved 1065% of its required acreage.

Out of these 17 valid permits, 3 files could not be found (18%) and permit compliance could therefore not be assessed. Out of the remaining 14 permits, 7 did not state any special conditions, 6 permits stated 2 special conditions, and 1 permit stated 8 special conditions. Out of the 7 permits requiring special conditions, 1 had 0% permit compliance, 2 had 50% permit compliance, and 4 had 100% permit compliance.

Commercial Mitigation Bank

Three projects in this data set used a commercial mitigation bank. In fact, all three used the same bank – White Cedar Mitigation Bank (see Figure 6 for location).

White Cedar Wetland Mitigation Bank is a commercial wetland mitigation bank located in the City of Chesapeake (Martin, 2003). It services wetland impacts occurring in Chesapeake, southern Virginia Beach and eastern Suffolk (Martin, 2003). The MOA instrument was signed by the Mitigation Bank Review Team (MBRT) in 1995(Martin, 2003). The bank encompasses 273 acres, all of which were sold out as of December 2002 (Martin, 2003). The site was originally prior-converted (PC) farmland and farmed wetlands (Martin, 2003). The restoration was done in two phases (Martin, 2003). Starting in 1995, Phase I was simply plugging the ditches (Martin, 2003). Phase I ended up been predominantly vegetated with *Acer rubrum, Salix nigra*, and *Taxodium distichum* (Martin, 2003). The lack of *Chamaecyparis thyoides* (Atlantic White Cedar) was due to the overabundance of hydrology (Martin, 2003). Therefore, Phase II included grading down the crowns and using the excess material to fill the ditches and other low areas (Martin, 2003). Phase II did not produce a monotypic cedar community, but did produce 25-35% cedar coverage (Martin, 2003). Rooted cuttings were used to vegetate the site, at a minimum rate of 700 stems/acre (Martin, 2003). The site is currently used by wildlife such as waterfowl and shorebirds (Martin, 2003). The site has continuously been monitored by the Corps of Engineers project manager, Mr. Steve Martin. The monitoring period officially ends in 2004, at which time the ownership may be transferred to a nonprofit conservancy group, such as the Dismal Swamp Wildlife Refuge, for safekeeping (Martin, 2003).

These three permits required 19.56 acres for 10.73 acres of wetland impacts (1.82:1). The impacts were to 1scrub/shrub and 2 forested wetland communities. On average, the banks were paid 1 ± 1.96 years after the permit was issued. No special conditions were included in any of these permits, so all three are in 100% technical and permit compliance.

Virginia Wetland Restoration Trust Fund

Nine projects required 22.25 acre of mitigation through payments to the Virginia Wetland Restoration Trust Fund.

The Virginia Wetlands Restoration Trust Fund (the Trust Fund) is managed by The Nature Conservancy (TNC) and the Army Corps of Engineers. There is a managing Memorandum of Understanding (MOU) between TNC and the Corps of Engineers (1995). In the Norfolk District, Mr. Gregory Culpepper is the Corp's point of contact and Trust Fund manager. The Trust Fund is unique in that it is one of the few available and approved forms of compensatory mitigation for impacts to waters of the United States (streams). Mr. Culpepper is responsible for writing estimates for project applications proposing to use the Trust Fund as compensatory mitigation for unavoidable impacts to streams and wetlands. He is also responsible for managing the moneys contributed for aquatic impacts in Virginia and evaluating potential sites for conversion or restoration.

For the purposes of this study, it is assumed that once a Trust Fund contribution is made, that the mitigation will be successfully completed due to the strict monitoring requirements. According to Mr. Culpepper, the Trust Fund usually turns all contributions towards site work within 3 years of receiving the money (2002). Therefore, although there is a temporal wetland and waters loss, the monies are required to be used for wetland and steam creation or restoration within that approximate 3 year time frame (Culpepper, 2002). Most Trust Fund projects are restoration of wetlands and streams, as these are the most successful forms of mitigation (Culpepper, 2002). Mr. Culpepper attempts to direct the monies into projects with similar vegetated communities as those impacted (Culpepper, 2002). Most of the Trust Fund projects involve forested wetland communities (Culpepper, 2002). According to the MOU, "a primary goal of the fund is to ensure that at least two acres of wetlands are created or restored for each acre impacted" or " a minimum ratio of 10:1 wetland acres preserved... on a case-by-case basis" for each acre impacted (1995). The projects, once completed, undergo intensive monitoring for at least 5 to 10 years and then less intensive perpetual monitoring thereafter to ensure that the sites meet the wetland criteria in the MOU (Culpepper, 2002). Reference wetlands are generally used for comparative purposes, as well (Culpepper, 2002).

These 9 projects paid for 22.25 acres to compensate for 14.27 acres of wetland impacts (1.5:1). All 9 projects are 100% in technical compliance. Out of these 9 projects, 1 file could not be found. For the remaining 8 projects, 2 permits required 1 special condition and 6 permits did not specify any special conditions. Both permits that required a special condition are 100% in compliance with their permits. Impacts for 7 projects were to forested wetlands and impacts for the other 2 projects were to emergent wetlands. The average payment to the Trust Fund was $47,555.10 per acre. The minimum payment was $12,000.00 per acre. The maximum payment was 187,500.00 per acre. On average, the payment to the Trust Fund was received within 1.9 years of permit issuance.

Site Specific Data

While conducting site visits, the standard data form included in the 1987 Wetland Delineation Manual was used to collect data about each site. The number of data points taken at each of the 16 sites visited varied from 1 to 4, with a total of 30 data points taken. This number of data points was largely determined by the number of community types present on the site. The results can be seen in Table 6.

Overall, the average percentage of vegetation classified as FAC or wetter was 79%, with sites ranging from 0% to 100%. A list of the vegetative species found is in Table 7. Water was present on the surface (inundation) on 33% of the data points. Water was found in the soil pit at or above 12 inches in 50% of the samples. Saturated soils were present 77% of the time. The average number of primary hydrologic indicators per site was 2.4; the average number of secondary indicators per site was 1.1.

Vegetative criteria and hydrological criteria are usually emphasized over hydric soil criteria, as hydric soil characteristics take years to develop. However, in these sites the hydric soil indicators were relatively strong. Hydric soil matrices (chroma 1 or chroma 2 with mottles) was found in 41% of the samples. An average of 2.6 hydric soil indicators were recorded per site.

Overall, 4 sites (25%) were found to be missing one or more of the three criteria necessary for a wetland determination (hydrophytic vegetation, hydric soils, and hydrology or hydrologic indicators). These missing criteria included hydrophytic vegetation at 3 sample points, hydrologic indicators at 2 data points, and hydric soils at 6 data points. A wetland determination was made at 80% of the sample points.

Preservation

Although preservation of wetlands and upland buffers does not usually count towards no net loss, it is worth mentioning. According to the permits, three projects were required to preserve wetlands. One of these permits became invalid (the impacts were never realized), so in the end 2 projects preserved 69.2 acres of wetlands and upland buffers. Only 1 project filed a restrictive covenant to legally preserve the area in perpetuity. The average ratio of preserved acreage to required acreage for these 2 projects is 34.6:1.

