In-Lieu Fee Programs under Section 404 of the Clean Water Act for Coal Mining: Analysis of Restoration Costs and Alternatives

John Bonham
Kurt Stephenson

Virginia's
Rural Economic Analysis Program
Department of Agricultural and Applied Economics
College of Agriculture and Life Sciences
Virginia Tech
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John Bonham was Graduate Research Assistant
Kurt Stephenson is Associate Professor
Department of Agricultural and Applied Economics,
Virginia Tech

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INTRODUCTION

In 2003, coal production in Eastern Kentucky, West Virginia, and Virginia totaled nearly 280 million tons, or about one quarter of total U.S. coal production (U.S Dept of Energy 2003). In many counties in the southern Appalachian region, coal mining comprises more than 25 percent of the value of all economic output (University of Kentucky Center for Business and Economic Research, 2001).

A number of different mining processes are used to extract coal in the region. Surface coal mining operations require the excavations or cuts in the surface material to expose and extract coal. During this process, excess rock and soil (overburden) must be relocated. To a lesser extent, deep mining operations also face challenges of depositing excavated material. While this material may be replaced after the coal has been extracted, some excess material might still need to be deposited elsewhere. Sometimes the excess overburden might be deposited in valleys (called valley or hollow fills). In the process ephemeral, intermittent, or perennial streams might be filled or otherwise negatively impacted.[1]

Section 404 of the Clean Water Act (Section 404) requires that permits be obtained by parties discharging dredge or fill materials into waterways. Under Section 404, the U.S. Army Corps of Engineers (Corps) administers Nationwide Permit 21 (NWP21) that governs the discharge of fill material into streams from surface mining activities. The Corps developed NWP21 in part to extend the Section 404 permitting program to address the placement of fill from surface mining activities in ephemeral and intermittent streams. As part of the permitting program, permit recipients (called permittees) are required to perform compensatory mitigation to offset ecological services lost due to such fill activities. Compensatory mitigation occurs via activities designed to restore ecological services in stream channels either on the site of the disturbance itself or at an off-site location. The regulatory objective of Section 404 programs is to ensure that improvements in aquatic resources from compensatory mitigation offset the degradation in aquatic resources from the impacted areas.

Compensatory mitigation can generally be provided by the permittee, commercial mitigation banks, and in-lieu fee programs. Most mitigation performed by permittees occurs on or near the permitted mining site. Where permittees do not have a capacity or desire to perform such mitigation activities on-site, they may meet their compensatory mitigation obligations by buying mitigation credits from a mitigation bank or contributing fees to an in-lieu fee program.

Several of the Corps districts have, or are developing, in-lieu fee programs to secure off-site compensatory mitigation under NWP21 (U.S. Army Corps of Engineers, Louisville District, 2002; U.S. Army Corps of Engineers, Pittsburgh and Huntington District, 2004; U.S. Army Corps of Engineers, Norfolk, 2003). In these programs, permittees make payments to an approved mitigation sponsor in-lieu of implementing their own mitigation on-site. The sponsor, typically a government agency or a nonprofit organization, takes on the permittee's mitigation responsibility and then uses the collected fees to identify, construct, and maintain compensatory mitigation projects. In principle, in-lieu fee programs set the per unit fees for stream mitigation by estimating their cost of stream restoration and enhancement projects. This fee, typically expressed as dollars per linear foot, is then multiplied by the amount of stream mitigation (feet of stream) that a permittee is required to restore or enhance.

[1] Water flows in an ephemeral stream only after rain events. Ephemeral streams are located above the water table. Intermittent streams have continuous flow only during certain times of the year. Intermittent streams are fed by both rain runoff and seasonal groundwater discharge. Perennial streams flow continuously throughout the year.

Mining companies, in complying with these requirements, have a financial interest in assuring that their compensatory mitigation requirements are met at the lowest possible cost while also meeting their regulatory obligations to provide ecologically meaningful and successful mitigation. The objective of this research is to evaluate the cost implications to permittees of securing off-site compensatory mitigation through in-lieu fee programs.

Specifically, this research aims

1. to estimate the cost of stream restoration projects that could be used as compensatory mitigation and the setting of fees under an in-lieu fee program and
2. to evaluate how in-lieu program design may increase or decrease the total amount of permittee fees required to assure adequate mitigation.

The outline of the report is as follows. "Overview of in-lieu programs" describes how compensatory mitigation is secured under in-lieu fee programs. "Compensatory stream mitigation costs: a conceptual overview" provides a conceptual overview of the factors that influence the total cost of providing compensatory mitigation for stream impacts. The factors that influence total mitigation costs include the nature of the stream impact, the cost of physically providing the mitigation project (planning, construction, and post-construction activities), the risk that the project will fail ecologically, and regulatory approval costs. In "Stream mitigation costs," estimates of the costs to plan, construct, and monitor 14 completed stream mitigation projects in the rural southern Appalachian region are presented. "Compensatory mitigation costs under an in-lieu fee program" provides an analysis of how the design of in-lieu fee programs can influence the total mitigation costs paid by the permittee. "Alternatives" explores alternative mitigation program designs that have some potential to lower the overall cost of meeting NWP 21 compensatory mitigation requirements.

OVERVIEW OF IN-LIEU FEE PROGRAMS

Under Section 404, the Corps issues permits to parties wishing to discharge fill material into waters of the United States. To secure a permit, the permittee must first take all appropriate and practical steps to first avoid and then minimize all adverse impacts associated with the discharge (called sequencing: avoid then minimize adverse impacts). For unavoidable impacts, the losses in aquatic functions must then be replaced (called no-net-loss in the wetland program). Replacement of the loss in aquatic resources could occur by either on-site or off-site compensatory mitigation projects. Regulatory guidance states a preference for mitigation completed on or adjacent to the site of the fill activity (on-site mitigation) (U.S. Army Corps of Engineers 2002). Yet, regulatory agencies may allow off-site mitigation when there are limited opportunities for constructing successful on-site projects or when off-site mitigation is environmentally preferable to on-site mitigation (U.S. Army Corps of Engineers 2000). In addition, regulatory guidance also states a preference for in-kind mitigation but would allow out-of-kind mitigation if better environmental results can be achieved than through in-kind mitigation (U.S. Army Corps of Engineers 2004).

Most off-site mitigation occurs when the permittee pays another party to assume the responsibility for meeting the compensatory mitigation requirement. Such off-site mitigation can occur through commercial mitigation banks or an in-lieu fee program. According to the Corps' in-lieu fee guidance, in-lieu fee mitigation "occurs in circumstances where a permittee provides funds to an in-lieu fee sponsor instead of either completing project specific mitigation or purchasing credits from a mitigation bank approved under the Banking Guidance." (U.S. Army Corps of Engineers 2000, p. 66914). In essence, the in-lieu fee program is any provider of compensatory mitigation that has *not* been developed and approved in accordance with the Corps' mitigation banking guidance (Scodari and Shabman 2000).

Commercial mitigation banks are approved under the Corps' mitigation banking guidance. Under commercial mitigation banking, private entrepreneurs restore or enhance aquatic resources to produce mitigation credits. Credits are a measure of the amount of restoration or enhancement (ecological lift) that has taken place, and these credits can, in turn, be made available for sale to permittees seeking to fulfill their regulatory requirements. The banking guidance states that all proposed mitigation banks must be approved by a Mitigation Banking Review Team (MBRT). The MBRT, which includes the Corps, EPA, and relevant state agencies, requires a potential commercial credit seller to meet a variety of requirements and project milestones. To gain approval, implementation of any proposed mitigation project must be either complete, under construction, or in the advanced planning stages (plans developed in sufficient detail to enable the MRBT to assess the amount and type of credits that will be created at the bank site). Once the MBRT approves a commercial mitigation bank, the entrepreneur must then gain regulatory approval to sell the credits to permittees. Thus, significant progress toward constructing a compensatory mitigation project must be made before permittees are allowed to begin fill activities by purchasing credits (Scodari and Shabman 2000).