Files

In searching for the project files for this data set, 4 files could not be found. See Table 5 for the results of the file reviews. Out of the 26 files found, 12 were deemed complete. Completeness was determined if all the information necessary to determine the location of the mitigation site, the actual permit, the final mitigation plan, and any post-permit issuance changes and compliance was included in the file. Only 2 permit files were missing information vital to performing this compliance study. The remaining 12 project files included all the base information up to permit issuance, but were missing post-permit changes and compliance site visit notations. Only 7 of the 26 files had a clearly marked, comprehensive final mitigation plan. None of the files recommended any deadlines for the special conditions or mitigation requirements.

No Net Loss

Overall, 5 of the 29 valid permits (17%) did not meet no net loss. Therefore, 83% of the sampled projects did meet no net loss of wetlands. The net mitigation was 5.25 acres short of what was required in the permits. The average technical compliance (acreage of mitigation done divided by acreage of mitigation required) is 91%. Five projects mitigated for more wetland acreage than was required. The differences between acreage required and acreage achieved ranged from 2.4 fewer acres than required to 0.26 additional acres than required. Technical compliance on individual projects ranged from 0% to 1065%. The overall no net loss ratio for this data set is 1.76:1.

Summary of No Net Loss Calculations	
Permits with < 1 acre mitigation for each acre impacted	5
Total Acres Impacted	33.573
Total Acres of Mitigtaion Required	59.072
Total Acres of Wetland Mitigation Completed	65.247
Ratio Required Acreage: Impacted Acreage	1.94:1

Table 3
Summary of No Net Loss Calculations

V. Discussion/Conclusions

Is Norfolk District meeting no net loss for permit years 1996 to 1998? Based on the results described above, the answer is yes. Out of the 29 projects that actualized their proposed wetland impacts, the net ratio of acres of wetlands created or restored to acres of wetlands impacted is 1.76:1. The sampled applicants for these permit years have created or restored 59.07 acres of wetlands in compensation for 33.57 acres of impacts to wetlands. Therefore, these results suggest that the Norfolk District met no net loss for permit years 1996-1998.

It should be noted, though, that this study was very restricted in sample size and geography. Also, the study design does not take into account unreported impacts and impacts that did not require mitigation (impacts < 0.10 acre). Other factors that may skew these results includes the fact that Trust Fund projects may involve preservation (which should not count towards no net loss) and the fact that if an applicant created more wetland acreage than required, that excess acreage may be planned to compensate for other future impacts and not just the impacts listed in this study. Any similar future studies should try to take these factors into account, as well.

However, this study does not evaluate the other half of no net loss – function. Currently, Norfolk District has no functional assessment in place, besides "best professional judgment." In order to fully support the District's ability to meet no net loss and protect the wetlands in Virginia, a functional assessment must be chosen, modified if necessary, and used. This will take a lot of the subjectivity out of mitigation review and approval and standardize the District. It will allow project managers to more concretely summarize what is being lost and what must be gained to compensate for the loss. Based on this reviewer's best professional judgment, many of these projects met no net loss of wetland acreage, but the wetlands mitigated were of low quality and function.

Several of the factors listed in the literature review as being important to determining the success of mitigation projects were notably missing in the sampled project files and permits.

One of those factors is monitoring plans. Only 53% of the projects sampled required monitoring by applicant in their permits or through the Trust Fund or the mitigation bank. All but one project submitted some or all of the monitoring reports. Out of the 5 creation/restoration projects requiring monitoring, only 3 specifically required well monitoring. No well monitoring results were submitted. None of the permits required as-built surveys to verify the final mitigation areas elevations.

Another factor that is lacking in the District is a clear goal and clear success criteria necessary to achieve that stated goal. Most permits and permit files simply stated that the applicant proposed to impact 1 acre of forested wetland and offered creating 2 acres of forested wetland as compensation. The project manager needs to document the wetland being lost and what needs to be compensated for based on that. For example, if the applicant is proposing impacts to a pristine mature forested wetland predominantly vegetated with species "A" and "B", then the project manager must decide what needs to be mitigated for. Simply stating in the permit that 2 acres of forested wetlands does not direct the applicant towards creating a wetland to compensate for the one impacted. Is the value (pristine) most important? Is the fact that is forested most important? Maybe it's the species present that are most important. Very few permits really detailed what was expected of the mitigation site and how it compensates for the impacted site. Adding deadlines to the specific conditions and requirements will help keep the applicant working in a timely manner. It should be noted that these permits were written not long after the Branch Guidance was released (December 1995), so most likely looking at projects permitted between 1999 and 2003 would show great improvements in this area.

Despite these deficiencies, the Norfolk District is in good shape. Only 2 sites were completely out of compliance. The other 27 sites created or restored some jurisdictional wetlands, at varying rates of technical compliance. Even though the sampled projects, overall, did not create or restore the required amount of mitigation acreage, the net gain was 1.76 acres for every acre impacted – better than most other Corps of Engineers Districts are reporting.

This study showed the greatest temporal loss was with creation and restoration as mitigation; the least temporal loss was realized with use of the commercial mitigation bank. The highest rates of success (acreage mitigated divided by acreage required) were with the use of the mitigation bank and the Trust Fund.

Monitoring was required in one-third of the permits requiring creation and restoration. Reports were only received for one-quarter of the projects, and none of those included any well monitoring data.

Invasive species were present on 38% of the sites, but considering that the sites have passed the required monitoring periods, none of those sites can be required to be remediated. This stresses the importance of compliance checks during mitigation construction.

A contingency plan, such as a performance bond to ensure that the mitigation is successfully completed, was noticeably absent in 80% of the permits. Most mitigation banks do require a performance bond in their Memorandums, however. Only 4 sites showed poor or moderate vigor and only 1 site was not self-sustaining (a *Spartina* beach site that was experiencing erosion of the sand and the vegetation).

Most of the data points showed very wet mitigation sites, despite the fact that July 2001 through August 2002 was exceedingly dry (11.72 inches below normal) and low precipitation (especially during the winter months) causes the groundwater table to fall to very low levels. Although it is promising that so many sites met the hydrological criteria, this could stunt the successional progress of these sites in wetter than normal years. A high percentage of the data points passed the FAC neutral test, 33% of the data points had some inundation, and 50% of the data points evidenced water within the top 12 inches of the soil pit. On average, the sites had 2.4 primary hydrological indicators, 1.1 secondary hydrological indicators, and 2.6 hydric soil indicators. Hydric soils with a matrix Munsell color of 1 or 2 with mottles was seen in 41% of the sites.

The conclusion these results lead to is that overall there was a technical net gain of wetland acreage over the 30 projects sampled. Individually, these projects ranged from complete noncompliance to creating more wetlands than were required. Overall, 33 acres were impacted through these 30 permits, 65 acres of mitigation were required, and 59 acres of wetlands were achieved. So, although less acres were created or restored than were required, greater than a 1:1 replacement of impacted wetlands was obtained. There may however be a functional net loss.

The next chapter includes recommendations to increase Norfolk District's overall compliance and increase their net gain ratio of wetlands.

VI. Recommendations

The previously discussed results lend themselves towards recommendations to improve the Norfolk District Regulatory Branch's consistency and compliance .

Prior to the start of this study, this researcher believed that the Branch should initiate a mitigation compliance section. This would take the compliance responsibility away from the project manager and allow them to concentrate of incoming applications without having to constantly switch directions to keep up with compliance of old projects. After completing this study, however, it is thought that a compliance project manager would spend too much time just trying to become familiar enough with the project location and history and this probably would not be a more efficient technique for the Norfolk District. However, the following recommendations would help project managers track their compliance projects more efficiently.