While each in-lieu fee program is different, in-lieu fee programs generally differ from commercial banks in the timing between fill activity, receipt of fees, and compensatory mitigation. In-lieu fees are paid (and fill occurs) before any compensatory mitigation project has been defined. Unlike commercial credit bankers, in-lieu fee programs can accumulate fees until sufficient funds have been accumulated to begin detailed planning and construction of compensatory projects (Scodari and Shabman 2000). In addition, in-lieu fee programs do not face the same regulatory approval costs as commercial bankers. While an in-lieu fee sponsor must have compensatory mitigation projects approved by a similar process as the MRBT, commercial bankers must also gain regulatory approval to then sell the credits to respective buyers (permittees). In-lieu fee programs do not require approval to sell the credits since the transaction (payment of fees) occurs before the creation of the offsetting mitigation. Finally, in-lieu fee sponsors are generally not private entrepreneurs but rather a governmental agency or a nonprofit organization (U.S. Army Corps of Engineers 2000).

Under NWP21 in the Appalachian coal mining region, in-lieu fees are emerging as the primary way permittees can secure off-site compensatory mitigation. The Corps Louisville District has recently instituted an in-lieu fee program covering eastern portions of Kentucky (Sparks et al 2003; U.S. Corps of Engineers, Louisville District 2002, 2003). In-lieu fee programs have also been proposed for West Virginia (U.S. Corps of Engineers, Pittsburgh and Huntington District 2004). Virginia's existing wetland in-lieu fee program has been expanded to cover stream impacts (U.S. Corps of Engineers, Norfolk District 2003).

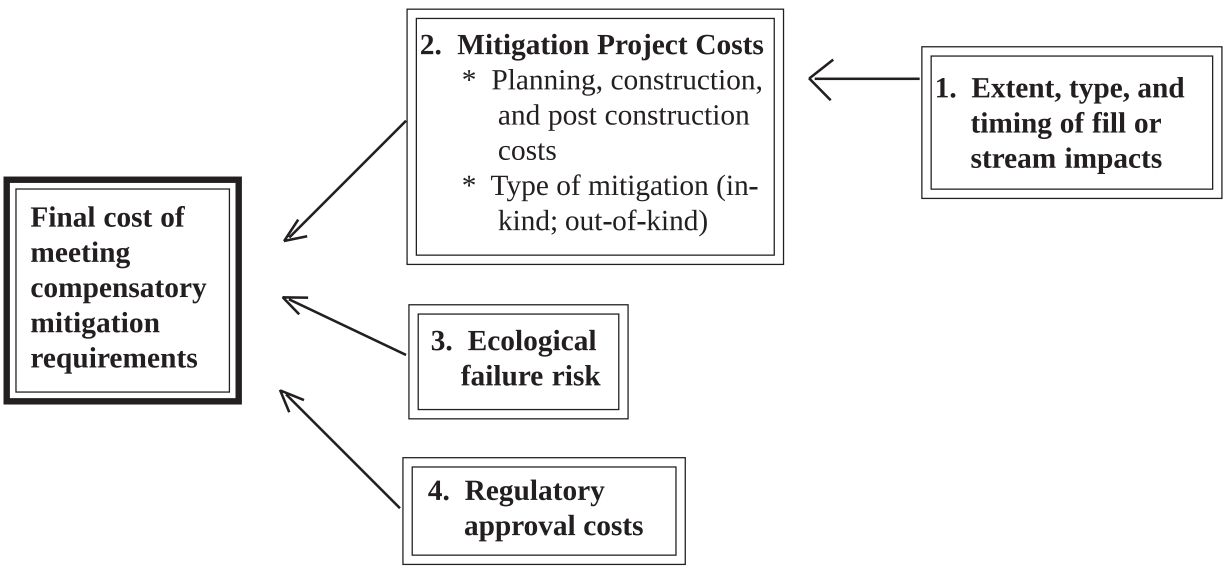
Each of these programs reflects the general in-lieu fee program structure defined above. Fill occurs in advance of the identification and construction compensatory mitigation projects. In Kentucky, in-lieu fees are paid to the Kentucky Department of Fish and Wildlife Resources, the in-lieu fee sponsor, that is then primarily responsible for identifying and implementing compensatory mitigation projects. The current fee under the Kentucky program is $100 per linear foot of stream fill. In West Virginia, the West Virginia Department of Environmental Protection is the proposed in-lieu fee sponsor. Once sufficient fees have been collected, the sponsor identifies possible mitigation projects and develops implementation plans. The plans are approved by a mitigation review team before the in-lieu fee program sponsor begins construction of compensatory mitigation projects.

The in-lieu fee programs such as those being established under NWP21 are a distinct way to secure off-site compensatory mitigation. The way in-lieu fee programs are designed will, in turn, influence the cost to the permittees of securing compensatory mitigation. A unique challenge of an in-lieu fee program is estimating the future cost of constructing compensatory mitigation projects. Since fees are accepted prior to constructing any compensatory mitigation projects, the sponsor has no direct evidence about the cost of constructing successful mitigation projects.

COMPENSATORY STREAM MITIGATION COSTS: A CONCEPTUAL OVERVIEW

In complying with NWP21 requirements, the mining industry has a financial interest in assuring that their compensatory mitigation requirements are met at the lowest possible cost, while also meeting their regulatory obligations to provide ecologically meaningful and successful mitigation. The final cost of meeting compensatory regulatory requirements is dependent on four general factors: Stream impacts, mitigation project costs, ecological failure risk, and regulatory approval costs (Figure 1). Each cost factor could influence the final cost of providing off-site compensatory mitigation independently of the other three.

Figure 1. Factors that influence final compensatory mitigation costs



Extent and Type of Stream Impacts

An obvious challenge to achieving the regulatory objectives of NWP21 is to estimate the loss of aquatic function from the fill activity and the corresponding gain in aquatic function from the mitigation project. Numerous measurement and assessment protocols could be (and are) used to measure the loss and gains in aquatic function.

The relative merits of different ecological function assessment protocols are beyond the scope of this report, but the amount of compensatory mitigation required of the permittee should be sensitive to quantity and quality of the stream impacts. Assessments of the stream length impacted and the initial ecological quality of the stream will both be critical factors in determining how much compensatory mitigation will be required (Figure 1, Box 1). Other factors held constant, 1,000 feet of intermittent stream fill will require twice as much compensatory mitigation as 500 feet of intermittent stream fill. The quality of the stream filled should also influence the amount of compensatory mitigation. Mining related impacts on a highly productive, pristine stream should require more compensatory mitigation than impacts to a stream that has been previously degraded.

The timing of the adverse stream impacts relative to the compensatory mitigation also influences the amount of compensatory mitigation needed. In concept, when an impact occurs, aquatic resources are lost or degraded for a number of years (perhaps forever). Compensatory mitigation projects aim to increase aquatic functions over a number of years (perhaps a perpetual increase). The regulatory objective of completely offsetting permitted impacts requires that the *sum* of the lost annual aquatic resources be offset by the *sum* of the annual gain in aquatic functions from the compensatory mitigation project (properly weighted or discounted by a time preference). If the fill activity occurs before a compensatory mitigation project is fully operational, the amount of mitigation needed to offset the fill could be increased to reflect the temporary (temporal) loss in aquatic functioning. In essence, the temporary loss in aquatic function might also be compensated. The opposite is also true. In concept, compensatory mitigation could be provided in anticipation of a fill activity. In this case, the compensatory mitigation is providing a temporary net gain in aquatic services, and the total amount of compensatory mitigation needed to offset the same fill is reduced because compensatory mitigation is provided in advance of the fill.

Mitigation Project Costs

An obvious component of the cost of compensatory mitigation is the cost associated with actual construction of the mitigation project (Figure 1, Box 2). Costs would include financial outlays and other opportunity costs of implementing a compensatory mitigation project. In general, four general types activities must be performed for a compensatory mitigation project: 1) preconstruction planning and design, 2) site acquisition, 3) construction, and 4) post construction. Preconstruction costs include the expenses incurred identifying the project site, making a preliminary project assessment, designing the project, and the management and administration of each of those activities. Mitigation guidelines suggest that long-term protection be provided for mitigation project sites. Site acquisition costs refer to the legal protection of the project site, which can be done by, but is not limited to, fee simple purchase or conservation easements. Acquisition costs include title searches and surveys as well as the direct cost of securing the property or easements. Construction costs include labor, materials, capital equipment, and management costs of physically constructing the mitigation project. Post construction expenses include activities that verify and ensure that the mitigation is achieving ecological success criteria identified by regulators. Post construction activities would include monitoring the project site, performing remedial action needed to achieve performance objectives, and long-term maintenance of the site. Costs should also include overhead and management costs of performing and overseeing these activities.

The specific types of activities that must be performed (and thus the costs of performing them) could vary with the type of compensatory mitigation project undertaken. Conceptually, stream mitigation can be either in-kind or out-of-kind. In-kind stream mitigation aims to strongly link compensatory mitigation to the type of stream fill or impact. Under NWP21, in-kind projects are generally meant to be stream restoration and enhancement activities aimed at improving aquatic habitat. Restoration is defined as the return of a stream to its natural pattern, profile, and dimension along with creating aquatic habitat and establishing riparian vegetation and floodplain function (In-lieu Fee Guidelines from Kentucky and West Virginia). For example, restoring physical stream habitat (structures such as stream bends, meanders, pool, and rapids) in a modified stream would classify as in-kind restoration (Rosgen 1994). Stream enhancement is defined as the establishment of riparian vegetation, the stabilization of eroding stream banks, and the creation of aquatic habitat in-stream (In-lieu Fee Guidelines from Kentucky and West Virginia). Most restoration projects also involve some stream enhancement activities.

Natural resource managers in Virginia, coal industry representatives, and nonprofit conservationists have expressed a desire to allow abandoned mine land reclamation as a form of compensatory mitigation. Rather than directly modifying stream habitat such out-of-kind projects may improve water quality and hence aquatic resources by reducing sediment or pollutant discharges from upland areas. These projects are called out-of-kind mitigation because the projects do not directly attempt to alter the physical characteristics of the stream channel or habitat. The types of activities undertaken in an out-of-kind project will differ significantly from in-kind projects, thus influencing the final costs of providing compensatory mitigation.

Allowing out-of-kind mitigation is also consistent with the broader goals of watershed enhancement, sometimes called a watershed approach to mitigation. A watershed approach is often advocated as a way to assess the current stressors and impairments to achieving key aquatic functions and resource objectives within a watershed (National Research Council 2001). Conceptually, compensatory mitigation could be targeted within the watershed to locations and projects that would produce the greatest improvement toward achieving those watershed objectives. By this definition, such an approach requires thinking about a portfolio of potential restoration activities that might extend beyond the immediate vicinity of the fill activity (on-site) or involve more diverse set of projects than restoring physical in-stream habitat (in-kind).

Ecological Risk

Every compensatory mitigation project has a positive probability that the project will fail to sufficiently replace the aquatic resource lost due to a fill activity (Shabman, Scodari, and King 1994). For the purposes of this report, this possibility is called ecological risk. The positive probability that a mitigation project will fail to deliver adequate mitigation represents a real cost of compensatory mitigation programs (Figure 1, Box 3).

At least three different types of ecological risk can be identified: project failure risk, temporal risk, and accounting risk. Project failure risk occurs when a specific mitigation project fails to achieve the ecological success criteria identified by regulators. Project failure risk could occur because of inadequate project design, poor project siting, exceedingly narrow success criteria, or unexpected obstacles or natural events. A second type of risk, temporal risk, is the unexpected delays in providing adequate compensatory mitigation. As the time period between an impact and compensation increases, the temporary loss of aquatic resources also increases. Conceptually, the public must be compensated for these temporary losses, but the specific amount of time between fill and compensatory mitigation may not be known with certainty. Unexpected delays in the planning process or post construction remedial measures may increase the time to successfully complete compensatory mitigation projects, creating temporal risk. The final type of ecological risk could be called accounting risk. Accounting risk occurs when there is a chance that ecological assessment protocols will not adequately identify all the ecological services lost to the fill activity. The perception often is that ecological accounting risk increases with the uncertainty about the adequacy of ecological assessment protocols. For instance, ecological accounting risk might be higher for out-of-kind mitigation because of the difficulty of identifying and comparing changes in ecological function from a stream fill and an upland compensatory mitigation project designed to improve water quality. Conceptually, accounting risk could exist even if mitigation failure risk and temporal risk are zero.

Regulatory rules make permittees ultimately responsible for the cost liability of these ecological risks. Options to ensure against many of these risks include the use of mitigation ratios, financial liability requirements (e.g. performance bonds, letters of credit, insurance), and advance mitigation requirements. Each risk management option would have different cost implications for the permittee. A mitigation ratio identifies the amount of compensatory mitigation that must be performed for every unit of impacted stream. To use a simple example, a 2:1 ratio would require that 1,000 feet of stream restoration be provided for 500 feet of stream impact. Mitigation ratios higher than 1:1 could be used to manage project failure, temporal, or accounting risk.[2] Financial assurances, like performance bonds or letters of credit, are other options that could be used to manage risks. Under this mitigation option, permittees must provide financial collateral to regulators for compensatory mitigation. If the mitigation is unsuccessful, financial resources are available to remediate the site or provide additional mitigation. These financial assurances also create a financial incentive to successfully complete a mitigation project. Another option to managing ecological risk would be to allow or encourage permittees to provide compensatory mitigation in advance of fill activity. If mitigation projects were constructed in advance of stream impacts, project failure and temporal risks would be virtually eliminated.

Regulatory Approval Costs

Regulatory approval costs are also an important factor influencing the cost of meeting compensatory mitigation requirements (Figure 1, Box 4). As part of the regulatory permitting process, permittees must gain regulatory approval to construct specific compensatory projects that will be sufficient to offset fill activities. Regulatory approval costs include legal fees and engineering design costs associated with negotiating performance criteria and securing approval from the various permitting agencies.

STREAM MITIGATION COSTS

Several Corps districts have, or are developing, in-lieu fee programs to secure off-site compensatory mitigation under NWP21. Even given this interest, few off-site compensatory mitigation projects have been constructed to offset stream impacts. Thus, little information is available by which in-lieu fee sponsors can establish an appropriate fee. This section of the report provides estimates of the costs of stream restoration and enhancement projects that could be used as compensatory mitigation under NWP21. The estimates of costs include only those costs incurred in the planning and construction of stream mitigation projects (Figure 1, Box 2).

Project Mitigation Costs

The costs of potential off-site compensatory mitigation projects are estimated by compiling the costs of on-going stream improvement projects in rural areas and in similar physiographic regions across Kentucky, North Carolina, and Virginia. Projects selected for cost estimation are projects currently used to satisfy compensatory requirements under NWP21 or could conceivably be considered as compensatory mitigation by regulatory authorities. Mitigation projects that are used as compensatory mitigation under NWP21 are considered ideal; however, because the regulatory requirements have only recently been increased, the number of such projects is limited. For each identified project, preconstruction planning and design, site acquisition, construction, and post construction costs are estimated.