Currently, the District Regulatory Branch maintains a Filemaker-based database, called Tracker. Project managers log application information and their actions taken for each project. There is an area to mark the required mitigation, but no area for specific mitigation requirements and no area for follow-up notes.

One of the most frustrating parts of this study was trying to talk to each project manager to find out the current status of their projects because it wasn't noted in the file or in the database. By keeping detailed records in the database, it will be easily accessible to other project managers. This can be especially important when project managers leave their positions at the Corps of Engineers and there is no way to follow up with them. Even worse, files often disappear, leaving no information about the project except the sketchy descriptions entered into Tracker. Having a consolidated mitigation database would allow detailed data to easily be accessed. The database fields would include descriptions of the following:

- Watershed
- Functional assessment
- Monitoring plan details, due dates and completion dates
- Compliance check dates and findings
- Financial assurances
- Permit special conditions, due dates and completion dates
- Restrictive covenant requirements and evidence of recordation
- Mitigation plan details and due dates

Along the same lines, when a project manager leaves the Corps of Engineers, all their projects should be reassigned. This will most likely lead to less files disappearing with time and this makes sure the compliance responsibilities will be followed through by someone.

Another recommendation is to account for temporal losses better. Forested wetlands were impacted in 13 of these 30 projects sampled. Only 1 site had any forested wetlands on them and that site was a restoration area that was forested to begin with. These projects have been in the ground 1.8 years, on average. If the impacts were realized the year after the permit was issued (6 years ago, on average), then we have seen a 4 year delay on getting the mitigation area constructed, and more than 6 year delay (probably more like 15 year delay) in reaching a forested community. Norfolk District should consider increasing the required mitigation ratios for creating or restoring forested or scrub/shrub wetlands or requiring that compensation be made through a mitigation bank that has been in the ground for a minimum amount of time.

Finally, a functional assessment that can routinely be used by project managers to assess impacts and mitigation has to be implemented. This will probably take a lot of work to assess which methods are most applicable to the different geographic regions of Virginia and modify them to be rapid methods of assessment that can easily be used on all projects. This will help alleviate some of the subjectivity currently involved with determining appropriate compensatory mitigation.

Being a regulatory project manager is not an easy job. Someone once said that to do it well, you must be disliked by all sides. But, we at the Norfolk

District can feel good that we are meeting, and exceeding, no net loss of wetlands. Hopefully this thesis will generate good discussion amongst regulators everywhere so that we can all find ways to do our jobs better.

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Appendix A

Project Location Maps

Thesis Study Sites

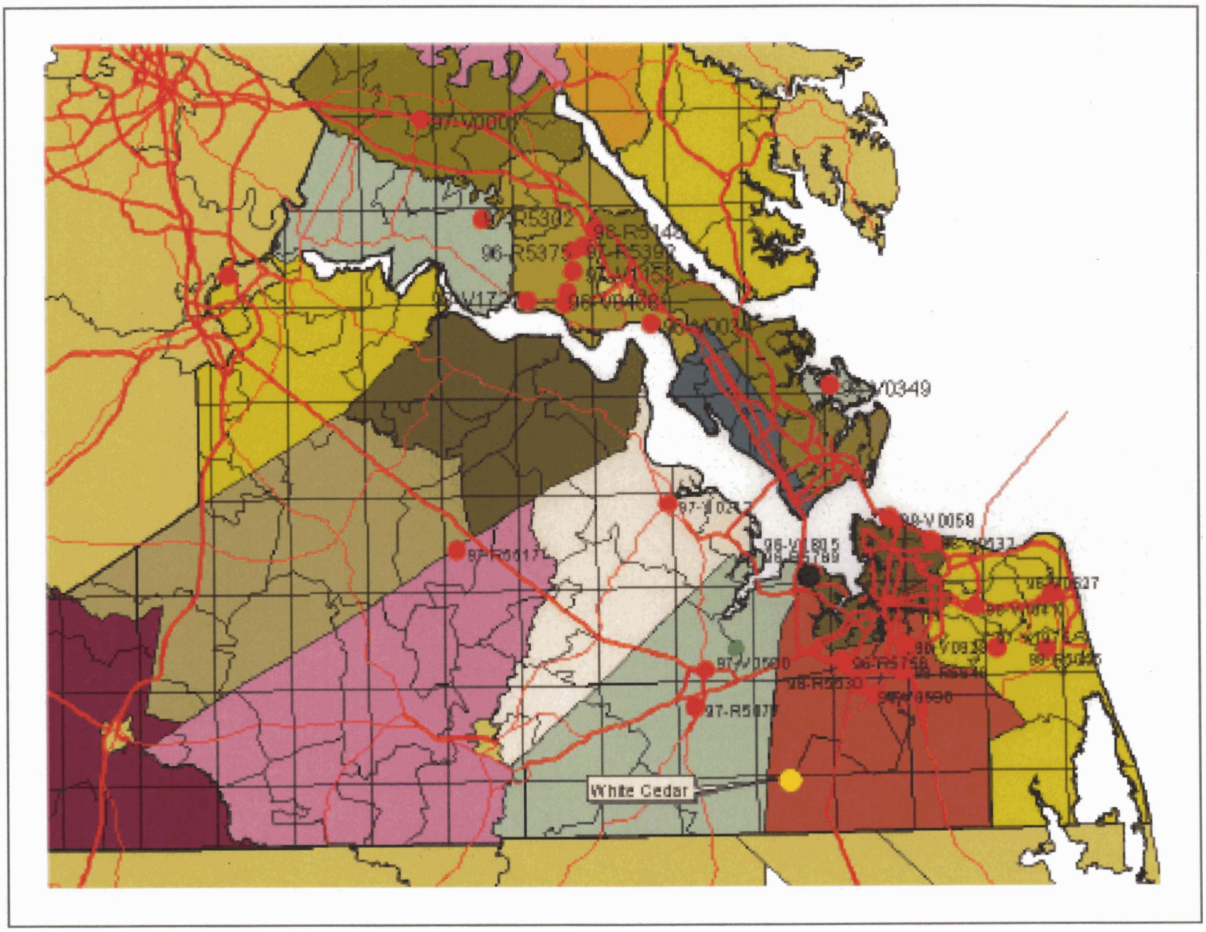

Figure 3
Thesis Study Sites

30 0 30 Miles

N
W E
S

Thesis Study Sites (Peninsula)

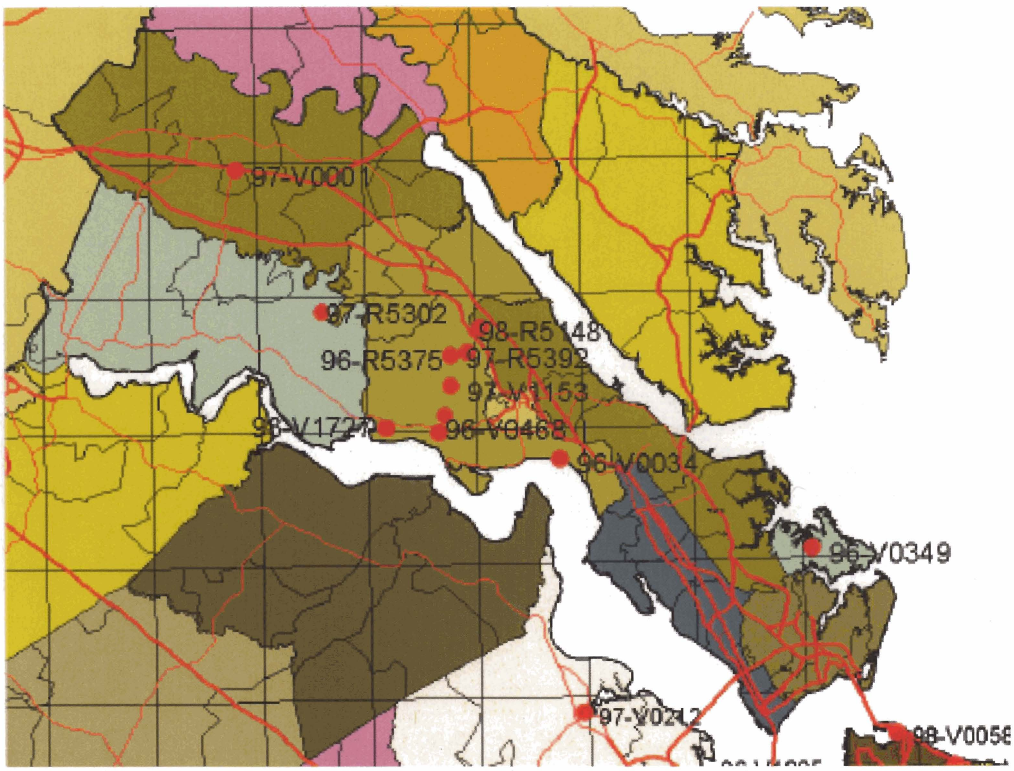

Figure 4
Thesis Study Sites - Peninsula

Thesis Study Sites (Southside)

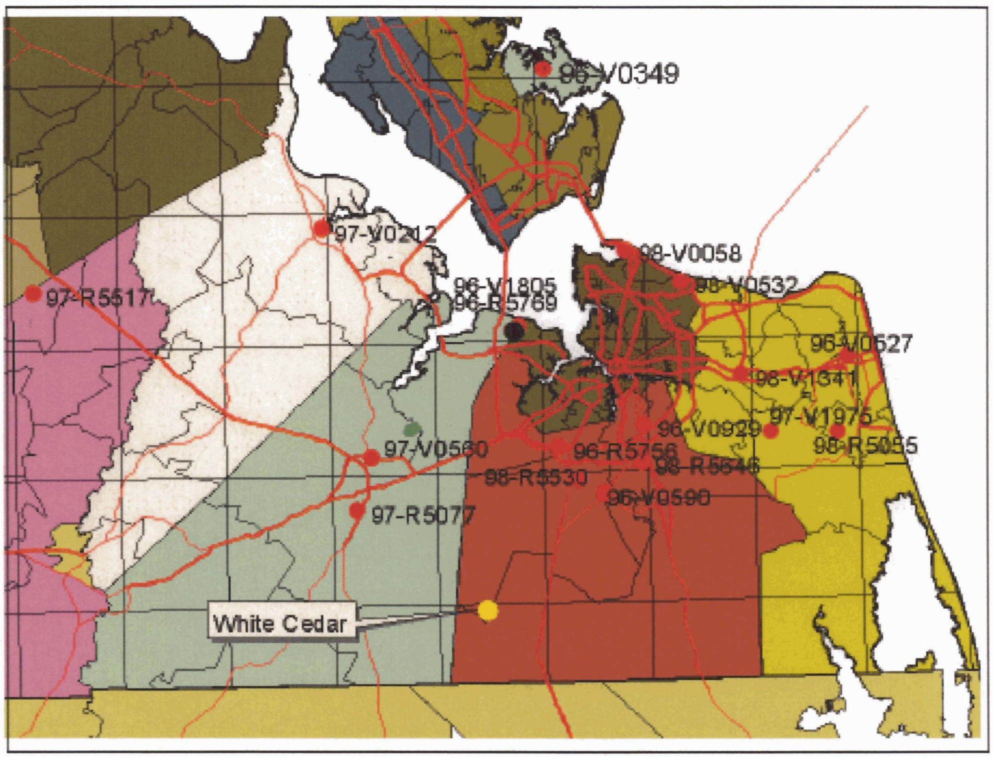

Figure 5
Thesis Study Sites - Southside

White Cedar Mitigation Bank Location

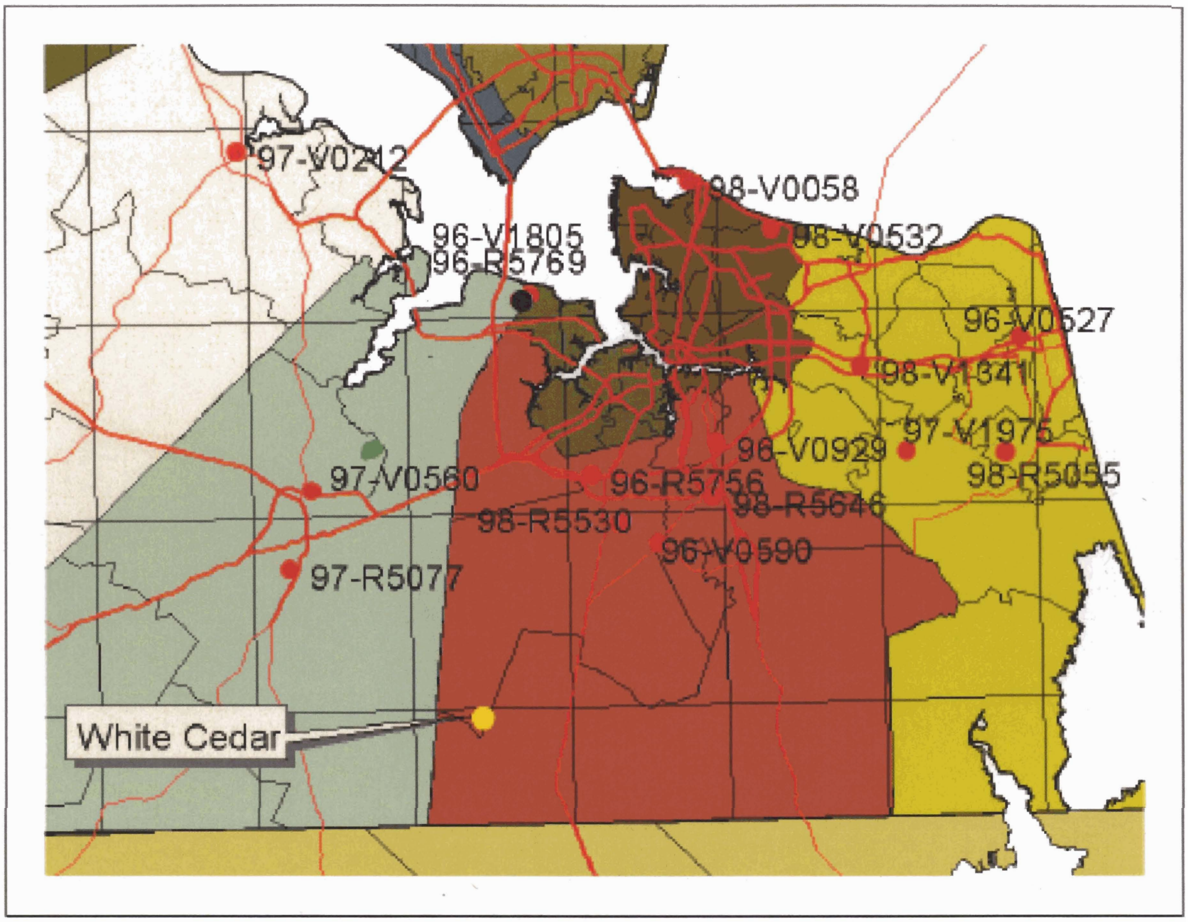

Figure 6
White Cedar Mitigation Bank Location

Appendix B

Project Summary Spreadsheets

Table 4
Study Results (Long Form)