Emphasis is given to identifying off-site, in-stream restoration and enhancement projects since in-lieu fee programs developed or proposed for NWP21 focus on in-kind compensation. The Kentucky in-lieu fee program limits use of fees to only in-kind stream restoration projects (U.S. Army Corps of Engineers, Louisville District 2003). The proposed in-lieu fee program covering NWP21 impacts in West Virginia contains language similar to the Kentucky program (U.S. Army Corps of Engineers, Pittsburgh and Huntington Districts 2004). The Norfolk District, however, has expressed a willingness to consider allowing out-of-

[2] All other factors equal, a 2:1 mitigation ratio for project failure risk implies that the probability that any one compensatory project will completely fail to deliver any functional improvements is 50 percent.

kind mitigation in a proposed in-lieu fee program in Virginia (U.S. Army Corps of Engineers, Norfolk District 2003b). Guidance has also been issued that explicitly allows a specific type of out-of-kind mitigation (U.S. Army Corps of Engineers 2004).

Fourteen completed or nearly completed projects were evaluated.[3] Nine of the projects are located in North Carolina, four in Virginia, and one in Kentucky (Table 1). Twelve of the projects are considered in-kind projects centered on stream restoration and enhancement. Two Virginia projects could be representative of out-of-kind mitigation since each involved the amelioration of acid mine drainage from abandoned mine land.

Table 1. Stream improvement projects

Project name	State	Project type	Length (ft)	Status
Bear Swamp	N. C.	In-kind	1,500	Monitoring
Lyle Creek	N. C.	In-kind	2,300	Monitoring
Suck Creek	N. C.	In-kind	3,000	Monitoring
County Line Creek	N. C.	In-kind	3,500	Monitoring
Brush Creek	N. C.	In-kind	3,590	Monitoring
Beaver Creek	N. C.	In-kind	4,300	Monitoring
Brown Branch	N. C.	In-kind	5,400	Monitoring
Jumping Run Creek	N. C.	In-kind	6,997	Monitoring
Stone Mountain	N. C.	In-kind	10,622	Monitoring
Balls Fork	Ky.	In-kind	750	Monitoring
Bear Creek	Va.	In-kind	3,500	Completed
Birchfield Creek	Va.	In-kind	15,840	Completed
Black Creek	Va.	Out-of-Kind	19,892	Completed
Ely & Puckett Creeks	Va.	Out-of-Kind	105,000	Monitoring

The nine North Carolina projects were undertaken through the state's Ecosystem Enhancement Program. This state-operated in-lieu fee program provides compensatory mitigation for impacts to streams across the state as required by the Corps' Wilmington District under Section 404. The program is sponsored and managed by the North Carolina Department of Environmental and Natural Resources. All projects are located in rural areas, six in the mountains, one in the foothills, and two in the piedmont regions of North Carolina. All nine projects are stream restoration projects involving channel modifications, bank stabilization, and riparian zone vegetation. All the projects are in the post construction monitoring phase.

The Virginia Department of Mines, Minerals and Energy provided cost data for four projects involving abandoned mine land. These projects were constructed under restoration programs outside the purview of Section 404. Two projects involved the abatement of acid mine drainage, and two projects involved the removal of sediment deposits from streams and other stream enhancement activities. The acid mine drainage projects are out-of-kind by regulatory standards because they did not involve in-stream improvements to habitat but were evaluated because they improve water quality. They are particularly relevant because similar sites are found in geographic areas where future mining impacts are likely to occur.

One completed project, Balls Fork, from the newly established in-lieu fee program in Kentucky was identified. The program is administered by the Corps' Louisville District and sponsored and managed by the Kentucky Department of Fish and Wildlife Resources. Six other projects from the Kentucky in-lieu fee program are in the planning phase (Table 2). Each of the projects involves in-stream restoration and/or enhancement and is currently being accepted as compensatory mitigation under NWP21.

[3] Stream restoration projects in Tennessee and Texas were identified but were not evaluated due to a lack of available cost information. Information on stream restoration projects undertaken by commercial mitigation banks were sought but information was unobtainable. Other projects were identified but not used because they did not meet the requirements of this study in terms of physiographic and rural geography or because cost data were unavailable.

Table 2. Planned projects in Kentucky

Project Name	Project Type	Length (ft)	Status
Bullskin Creek	In-Kind	1,823	Design
Wolf Run	In-Kind	1,060	Planning
Terrys Branch	In-Kind	3,200	Design
Flutylick Branch	In-Kind	1,530	Planning
East Fork Little Sandy	In-Kind	1,522	Design
Upper Laurel Creek	In-Kind	2,673	Design

The fourteen completed (or nearly completed) projects can be grouped according to the size and type of the project (Table 3). The fourteen projects evaluated exhibit significant differences in size. Many restoration projects were relatively small in scope, improving less than 3,000 feet of stream. On the other hand, the study also included several large-scale watershed restoration projects impacting tens of thousands of feet of stream. The projects were placed into three groups defined by size: less than 3,001 feet, 3,001 to 10,000 feet, and greater than 10,000 feet. Compensatory mitigation costs (per linear foot) may be affected by project size because each project contains fixed costs imbedded in each expense component for which economies of scale can be realized. Costs may also be affected by project type. Arguments are sometimes made that out-of-kind mitigation may offer greater potential to improve aquatic resources at a lower cost than strict in-kind mitigation. Unfortunately, projects could not be identified for every combination of project size and type due to the limited number of projects available.

Table 3. Projects grouped by size and type

Project Size (ft)	Type	
	In-kind	Out-of-kind
Small		
< 3,001	Bear Swamp	
	Lyle Creek	
	Suck Creek	
	Balls Fork	
Medium		
3,001 - 10,000	County Line Creek	
	Brush Creek	
	Beaver Creek	
	Brown Branch	
	Jumping Run Creek	
	Bear Creek	
Large		
> 10,000	Stone Mountain	Black Creek
	Birchfield Creek	Eli/Puckett Creeks

Data Collection Procedures

Costs for each project and each cost category were collected through a combination of methods including reviews of official records, interviews with program staff, and professional inferences. A complete list of data sources is provided in the reference section. Project costs were estimated in present value terms using a 5 percent discount rate. The present value of costs was estimated because most of these projects take a number of years to complete. Thus, the timing of cost outlays will vary from project to project. Further, all costs are reported in current dollars. If a project was undertaken before 2000, the costs were adjusted to 2002 dollars using the GDP implicit price deflator.

Construction costs were the best documented cost category. Most construction costs were collected from official records or reports from the respective programs. Preconstruction planning and design costs were not as well documented as construction costs. The North Carolina program provided figures for project design and site acquisition in the *Wetlands Restoration Program 2003 Annual Report*. Such detailed documentation, however, was not available for other projects, and costs were estimated using a variety of approaches including project records and estimates provided by project managers.

Estimates of site acquisition and protection costs could not be obtained for many projects. In many cases, land for these projects was not purchased, either because the land remained in control of the original owner or the land was on state-owned property. For land not purchased, the value the conservation easements was often unavailable. In several cases, program officials rely on donated conservation easements. Regardless of whether the site acquisition is paid for by the in-lieu fee sponsor or donated by a landowner, site acquisition costs are still being incurred because future use of the property is being restricted. Actual mitigation costs are underestimated to the extent that these costs could not be obtained or generated.

With the exception of most of the North Carolina projects, recorded estimates of post construction monitoring, remediation costs, and long-term site maintenance were unavailable. Estimates of post construction costs in Kentucky and some Virginia projects were obtained by interviews with project managers. In cases where individual post construction costs were unavailable, estimates were extrapolated based on North Carolina data. Average monitoring/maintenance and long-term management costs for North Carolina projects were found to equal 21 percent and 3 percent of construction costs, respectively.