Project ID	Project Name	Locality	Acreage of Impacts	Cowardin Classification of Impacts	(f)orested/(s)crub/ shrub/ (e)mergent - Mitigation Required
97-R5077	Suffolk Industrial Park	Suffolk	0.717	PEM1	e
96-V0590	Centex Homes	Chesapeake	0.06	E2EM1	e
96-V0034	Kingsmill	James City	0.16	E2EM1/PEM1	e
97-V0001	Colonial Downs	New Kent	0.31	M2FO1	f
98-R5605	Fort Lee	Prince George	0.053	PUB1/PEM2	ef
98-V0532	Pretty Lake	Norfolk	0.027	E2EM1	e
97-V0560	Beamon Farm	Suffolk	2.87	PFO1	f
98-V0058	Monkey Bottom	Norfolk	0.27	E2UB3	e
97-V1975	Sentara	Virginia Beach	7.6	PSS1	
98-V0971	Espejo	Norfolk	0.008	E2EM1	
96-V0349	Bennett Creek	Poquoson	0.213	PEM1/E2EM1	e
97-V1152	Fords Colony	James City	1.93	PFO	f
98-V1341	Pocohontas Village	Virginia Beach	0.31	PEM1	e
96-V0527	Olmstead	Virginia Beach	0.03	PFO1	e
96-V0468	Route 5	James City	2.789	PFO1	f
97-V0212	Smithfield Foods	Isle of Wight	0.05	E2EM1	e
98-R5148	Lowes	York	0.02	PEM1	e
98-V1727	Governor's Land	James City	0.142	PFO1A-C	
96-V1805	Bishops Green	Portsmouth	0.13	PFO1	
96-R5769	Harbourview	Suffolk	0.014	PEM1	
98-R5055	Geico	Virginia Beach	0.41	PFO1	
96-V0929	Estella Drive	Chesapeake	2.5	PFO1	
97-R5392	Quail Ridge	James City	0.797	PFO1	
98-R5646	BECO	Chesapeake	0.81	PFO1	
98-R5530	Riddicks Quay	Chesapeake	0.63	PFO1	
96-R5756	Cavalier Park	Chesapeake	9.17	PFO	
97-V1295	Rubette Land Trust	Virginia Beach	0.044	E1EM1	e
97-R5517	New Life Church	Southampton	0	PEM1	
97-R5302	Burroughs	Charles City	0.289	PFO1	f
96-R5375	Warhill Tract	James City	1.22	PFO1	e

Table 4, continued…

(f)orested/(s)crub/ shrub/ (e)mergent - Existing Mitigation	TF payment ($)	# years (Trust Fund payment)	$/acre (Trust Fund Payment)	Trust Fund Acreage	Acreage of tland Creation	Acreage of Wetland Restoration	Mitigation Bank Acreage	# Years Delay in Bank Payment
s					0.65			
e						0.06		
e					1.8			
es					0.882			
ef						6.5		
e						0		
es						3.8		
e					0.01			
							13.3	0
	1,500.00	1	187,500.00	0.008				
e						0.213		
es					2.22			
e					0.4	0.08		
e					0.03			
f	7,700.00	5	55,000.00	0.14				
e						0.17		
e					0.15			
	11,654.00	1	45,523.44	0.256				
	10,424.40	4	40,093.85	0.26				
	308.00	4	22,000.00	0.014				
	14,350.00	0	17,500.00	0.82				
							5	0
	28,692.00	1	35,865.00	0.8				
	19,440.00	0	12,000.00	1.62				
							1.26	3
	229,500.00	1	12,513.63	18.34				
no veg					0			
nr					0			
s						0.289		
no veg					0			

Table 4, continued…

No Net Loss Ratio	Sum of No Net Loss Mitigation Achieved	Mitigation Required (Acreage)	Mitigation To Impacts Ratio Required	Wetland Acreage Achieved – Wetland Acreage Required	% technical compliance (Acreage Achieved / Acreage Require)	Acreage of Preservation	Preservation Ratio	Restrictive Covenant Required?
0.91	0.65	0.99	1.4	-0.34	65.66%			
1.00	0.06	0.06	1.0	0.00	100.00%			
11.25	1.8	1.72	10.8	0.08	104.65%			
2.85	0.882	0.62	2.0	0.26	142.26%			
122.64	6.5	8	150.9	-1.50	81.25%			
0.00	0	0.03	1.1	-0.03	0.00%			
1.32	3.8	3.8	1.3	0.00	100.00%			
0.04	0.01	0.23	0.9	-0.22	4.35%			
1.75	13.3	13.3	1.8	0.00	100.00%			
1.00	0.008	0.008	1.0	0.00	100.00%			
1.00	0.213	0.02	0.1	0.19	1065.00%			
1.15	2.22	2.2	1.1	0.02	100.91%	65.05	33.70466321	n
1.55	0.48	1.16	3.7	-0.68	41.38%			
1.00	0.03	0.03	1.0	0.00	100.00%			
0.05	0.14	0.14	0.1	0.00	100.00%	99	35.49659376	y
3.40	0.17	0.07	1.4	0.10	242.86%			
7.50	0.15	0.85	42.5	-0.70	17.65%			
1.80	0.256	0.256	1.8	0.00	100.00%			
2.00	0.26	0.26	2.0	0.00	100.00%			
1.00	0.014	0.014	1.0	0.00	100.00%			
2.00	0.82	0.82	2.0	0.00	100.00%			
2.00	5	5	2.0	0.00	100.00%			
1.00	0.8	0.8	1.0	0.00	100.00%			
2.00	1.62	1.62	2.0	0.00	100.00%			
2.00	1.26	1.26	2.0	0.00	100.00%			
2.00	18.34	18.34	2.0	0.00	100.00%			
0.00	0	0.03	0.7	-0.03	0.00%			
		0.93	1.0			0		n
1.00	0.289	0.289	1.0	0.00	100.00%			
0.00	0	2.4	2.0	-2.40	0.00%			

Table 4, continued…

Date Site Graded	# Years Since Site Planted	Mitigation Done on or off site	Was Well Data Required	Well Results	Planting Method	Invasive Species Present	% of Site Affected by Invasive Species	Was Soil Manipulated?
u	4	on	n		p	*Typha latifolia*	5-10	y
u	u	on	n		p	n	0	n
u	u	on	n		p	n	0	y
u	u	on	n		p	*Typha latifolia*	5-10	unk
2000	2	on	n		nr	*Typha latifolia*	< 5	n
u	u	on	n			n	0	n
	1	off	y	nr	p	n	0	y
u	u	on	n		p	n	0	y
		off	other					
		off	other					
u	u	on	n		s	n	0	n
1998	4	on	y	nr	p	*Typha latifolia*	10-20	y
2001	1	on	n		p	n	0	n
u	u	on	n			n	0	n
		off	n			n	0	n
1998	4	on	n		s	*Phragmites australis*	5	n
1999	3	on	n		se	*Typha latifolia*	<5	n
		off	other					
		off	other					
		off	other					
		off	other					
		off	other					
		off	other					
		off	other					
		off	other					
		off	other					
		on	n					
		on	n			~		
	5	on	n		se	n		n
2001	0	off	y	nr	unk	n	0	added compost