One additional caveat is in order concerning the cost data estimated or reported for these projects. The accuracy or completeness of the cost accounting in each program could not be comprehensively verified. Even for the best documented program (North Carolina), the costs appear to be related to the direct costs of completing a mitigation project (planning, construction, post construction). Conceptually, the direct costs would include personnel time, capital charges, and materials of completing each stage of the mitigation process. It is doubtful that other types of cost related to program overhead have been attributed to these specific projects. Such costs might include general office expenses (rent and other general office expenses) and non-salary costs of state employees (e.g. fringe benefits). A complete cost accounting, however, would require that a portion of these costs be attributed to specific projects. To the extent that such costs are not incorporated into the cost of providing the mitigation, an in-lieu fee sponsor would be providing permittees with a state-supported subsidy. Given this caveat, the cost estimates that follow should be viewed as lower bound estimates of project costs.

Results

Combined, the fourteen projects improved 186,191 linear feet of stream at a present value cost of $11,022,674, an average of $59.20 per linear foot (Table 4). Although the average cost was $59.20 per linear foot, mitigation costs showed a significant amount of variation across projects. Cost per linear foot ranged for individual projects ranged from a low of $28 to a high of $129.

Table 4. Total project costs[1]

Project name	Project type	Total costs	Project length
		$	(ft)
Black Creek, Va.	Out-of-kind	827,751	19,892
Ely/Puckett Creeks, Va.	Out-of-kind	5,040,281	105,000
Birchfield Creek, Va.	In-kind	761,154	15,840
Bear Creek, Va.	In-kind	98,182	3,500
Jumping Run Creek, N.C.	In-kind	753,616	6,997
Stone Mountain, N.C.	In-kind	964,732	10,622
Brush Creek, N.C.	In-kind	405,099	3,590
County Line Creek, N.C.	In-kind	386,576	3,500
Lyle Creek, N.C.	In-kind	261,773	2,300
Brown Branch, N.C.	In-kind	457,284	5,400
Beaver Creek, N.C.	In-kind	429,847	4,300
Bear Swamp, N.C.	In-kind	193,878	1,500
Suck Creek, N.C.	In-kind	366,832	3,000
Balls Fork, Ky.	In-kind	75,669	750
Aggregate		11,022,674	186,191
Average unit costs		**59.20**	

1. Present Value – 5% discount rate

Average unit costs, broken out by cost category, are $37.40 for construction, $13.63 for preconstruction, $2.70 for site acquisition, and $5.47 for post construction (Table 5). Construction costs represent the largest share of total costs at 63 percent, followed by preconstruction at 23 percent. Site acquisition and post construction costs represent 5 percent and 9 percent of total costs, respectively (Table 5). These costs should be viewed as a lower bound estimate because of the challenges of estimating site acquisition and post construction costs described above.

Table 5. Unit costs[1] by expense category

	Preconstruction	Site acquisition	Construction	Post construction
Average unit costs $	13.63	2.70	37.40	5.47
Percent of total costs	23	5	63	9

1. Present value—5% discount rate

Preconstruction costs as a percentage of total project cost are fairly consistent across the fourteen projects. As a percentage of total costs, preconstruction expenses in North Carolina and Virginia were 24 percent and 23 percent, respectively. Preconstruction expenses for the Balls Fork project in Kentucky were only 8 percent of total costs. The Kentucky preconstruction costs are an underestimate since some design was conducted in-house and was not directly assigned a monetary cost (Sampson). Future projects in Kentucky, including those in the planning phase (Table 2), will be designed externally at an estimated cost of $25 per linear foot, an estimate based on North Carolina data (Sampson).

Site acquisition costs averaged $2.70 per linear foot. For projects with such data, site acquisition costs averaged $3.87 and represented 6 percent of total costs. Because three of the four sites in Virginia were not acquired, the cost of the projects are understated since permanent protection is typically a regulatory requirement under Section 404 programs. Similarly, Kentucky is relying on the donation of conservation easements to acquire sites. Full accounting for site acquisition has the potential to significantly increase the cost of compensatory mitigation in the coalfields.

Post construction activities cost an average of $5.47 per linear foot or 9 percent of total costs. However, many of the expenses were extrapolated from the nine projects in North Carolina. Whether these post construction costs would be reflective of post construction costs that would be incurred under a NWP21 is not known.

Costs vary by both project type (in-kind, out-of-kind) and size. Total unit costs appear to be related to the size of the project. Average total unit costs are $118.96 per linear foot for small projects, $92.74 for medium projects, and $65.22 for large projects (Table 6). The range of costs across project size and type is shown in Figure 2. It should be noted, however, that site acquisition costs were not estimated for any of the large projects. Site acquisition costs averaged 5 percent of total costs for small and medium projects. If this same percentage were applied to the large sites, average total costs of the large projects would have been $68.48 per linear foot. After adjusting for site acquisition, the large projects cost 42 percent less than small projects and 26 percent less than medium projects. Economies of scale are realized in all phases of the projects with most of the gain in efficiency achieved during post construction—post construction costs of the large projects are 66 percent lower than those of the small projects. Preconstruction and construction costs for large projects are 50 percent and 33 percent lower than those of small projects, respectively.

Table 6. In-kind project costs[1] by project size

	Preconstruction	Site acquisition	Construction	Post construction	Total costs
Small (< 3,001 ft.)					
Average unit costs $	26.14	5.65	68.35	18.81	118.96
Percent of total costs	22.0	5.0	57.0	16.0	100
Medium (3,001 - 10,000 ft.)					
Average unit costs $	21.25	4.21	57.28	10.01	92.74
Percent of total costs	23.0	5.0	62.0	11.0	100
Large (> 10,000 ft.)					
Average unit costs $	13.04	-	45.82	6.37	65.22
Percent of total costs	20.0	-	70.0	10.0	100
Aggregate					
Average unit costs $	18.31	2.57	53.70	9.52	84.09
Percent of total costs	22.0	3.0	64.0	11.0	100

1. Present value—5% discount rate

In-kind costs also varied considerably across programs. The nine North Carolina in-kind stream restoration/ enhancement projects improved 41,209 feet of stream at an average cost of $102 per linear foot. These cost estimates are considered the most reliable of all projects analyzed in this report because of the apparent comprehensive quality of the cost accounting in the North Carolina program. Also, these projects are constructed by a state-run in-lieu fee program that provides Section 404 compensatory mitigation in the Corps Wilmington District, thus reflecting the costs of providing the quality sufficient to count for mitigation under Section 404. These projects, however, were not constructed in the Appalachian coal mining regions. The two in-kind stream projects in Virginia averaged $44.43 per foot. These projects were constructed outside the Section 404 program, and it is unknown how regulatory oversight would have influenced the cost of the mitigation. The one project completed under the Kentucky in-lieu fee program (Balls Fork) cost about $100 per foot. This cost may not, however, be representative of in-kind restoration projects in this program because planned projects are being projected to cost more.

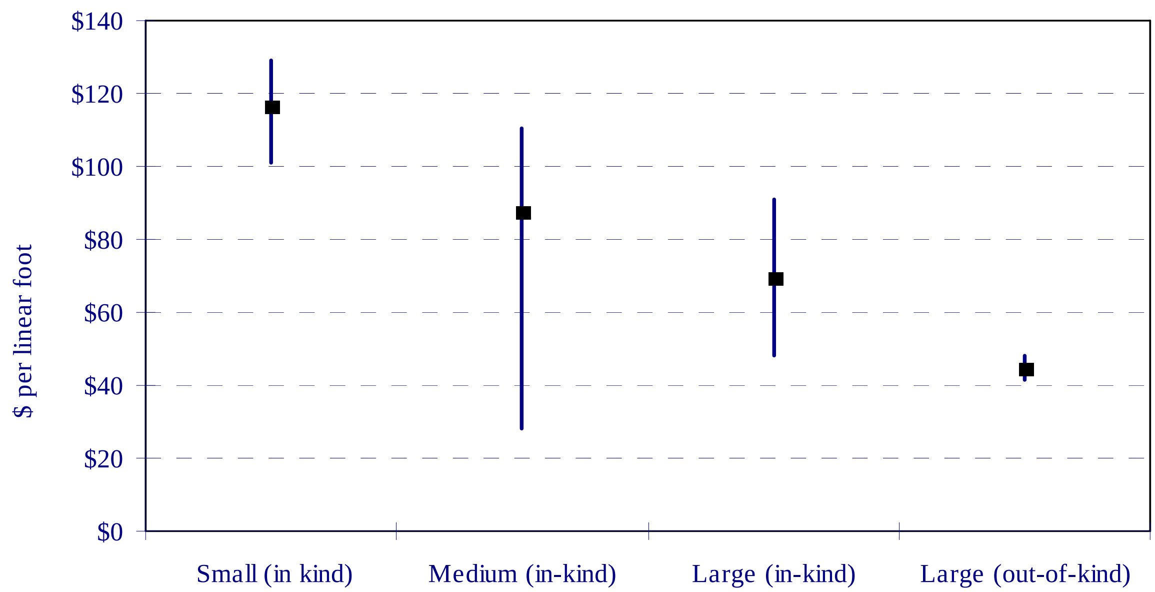
Costs for the two out-of-kind projects suggest that out-of-kind mitigation has some potential to achieve low cost mitigation relative to in-stream restoration. The average total unit cost for all in-kind projects is $84.09, 79 percent higher than the $46.98 average cost of the out-of-kind projects (Table 7 and Figure 2). Not surprisingly, the largest difference between the two groups is construction costs, accounting for 65 percent of the difference between total unit costs for the two groups. The two acid mine drainage projects have an weighted average construction cost of $29.40, whereas the average construction costs of the in-kind projects is $53.70.

Table 7. Out-of-kind project costs ($ / linear foot) [1]

	Preconstruction	Site acquisition	Construction	Post construction	Total costs
	----------	----------	$	----------	----------
Black Creek	9.42	-	26.93	5.27	41.61
Ely/Puckett Creeks	11.70	3.29	29.87	3.15	48.00
Average[2] unit costs	11.34	2.77	29.40	3.48	46.98
	----------	----------	%	----------	----------
Percent of total costs	24.0	6.0	63.0	7.0	100.0

1. Present value – 5% discount rate
2. Weighted by project length.

Figure 2. Total project cost distribution (high, low, average) by type and size



It should be noted that such numbers should be interpreted with extreme caution because of the difficulty in comparing the improvements in ecological services from in-kind versus out-of-kind projects. For instance, out-of-kind projects aim to improve the aquatic resources by improving water quality, but estimating the stream length positively impacted by these two projects was difficult.[4] The lengths of these projects were estimated by project staff (Davis in the case of Black Creek and Linkinhoker in the case of Eli/Puckett Creeks) as the distance expected to realize significant improvement in water quality as a result of the project. The magnitude of the water quality improvement and how water quality improvements would offset stream fills is unknown. It should also be noted that both of these projects are large projects relative to categories used above. The low linear foot cost of the projects may be a result of achievements of economies of scale.

[4] The number of linear feet of restored physical habitat may be directly observed. An out-of-kind project that reduces contaminants entering the stream will improve water quality downstream, but the improvements will be a declining function of distance from the effluent source reduction. Thus, the challenge is to identify the length of stream positively impacted by an out-of-kind mitigation project. For purposes of this analyses, no in-stream data existed to quantify impacts. However, the out-of-kind projects were confined to relatively small headwater watersheds. Since the restoration activity covered a large portion of the watershed, the entire length of the stream prior to emptying into a larger stream was used to define length of stream impact. Thus, this analysis assumes (without empirical support) that the restoration activities produced no positive impact on the larger downstream waters.

Last, tentative cost estimates were obtained for a number of in-kind projects being planned under the Kentucky in-lieu fee program (Table 1). Kentucky reported cost estimates for six in-kind projects that are in the planning phase (Table 8). Combined, the projects will involve the restoration or enhancement of 11,808 feet of streams at an average cost of $209.56 per linear foot. These costs are considerably higher than the costs listed in Table 6 and consistent with program administer statements that the original $100 per linear foot fee may be insufficient to cover costs.

Table 8. Estimated costs of projects in planning (Kentucky)

Project name	Project type	Project length	Total cost	Unit cost
		feet	$	$/ft
Bullskin Creek	In-kind	1,823	229,845	126.08
Wolf Run	In-kind	1,060	156,308	147.46
Terrys Branch	In-kind	3,200	488,098	152.53
Flutylick Branch	In-kind	1,530	410,288	268.16
East Fork Little Sandy	In-kind	1,522	416,446	273.62
Upper Laurel Creek	In-kind	2,673	773,477	289.37
Aggregate[1]		11,808	2,474,462	209.56

[1] Weighted average unit cost.

A number of factors could explain why these costs are higher than the recently completed in-kind projects. For example, the higher costs could be a function of a limited number of mitigation opportunities in Eastern Kentucky, a possibility magnified by the dependence on donated project sites. The higher costs could also be the result of different criteria used by different program administrators to select mitigation projects. For instance, strict adherence to in-kind stream channel modifications might increase construction costs and eliminate lower cost enhancement projects.

Project Cost Summary

The estimated cost of 12 in-kind stream mitigation projects from Kentucky, North Carolina, and Virginia was around $85 per linear foot. The in-kind projects constructed under the purview of section 404 averaged around $100 per linear foot. The total cost of these 12 projects is likely to be underestimated due to the challenges of estimating site acquisition and post construction costs. Significant variation in costs were observed, however. For in-kind projects, cost ranged from $28 to $129.25 per linear foot of restoration.

Although individual project estimates are lower bound estimates of costs, this study found evidence that costs can vary significantly across mitigation type (in-kind or out-of-kind). The cost of the two out-of-kind projects averaged about $50 per linear foot. Furthermore, close adherence to a preference for in-kind restoration (particularly involving channel modifications over stream enhancement) could be expensive. Some planned in-kind stream restoration projects in Kentucky are approaching $300 per linear foot (Table 8). It should be stressed that only an amount of the linear feet of stream miles improved by the mitigation project was estimated. These results cannot provide an indication of the qualitative improvement. For instance 1,000 feet of high quality habitat restoration may not provide the same level of ecological enhancement as 3,000 feet of modest improvements in water quality. In essence, the results presented here treat all linear feet of stream mitigation improvements as the same, which may not be the case.

Finally, the mitigation projects evaluated were preformed or managed by state government agencies. Given the way agencies are funded, it was difficult to obtain or ascertain the extent to which the cost estimates fully reflect total mitigation project costs. Given that some types of costs (such as overhead or site acquisition) may not be fully attributed to specific projects, the cost estimates reported here should be viewed as a lower bound estimate of costs.

COMPENSATORY MITIGATION COSTS UNDER AN IN-LIEU FEE PROGRAM

The cost estimates provided up to this point cover the planning, construction, and post construction costs associated with compensatory mitigation projects (Figure 1, Box 2). Such costs, however, may not be the amount paid by the permittees. The final cost to permittees of successfully meeting the compensatory regulatory requirement is related not just to the cost of providing the compensatory mitigation project but also to how ecological risks are managed and the regulatory approval costs of using off-site compensatory mitigation (Figure 1, Boxes 3 and 4). The evaluation of in-lieu fee programs is based on the general criteria of providing quality mitigation sufficient to meet the compensatory requirements in a least cost way. To the extent possible, examples will be drawn from new and proposed in-lieu fee programs under NWP21.

One of the principle challenges of managing an in-lieu fee program relates directly to the general features of in-lieu fee programs—that fees are paid before any compensatory project work is undertaken. Thus, at the time the fees are collected there is no direct evidence about the cost of providing successful mitigation projects. Therefore, costs must be estimated.