Table 4, continued…

Was Monitoring Required?	Was Monitoring Done?	File vs. Permit Description	Was there a Contingency Plan?	Level of Disturbance: (l)ow (m)edium (h)igh	Water Control Structure Present?	Site (Tidal) or (Sat)urated	% Open Water Onsite
n		d	n	l	y	sat	0
y	y	s	y	l	n	tidal	0
n		s	n	m	n	tidal	0
unk	unk	unknown	unknown	l	n	sat	0
n		s	n	l	y	both	20
n		d	n	l	n	tidal	0
y	y	s	y	l	y	sat	0
n		d	n	h	y	tidal	0
other		s	n		-	-	-
other		s	n		-	-	-
n		unknown	n	l	n	tidal	0
y	y	s	y	m	n	sat	0
y	n	s	n	h	y	sat	0
n		d	n	l	n	tidal	0
n		s	n	m	n	sat	0
n		s	n	m	n	tidal	0
n		d	n	m	y	sat	0
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
other		s	n		-	-	-
n		unknown	unknown		-	-	-
		s	n		-	-	-
n		s	n	l	n	sat	0
y	y	unknown	unknown	l	y		0

Table 4, continued…

% of Site Vegetated	Vigor of Vegetation	Vegetation (Homo)genous or (Strat)ified	Were Soils Stabilized?	Was the Soil Compacted?	technical compliance (100% = 1)	# Special Conditions in Permit	# Conditions in Compliance
50	mod	strat	3	2	0.656565657	2	0
100	good	homo	3	3	1	2	2
50	good	strat	2	3	1.046511628	2	2
100	good	strat	3	3	1.422580645	unk	unk
100	mod	strat	3	2	0.8125	0	0
100	poor	homo	2	1	0	0	0
100	good	homo	3	3	1	8	8
3	poor	homo	1	3	0.043478261	0	0
					1	0	0
					1	0	0
100	good	homo	3	2	10.65	0	0
100	good	strat	3	3	1.009090909	2	1
100	mod	strat	3	2	0.413793103	2	1
100	good	homo	3	3	1	0	0
100	good	homo	3	2	1	1	1
100	good	homo	3	3	2.428571429	2	2
100	good	strat	3	2	0.176470588	0	0
-	-	-	-	-	1	unk	unk
-	-	-	-	-	1	0	0
-	-	-	-	-	1	0	0
-	-	-	-	-	1	0	0
-	-	-	-	-	1	0	0
-	-	-	-	-	1	0	0
-	-	-	-	-	1	1	1
-	-	-	-	-	1	0	0
					1	0	0
					0	unk	unk
					0		
100	good	homo	3	2	1	0	0
0	poor		2	2	0	unk	unk

Table 4, continued..

% Permit Condition Compliance	Potential for Site to Succeed: 0 = poor 1 = probable	Is Site Self-Sustaining? 1 = yes 0 = no
0%	1	1
100%		1
100%		1
-		1
-	0	1
-	1	1
100%	1	1
-	0	0
-		1
-		1
-		1
50%		1
50%	0	1
-		1
100%		1
100%		1
-	0	1
-		1
-		1
-		1
-		1
-		1
-		1
100%		1
-		1
-		1
-		-
-		-
-		1
-	0	0

Table 5
File Review Results

Project ID	Was File Found?	% Complete	Completeness Rating 1 = missing vital info 2= mostly complete 3 = complete	Changes Documented	Compliance Check Performed?	Final Mitigation Plan Present	Deadlines Listed in Permit
97-R5077	y	80-100	2	n	y	n	n
96-V0590	y	80-100	2	n	y	y	n
96-V0034	y	80-100	2	n	n	n	n
97-V0001	n						
98-R5605	y	100	3	n	y	n	n
98-V0532	y	100	3	n	n	n	n
97-V0560	y	80-100	2	n	y	y	n
98-V0058	y	80-100	2	n	n	n	n
97-V1975	y	100	3	y	y	n	n
98-V0971	y	80-100	2	y	y	n	n
97-V1153	y	80-100	2	n	y	n	n
96-V0349	n						
98-V1341	y	80-100	2	y	n	n	n
96-V0527	y	100	3	n	n	n	n
96-V0468	y	100	3	n	y	n	n
97-V0212	y	80-100	2	n	y	n	n
98-R5148	y	<80	1	n	n	n	n
98-V1727	y	80-100	2	n	y	n	n
96-V1805	y	100	3	y	y	n	n
96-R5769	y	<80	1	y	y	n	n
98-R5055	y	100	3	y	y	y	n
96-V0929	y	100	3	y	y	y	n
97-R5392	y	100	3	y	y	n	n
98-R5646	y	100	3	y	y	y	n
98-R5530	y	100	3	y	y	y	n
96-R5756	y	100	3	y	y	y	n
97-V1295	n						
97-R5517	y	80-100	2	n	y	n	n
97-R5302	y	80-100	2	n	n	n	n
96-R5375	n						

Table 6 Data Point Results

Data Point 1 project	% vegetation FAC or wetter	Inches Water at Surface	Inches Water in Pit	Depth to Saturated Soil	# Primary Hydrological Indicators	# Secondary Hydrological Indicators	matrix	Mottles Present
97-R5077	0	-	-	-	0	0	>3	none
96-V0590	100	2	0	0	4	1	gleyed	none
96-V0034	50	-	-	-	1	1	sandy	none
97-V0001	75	-	-	2-6	3	2	1	none
98-R5605	90	6+	0	0	2	1	<1	
98-V0532	100		0	0	4	1	gleyed	none
97-V0560	63	-	-	0	1	2	1	few
98-V0058	100	-	-	0	3	1	sandy	none
97-V1153	100	-	8	0	2	1	<2	
96-V0349	100	2	0	0	5	1	gleyed	none
98-V1341	35	-	-	8	2	0	>2	none
96-V0527	100	12	0	0	5	1	gleyed	none
96-V0468	100	-	-	-	2	1	1	6
97-V0212	100	12	0	0	4	3	gleyed	none
98-R5148	100	-	-	-	1	1	2	8
97-R5517	88			moist	2	3	1	6

Data Point 1 project	# Hydric Soil Indicators	Vegetation Criteria Met?	Hydrologic Indicators Met?	Soil Criteria Met?	Wetland?
97-R5077	0	n	n	n	n
96-V0590	6	y	y	y	y
96-V0034	4	y	y	y	y
97-V0001	2	y	y	y	y
98-R5605	3	y	y	y	y
98-V0532	2	y	y	y	y
97-V0560	3	y	y	y	y
98-V0058	0	y	y	y	y
97-V1153	2	y	y	y	y
96-V0349	7	y	y	y	y
98-V1341	0	n	y	n	n
96-V0527	3	y	y	y	y
96-V0468	2	y	y	y	y
97-V0212	8	y	y	y	y
98-R5148	1	y	y	y	y
97-R5517	2	y	y	y	y