Nor is there any direct evidence about the ecological risks of mitigation failure. The mitigation project failure risk is unknown because compensatory mitigation projects are not yet planned or constructed when the fees are collected. In addition, temporal risks can be significant because of uncertainty about the length of time between when the fill occurs and when the compensatory mitigation will be provided. Unlike in-lieu fee programs, if compensatory mitigation is done in advance of the fill activity, temporal loss and temporal risk are zero. Under commercial mitigation banking, compensatory mitigation must be in the advanced planning or construction phases before the fill occurs and regulatory authorities can reasonably estimate the amount of time until the compensatory mitigation is fully functional. In-lieu fee program administrators, however, have less information with which to estimate the amount of temporal loss that will occur and thus how much additional mitigation is necessary to offset this temporary loss.

This lack of knowledge about costs and risks creates a management problem for the sponsor. If fees are set too low or if some mitigation projects of the sponsor fail to achieve environmental improvements, the program administrators will fail to provide a sufficient amount of compensation to offset impacts. Addressing this knowledge problem may tend to increase the costs of meeting the compensatory mitigation requirement. For example, in-lieu fee administrators may tend to build in safety factors or cushions throughout the in-lieu fee program to ensure that enough financial resources are available to provide the necessary mitigation and cover the possible risk of ecological failure (Scodari and Shabman 2000). For instance, the fees for a linear foot of mitigation may be set higher than the estimated costs to insure against the possibility that actual mitigation project costs will be higher than expected.

The ways in-lieu fee programs address ecological risks tend to be expensive and unresponsive to the type and magnitude of the risk being managed. Without evidence on the amount of risk being assumed when fees are accepted, in-lieu fee programs rely on mitigation ratios as a risk management tool. The Kentucky in-lieu fee program requires a 2:1 mitigation ratio for fills of high quality (least disturbed) intermittent streams and 3:1 ratio for fill of high quality perennial streams. The specific mitigation ratios selected are not typically tied to a specific type of ecological risk (temporal risk, project failure risk, etc.) and a single mitigation ratio has multiple justifications. For example, projects with higher chances of ecological success do not get assigned a lower mitigation ratio. Since the magnitude of specific risks are not, or cannot be accessed, mitigation ratios are not set relative to how much risk is being assumed but rather on historical practice or precedent (Personal communication, Sparks 2003). Other means of managing ecological risk, such as the use of financial assurances, are not or cannot be used. Rather than imposing high mitigation ratios, having permittees post financial assurances (performance bonds, letters of credit, etc.) could be used to provide public assurances against project failure risk. Financial assurance options may be a more direct and cost effective way to manage mitigation failure risk (Shabman, Stephenson, and Scodari 1998).

The lack of initial information about costs and risks may be partially overcome through experience. For example, better cost estimates would be expected as the sponsors gain experience administering the program. Yet, incentives and program rigidities may limit or slow reaction to new information on costs and risks. Once the fees and mitigation ratios are set, in-lieu fee program sponsors may not have the ability or willingness to change the fees or mitigation over time in response to new information. For instance, consider the possibility that in-lieu fees or mitigation ratios are set too high and the program is collecting more money than is needed to secure no-net-loss mitigation. If this situation occurs, the sponsor faces two choices: 1) recommend lowering the fees or mitigation ratios paid by the permittees, or 2) use the surplus funds to construct additional enhancement projects (in essence achieve a net gain). When the sponsor is a nonprofit conservation organization or a state resource agency, the incentive to lower fees may be limited. Some evidence suggests that lower fees occur. Many in-lieu fee programs covering wetland impacts appear to be providing a surplus of compensatory mitigation relative to fill activities (Scodari and Shabman 2000, 15).[5]

On the other hand, some features of an in-lieu fee programs may reduce the cost of securing off-site compensatory mitigation. Compared to other off-site mitigation options such as commercial mitigation banks, the regulatory approval costs may be relatively low. The lower regulatory costs are related to the different rules and regulatory attitudes between in-lieu programs and commercial banks. Both in-lieu fee sponsors and commercial credit entrepreneurs must receive regulatory approval from a mitigation review team to construct a proposed mitigation project. A significant difference between the two options occurs after regulatory officials approve the number of credits created by the mitigation project. Commercial mitigation ventures must then secure regulatory approval to sell mitigation credits to prospective permittees, which can be a lengthy, expensive process. In-lieu fee programs face no such approval because the fees are paid in advance of the compensatory mitigation.[6]

ALTERNATIVES

In-lieu fee programs are a well established way to secure off-site mitigation, but they have both advantages and disadvantages as a way provide low cost and ecologically successful compensatory mitigation. In particular, in-lieu fee programs face challenges in estimating mitigation costs and cost effectively managing ecological risks. In-lieu fee sponsors may not provide strong incentives to deliver cost-savings back to the permittees.

[5] Securing compensation in excess of fill activity could be partially explained by the need to cover the temporal losses between fill and compensation in an in-lieu fee program (Scodari and Shabman 2000). Yet in practice, identifying whether an in-lieu fee program is providing a net gain in function or merely compensating for temporal losses in aquatic function is difficult.

[6] It should be noted that the higher regulatory approval costs might add some value to the regulatory process. Under the commercial banking option, a credit sale is directly linked to a fill activity. This process makes tracking and verification of achievement of the no-net-loss objective relatively easy. In-lieu fee programs typically do not directly link a particular fill to specific mitigation projects. Instead an overall ledger of fill and compensatory mitigation is kept. By not linking specific compensatory projects to specific fill activities, estimating temporal losses and identifying progress toward achieving the no-net-loss objective is more difficult.

Other arrangements may have potential to overcome some of these problems. A largely unexplored option is a mitigation association (Stephenson and Shabman 2004). A mitigation association is an independent organization created by a group of two or more mining companies. Broad policies of the association would be established by a board of directors made up of its members, but day-to-day operations could be conducted by specially trained association staff. As an independent organization, the association would also maintain an independent budget from its members. Funding for the association's basic organization could be generated through membership dues. Funding for the mitigation projects would be paid by association members based on the association's actual costs for its mitigation projects.

The sole mission of an association would be to help meet the compensatory mitigation obligations of its members at the lowest possible cost. As a separate organization, the association, rather than individual mining companies, would manage the legal and financial responsibility of providing compensatory mitigation for its members, although as in any association its members would ultimately be liable for mitigation credit failures. In this regard, the financial and legal responsibility for mitigation success is similar to that for on-site mitigation. A mitigation association could also be used as an alternative to in-lieu fee programs for industry to secure off-site mitigation for its members. The association, rather than an in-lieu fee sponsor or commercial credit seller, would be responsible for identifying, constructing, and initially paying for these consolidated compensatory mitigation projects. In planning for off-site mitigation, the association would have strong incentives to identify low-cost sites with a high probability of achieving ecological success. Like other mitigation options, a mitigation association would be required to provide financial assurances and long-term maintenance requirements to insure that mitigation projects will succeed ecologically. Unlike the in-lieu fee option, however, the association also has strong incentives to pass cost savings back to the member mining companies. The association would pay for the cost of off-site mitigation projects by collecting payments from the members who need off-site mitigation credits.

An important advantage of a mitigation association would be the ability to consolidate industry mitigation into larger scale projects, thereby lowering costs through economies of scale. Through its members, the association could plan and coordinate large scale (watershed level) restoration activities that would provide compensatory mitigation. The mitigation association would then devise procedures for dividing credit for large scale restoration among its members.[7] Consolidating mitigation activities among a smaller number of projects would also economize on permitting costs to both the agencies and the mining companies. Approving one large scale compensatory mitigation plan would less expensive than approving numerous individual, smaller scale projects. Furthermore, the costs of completing these larger scale projects might be less expensive for the coal industry rather than the public or nonprofit organizations designated to carry out an in-lieu fee program. The coal companies have equipment and trained operators already mobilized in the field and arguably can more cost effectively deploy that equipment for stream restoration activities. Larger scale mitigation activities could also produce more pronounced and tangible ecological benefits due to the ability to assess and address water related issues on a watershed scale.