Data Point 2 project	% vegetation FAC or wetter	Inches Water at Surface	Inches Water in Pit	Depth to Saturated Soil	# Primary Hydrological Indicators	# Secondary Hydrological Indicators	matrix
97-R5077	100	2-6	2.5	0	3	1	2
96-V0590	[redacted]						
96-V0034							
97-V0001	100	6	0	0	2	1	<2
98-R5605	64	-	-	6	1	0	6
98-V0532	0	-	-	16	1	1	gleyed
97-V0560	60	6-8		6	3	1	1
98-V0058	-	-	-	-	-	-	-
97-V1153	100	-	6	0	2	1	gleyed
96-V0349	[redacted]						
98-V1341	63	-	10	0	3	0	gleyed
96-V0527	[redacted]						
96-V0468	-	-	-	-	-	-	-
97-V0212	-	-	-	-	-	-	-
98-R5148	100	2	0	0	3	2	gleyed
97-R5517	[redacted]						

Data Point 2 project	Mottles Present	# Hydric Soil Indicators	Vegetation Criteria Met?	Hydrologic Indicators Met?	Soil Criteria Met?	Wetland?
97-R5077	8	3	Y	y	y	y
96-V0590	[redacted]					
96-V0034						
97-V0001		3	y	y	y	y
98-R5605	none	0	y	y	n	n
98-V0532	none	2	n	n	n	n
97-V0560	4	3	y	y	y	y
98-V0058	-	-	-	-	-	-
97-V1153	6	2	y	y	y	y
96-V0349	[redacted]					
98-V1341	6	2	y	y	y	y
96-V0527	[redacted]					
96-V0468	-	-	-	-	-	-
97-V0212	-	-	-	-	-	-
98-R5148		3	y	y	y	y
97-R5517	[redacted]					

Data Point 3 project	%-vegetation FAC or wetter	Inches Water at Surface	Inches Water in Pit	Depth to Saturated Soil	# Primary Hydrological Indicators	# Secondary Hydrological Indicators	matrix
97-R5077	[redacted]						
96-V0590	[redacted]						
96-V0034	[redacted]						
97-V0001	[redacted]						
98-R5605	78	-	-	10	1	0	6
98-V0532	100		6	2	3	1	gleyed
97-V0560	64			moist	1	3	1
98-V0058	[redacted]						
97-V1153	[redacted]						
96-V0349	[redacted]						
98-V1341	63	-	4	0	4	1	gleyed
96-V0527	[redacted]						
96-V0468	[redacted]						
97-V0212	[redacted]						
98-R5148	100	2	0	0	2	1	gleyed
97-R5517	[redacted]						

Data Point 3 project	Mottles Present	# Hydric Soil Indicators	Vegetation Criteria Met?	Hydrologic Indicators Met?	Soil Criteria Met?	Wetland?
97-R5077	[redacted]					
96-V0590	[redacted]					
96-V0034	[redacted]					
97-V0001	[redacted]					
98-R5605	none	0	y	y	n	n
98-V0532	8	4	y	y	y	y
97-V0560		3	y	y	y	y
98-V0058	[redacted]					
97-V1153	[redacted]					
96-V0349	[redacted]					
98-V1341		2	y	y	y	y
96-V0527	[redacted]					
96-V0468	[redacted]					
97-V0212	[redacted]					
98-R5148		3	y	y	y	y
97-R5517	[redacted]					

Data Point 4 project	%-vegetation FAC or wetter	Inches Water at Surface	Inches Water in Pit	Depth to Saturated Soil	# Primary Hydrological Indicators	# Secondary Hydrological Indicators	matrix
97-R5077	[redacted]						
96-V0590	[redacted]						
96-V0034	[redacted]						
97-V0001	[redacted]						
98-R5605	71	-	-	6-10	2	0	
98-V0532	[redacted]						
97-V0560	[redacted]						
98-V0058	[redacted]						
97-V1153	[redacted]						
96-V0349	[redacted]						
98-V1341	[redacted]						
96-V0527	[redacted]						
96-V0468	[redacted]						
97-V0212	[redacted]						
98-R5148	[redacted]						
97-R5517	[redacted]						

Data Point 4 project	Mottles Present	# Hydric Soil Indicators	Vegetation Criteria Met?	Hydrologic Indicators Met?	Soil Criteria Met?	Wetland?
97-R5077	[redacted]					
96-V0590	[redacted]					
96-V0034	[redacted]					
97-V0001	[redacted]					
98-R5605			y	y	n	n
98-V0532	[redacted]					
97-V0560	[redacted]					
98-V0058	[redacted]					
97-V1153	[redacted]					
96-V0349	[redacted]					
98-V1341	[redacted]					
96-V0527	[redacted]					
96-V0468	[redacted]					
97-V0212	[redacted]					
98-R5148	[redacted]					
97-R5517	[redacted]					

Table 7
Vegetative Species Found on Mitigation Sites

Species	Classification	Species	Classification
Equisetum spp.	FACW	Acer rubrun	FAC
Spartina alterniflora	OBL	Pinus taeda	FAC-
Baccharis halmifolia	FACW	Quercus phellos	FAC+
Juncis effusus	FACW+	Myrica cerifera	FAC
Spartina patens	FACW	Prunus serotina	FAC-
Uniola paniculata	FACU-	Rhus radicans	FAC
Spartina alterniflora	OBL	Juniperus virginiana	FACU-
Juncus roemerianus	OBL	Quercus nigra	FAC
Juncus effusus	FACW+	Mitchella repens	FACU
Iva frutescens	FACW+	Campsis radicans	FAC
Phragmites australis	FACW	Nyssa sylvatica	FAC
Spartina cynosuroides	OBL	Chasmanthium laxum	FAC
Spartina alterniflora	OBL	Clethra alnifolia	FAC+
Woodwardia areolata	FACW+	Quercus rubra	FACU-
Salicornia virginica	OBL	Diospyros virginiana	FAC-
Acer rubrum	FAC	Taxodium distichum	OBL
Liquidambar styraciflua	FAC	Salix nigra	OBL
Quercus michauxii	FACW	Typha lattifolia	OBL
Caroinus caroliniana	FAC	Alnus serrulata	OBL
Vaccinium corymbosum	FAC -	Scirpus cyperinus	FACW+
Boehmeria cylindrica	FACW+	Cephalanthis occidentalis	OBL
Quercus phellos	FAC+	Fraxinus pennsylvanica	FACW
Smilax rotundifolia	FAC	Betula nigra	FACW
Campsis radicans	FAC	Hibiscus palustris	OBL
Leersia oryzoides	OBL	Ilex verticilata	FACW+
Viburnum nudum	FACW+	Sambucus canadensis	FACW-
Spartina alterniflora	OBL	Magnolia virginiana	FACW+
Spartina patens	FACW	Itea virginica	OBL
Spartina alterniflora	OBL	Acer rubrum	FAC
Scirpus cyperinus	FACW+	Myrica cerifera	FAC
Juncus effusus	FACW+	Elymus riparius	FACW-
Typha latifolia	OBL	Agrostis stolonifera	FACW
Cyperinus strigosus	FACW+	Panicum vigatum	FAC
Rhus copallina	FACU-	Cuscuta	FAC
Liquidambar styraciflua	FAC	Salix nigra	OBL
Bidens frondosa	FACW	Platanus occidentalis	FACW-
Iva frutescens	FACW+	Scirpus cyperinus	OBL
Bachharis halmifolia	FACW	Typha latifolia	OBL
Smilax rotundifolia	FAC	Eupatorium serotinum	FACU