Unlike an in-lieu fee program, a mitigation association could both lower ecological risks and lower costs to its members by providing advanced off-site mitigation (mitigation projects before fill occurs). Advance mitigation would eliminate temporal losses/risk and greatly reduce the mitigation failure risk.[8] Given time preferences for money, providing mitigation in advance of fills would impose a financial opportunity cost

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[7] Currently, most mitigation consists of individual companies undertaking their own compensatory mitigation. Total company mitigation is the sum of individual projects. Rather than summing individual projects, a mitigation association would do fewer, but larger projects and then divide the credit among company members.

[8] If mitigation is provided in advance, the mitigation association might receive credit for creating temporary net gains in aquatic services. This temporal gain might be justification for requiring a mitigation ratio of less than 1:1.

on the association. Yet since advance mitigation greatly reduces or eliminates ecological risks, a strong case could be made to regulatory authorities to lower mitigation ratios to reflect the lower risk. Lowering mitigation ratios may more than offset the financial opportunity costs of advance mitigation and thus provide a strong incentive for a mitigation association to seek and secure advanced off-site mitigation. An association of mining companies would be well positioned to do such advanced mitigation because association members would know future mining plans and sites and have a sound basis for identifying future off-site compensatory mitigation needs.

Organizations like a mitigation association have been used successfully in the wetland program to provide members with off-site compensatory mitigation. In the early 1990s, a group of home builders in Ohio sought to create a way to meet wetland mitigation requirements under Section 404. The home builders created a nonprofit foundation, the Ohio Wetlands Foundation, for the purpose of constructing compensatory mitigation projects. The Ohio Home builders Association provided the initial start-up funds to the foundation and members of the Association serve on the Foundation's Board of Trustees. The Foundation now receives yearly income from the sale of wetland credits and sells credits to anyone in need of wetland mitigation credits. As a nonprofit organization, the Foundation charges credit prices only sufficient enough to cover the full cost their wetland projects. The Ohio Wetland Foundation is one example of how competitors (home builders) can pool resources and work cooperatively to satisfy specific regulatory requirements at a lower overall cost.

An association could also consolidate on-site mitigation credits of its members and then allow members to draw on those credits to meet their mitigation requirements. The association could encourage and assist those member companies that can produce credits on-site above their mitigation requirements to do so. For instance, suppose mining companies A, B, and C formed a mitigation association. Together companies A, B, and C are seeking permits to fill 5,000 feet of intermittent stream. Member C has few on-site compensatory mitigation opportunities, but Members A and B together could construct enough on-site compensatory mitigation to completely offset the stream impacts of all three members. The association as a whole has generated sufficient compensatory mitigation to cover the total stream impacts of members A, B, and C even if all individual members have not. In such a situation, the association would operate to ensure joint compliance with Section 404 compensatory mitigation requirements. The association members would benefit by being able to take advantage of feasible, low cost on-site mitigation options regardless of where they exist, so that mitigation compliance costs of all three companies would be reduced. For such sharing of compensatory mitigation to happen, the association would adopt procedures where members in need of credits could pay other members who have produced credits in excess of their own needs. Company C would voluntarily provide payment to Companies A and B because it is less expensive than on-site mitigation at their site. In return, Companies A and B would have a portion of their project construction costs paid for by Company C. Ideally, the costs for undertaking any above and beyond mitigation by any member could be reimbursed from the association treasury on a set payment schedule. The association would then have an inventory of credits and could reimburse its treasury as members paid to purchase credits to meet their compensation requirements from that inventory.

Not only would costs be lower, but the regulators would have greater assurance of ecological success. While individual permittees still would be responsible for their on-site projects, the association would have an incentive to work with these operators to assure that the best restoration methods are applied and that the sites are carefully monitored and managed over time. Also, mitigation credits could be created in advance of many of the fills so that regulators could have less concern about credit failure.

Similar arrangements have been used elsewhere to help permittees meet their regulatory requirements under the Clean Water Act. In North Carolina, for example, a group of sewage treatment plant operators formed the Tar-Pamlico Basin Association as a way to meet new effluent discharge requirements. In the late 1980s, the Tar-Pamlico Sound in North Carolina faced a number of water quality problems associated with excessive nutrients. The state of North Carolina determined that point source dischargers should reduce aggregate nutrient loads by 30 percent from 1990 levels. Rather than have nutrient control limits written into individual discharge permits, a group of 13 point source dischargers agreed to form the Tar-Pamlico Basin Association in the early 1990s. North Carolina officials then assigned a legally enforceable aggregate nutrient cap (total allowable nutrient discharge in kilograms) to the Association. Financial penalties are charged to the Association rather than individual plants if the total nutrient discharges of the association members exceed the overall nutrient cap. The Tar-Pamlico Basin Association can meet is regulatory obligation by deciding how the members will achieve the overall nutrient cap, including deciding what nutrient control strategies will be used, which plants will install capital upgrades first, and how control costs will be shared among the members. If an individual member refuses to play by the Association's rules, the discharger will be expelled from the Association and be required by the state agency to implement more costly individual permit conditions.

The Tar-Pamlico Basin Association is an example of how regulatory requirements for separate permittees can be bundled under the organizational umbrella of an association. A mining mitigation association like the Tar-Pamlico Basin Association would work to assure joint compliance of its members with Section 404 permitting requirements. In the mining example, the mitigation association itself would be responsible for providing enough mitigation to compensate for the 5,000 feet of stream fill.

SUMMARY AND CONCLUSIONS

This report describes the costs of meeting compensatory mitigation requirements for stream impacts under Section 404 of the Clean Water Act. The focus of the analysis is estimating and evaluating the costs that might be expected under emerging in-lieu fee programs in the southern Appalachian region.

Empirical analysis of stream restoration projects completed within the region highlight the fragmented level of knowledge about stream restoration costs. Stream restoration is a fairly new activity. Coupled with the limited number of completed projects, information about costs other than direct construction costs is often poor and not rigorously documented. Given these caveats, however, stream enhancement/ restoration projects (in-kind) documented by this study averaged $85 per linear foot with a range of $28 to $130 per linear foot. Recent evidence of in-kind projects under way in a Kentucky in-lieu fee program indicate that costs often exceed $200 per linear foot.

An emphasis should be placed on the preliminary nature of these estimates. The projects reviewed in this report were completed by public agencies. Evidence collected during this research indicates that these projects are unlikely to reflect the full cost accounting. As such, these estimates represent lower bound estimates on the cost to construct the projects reviewed. Full cost accounting of preconstruction, construction, and post construction monitoring costs of the reviewed projects will increase these costs by some unknown factor. On the other hand, stream restoration is an emerging field. As experience with stream or watershed restoration increases, the future cost of providing compensatory mitigation might fall.

With these caveats some evidence was found that costs vary by the size and type of mitigation projects. The cost per linear foot of larger stream restoration projects (expressed in terms of linear feet of stream restored) were about half the cost of smaller restoration projects. Furthermore, there was limited evidence that there may be cost advantages to out-of-kind mitigation projects.

Finally, in-lieu fee programs exhibit a mixed potential to deliver low cost compensatory mitigation back to permit applicants. In-lieu fee programs have limited incentives for program administrators to transfer any cost-savings incurred back the permittees. In-lieu fee programs also are not operated in ways that encourage active management of ecological risks that lower permittee costs. On the other hand, compared to many compensatory mitigation alternatives, in-lieu fee programs face relatively low regulatory approval costs, and these lower costs may be reflected in the need to charge higher fees.

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