Table 7, continued…

Species	Classification	Species	Classification
Cyperus strigosus	FACW	Rhus copallina	FACU-
Microstigium vimineum	FAC	Nuphar	OBL
Sambuca canadensis	FACW-	Typha latifolia	OBL
Mikania scandens	FACW+	Peltandra virginica	OBL
Typha latifolia	OBL	Alnus serrulata	OBL
Phytolacca americana	FACU+	Pontederia cordata	OBL
Salix nigra	FACW+	Cephalanthus occidentalis	OBL
Liquidambar styraciflua	FAC	Clethra alnifolia	FAC+
Pinus taeda	FAC-	Typha latifolia	OBL
Rhus radicans	FAC	Osmunda cinamomea	FACW
Campsis radicams	FAC	Junsuc effusus	FACW+
Smilax rotundifolia	FAC	Liriodendron tulipifera	FACU
Lonicera japonica	FAC-	Pinus taeda	FAC-
Vitis rotundifolia	FAC-	Viburnum nudum	FACW+
Myrica cerifera	FAC	Mikania scandens	FACW+
Cassia fasiculata	FACU	Liquidambar styraciflua	FAC
Dicanthelium clandestinum	FAC+	Osmunda regalis	OBL
Agalinus purpurea	FACW-	Woodwardia areolata	FACW+
* Ulmus americana	FACW-	Myrica cerifera	FAC
Scirpus cyperinus	FACW+	Salix nigra	FACW+
Acer rubrum	FAC	Scirpus cyperinus	FACW+
Rhus copallina	FACU-	Cyperus strigosus	FACW
Juncus effusus	FACW+	Vaccinium corymbosum	FACW
Arundinaria	FACW-	Eupitorium capillifolium	FACU
Nyssa sylvatica	FAC	Spartina alterniflora	OBL
Vaccinium corymbosum	FACW-	Spartina patens	FACW
Quercus alba	FACU	Iva frutescens	FACW+
Clethra alnifolia	FAC+	Bachharis halmifolia	FACW
Quercus nigra	FAC	Spartina alterniflora	OBL
Mitchella repens	FACU	Acer rubrum	FAC
Liquidambar styraciflua	FAC	Salix nigra	OBL
Nyssa sylvatica	FAC	Taxodium distichum	OBL
Quercus phellos	FAC+	Chamaecyparis thyoides	OBL
Persea borbonia	FACW	Eupatorium capilifolium	FACU
Vaccinium corymbosum	FACW-	Triadenum virginicum	OBL
Acer rubrum	FAC	Polygonum pensylvanicum	FACW
Pinus taeda	FAC-	Ambrosia artemisiifolia	FACU
Carex lurida	OBL	Juncus effusus	FACW+
Saururus cernus	OBL	Scirpus cyperinus	FACW+

Appendix C

Sample Site Data Collection Form

Mitigation Compliance Site Inspection Data Sheet

Permit number: ______________________________
PM: ______________________________
Permitee: ______________________________
Location: ______________________________
City/County: ______________________________
Quad: ______________________________
Investigator's Name: ______________________________
Inspection Date: ______________________________

I. Impacted Area (as taken from project file and GIS)

Waterway: ______________________________
HUC code: ______________________________
Acreage impacted: ______________________________
Wetland type (Cowardin): ______________________________
Dominant species: ______________________________
Soils: ______________________________

II. Compensation Area (from record)

Site location: ______________________________
____
____

City/County: ______________________________
Lat/Long: ______________________________
Date of grading: ______________________________
Date of planting: ______________________________
Onsite/offsite? ______________________________
HUC code: ______________________________
Compliance checks by PM? ______________________________
____
____

Acreage attempted: ______________________________
Mid-course corrections necessary? ______________________________
____
____

Required/received well data? ______________________________
Well Results: ______________________________
Site planted/seeded/naturally regenerated? ______________________________
If planted or seeded, species and rates: ______________________________

Undesirable species being treated? ________________________________
Mapped soil series: ____
Was soil added/removed/manipulated (disked, raked, mulched…)?
____

III. Permit Requirements (from final permit letter)

Date permit issued: ________________________________
Reference wetland used? ________________________________
Monitoring Required? ________________________________
If so, requirements are: ________________________________
If so, reports submitted and dates: ____________________________
____
Other mitigation requirements stated in permit: ____________________
____
____
____
____
____
Description of mitigation site in permit (incl. acreage and Cowardin):
____
____
Description of mitigation site in file: __________________________
____
____
Mitigation goals stated? ________________________________
____
Goals specific, measurable, attainable? _________________________
III. On-site or off-site?
____
Was there a contingency plan? ______________________________

IV. Compensation Area (from site visit)

<u>Site sketch:</u>

Acreage achieved: ________________________________
Land use: ____
Level of disturbance: ______________________________

Hydrology

Source of hydrology? ______________________________

Description of water control structures: ______________________________

Description and number on monitoring wells: ______________________________

____

Site inundated/saturated? Depth to standing water? ______________________________

Field indicators of hydrology: Morphological adaptations/watermarks/drift lies/sediment deposits/drainage patterns/water-stained leaves/oxidized root channels/other

____

% open water: ______________________________

Vegetation

Percent survival: ______________________________

% vegetated: ______________________________

% un-vegetated: ______________________________

Vigor: ______________________________

Assessment:

* 10X10 foot plots – at least 2/acre – enough to characterize each different community (See vegetation data sheet)

Undesirable species and percent area affected? ______________________________

Homogeny of site? ______________________________

Soils

Are soils stabilized? ______________________________

Are the soils compacted? ______________________________

Confirm soil series? ______________________________

* See data sheets for soil profiles*

Wildlife Use

Describe species and evidence seen: ______________________________

____

V. Findings

Does site successfully meet all three wetland criteria (percentage)?

____

____

Does site successfully meet mitigation permit requirements (percentage)?

____

____

If not, is there potential to ever meet those requirements?

____

____

Is site self-sustaining?

____

____

Describe wetland functions at site:

____

Describe goals and functions not met at site:

Investigator Signature Date

Appendix D

Representative Site Photographs

Figure 7
97-V0560 Beamon Farm - Emergent

Figure 8
97-V0560 Beamon Farm - Forested

Figure 9
96-V0349 Bennett Creek

Figure 10
97-R5302 Burroughs Site

Figure 11
97-V0001 Colonial Downs

Figure 12
97-V1152 Ford's Colony

Figure 13
98-R5605 Fort Lee

Figure 14
96-V0034 Kingsmill

Figure 15
98-R5148 Lowe's site

Figure 16
98-V0058 Monkey Bottom

Figure 17
97-R5517 New Life Church

Figure 18
96-V0527 Olmstead Site

Figure 19
98-V1341 Pocohontas Village
Wetland Creation Area

Figure 20
98-V1341 Pocohontas Village
Restoration Area

Figure 21
98-V0532 Pretty Lake

Figure 22
97-V0212 Smithfield Foods

Figure 23
97-R5077 Suffolk Industrial Park
Stormwater Basin 2

Figure 24
97-R5077 Suffolk Industrial Park
Stormwater Basin 4

Figure 25
96-R5375 Warhill Tract

Vita

Kimberly Anne Baggett was born on January 23, 1976 in Bethpage, New York, and is an American citizen. She graduated from Poquoson High School, Poquoson, Virginia in 1994. She received her Bachelor of Science in Biology from Virginia Polytechnic Institute and State University, Blacksburg, VA in 1998. She received her Master of Science in Environmental Studies and Planning from Virginia Commonwealth University, Richmond, Virginia in 2003. She is currently employed with the United Sates Army Corps of Engineers, Norfolk District Office, Norfolk, Virginia as a Project Manager with the Regulatory Branch.