LOCAL ECONOMIC BENEFITS OF RESTORING DECKERS CREEK: A PRELIMINARY ANALYSIS

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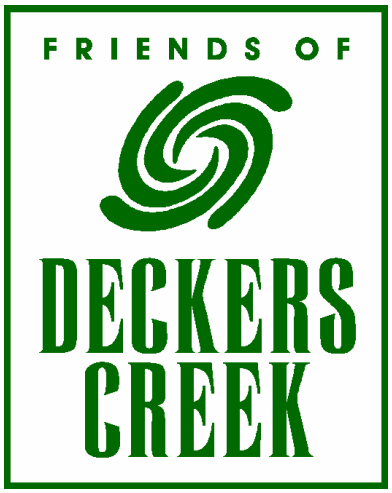

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Acronyms

AMD	Acid Mine Drainage
CVM	Contingency Valuation Method
FODC	Friends of Deckers Creek
NRCS	Natural Resource Conservation Service
NAIC	North American Industry Classification
O&M	Operation and Maintenance
RPC	Regional Purchase Coefficients
SAM	Social Accounting Matrix
TCM	Travel Cost Method
WCAP	Watershed Cooperative Agreement Program
WTP	Willingness to Pay
WVDEP	West Virginia Department of Environmental Protection

Executive Summary

This report estimates local economic benefits that can be expected from the restoration of Deckers Creek, which drains 64 square miles of Monongalia and Preston Counties before discharging to the Monongahela River in Morgantown. Parts of the upper watershed, as well as the lower five miles through Morgantown, are impaired by acid mine drainage from old coal mines. Deckers Creek and its tributaries are also impaired by bacteria and are littered with trash.

The objective of economic benefit analysis is to provide decision-makers with a tool for identifying and valuing the expected returns on their investments. Investment in public goods like environmental quality can generate very valuable returns, even if they are difficult to measure.

Local economic benefits from restoration can be estimated in three main categories. The first category includes local economic benefits that are generated when restoration costs are paid by Federal and State restoration funds that circulate as local wages and purchases. In Monongalia and Preston Counties, these benefits are generated by money spent on reducing acid mine drainage discharges from old coal mines, already $2 million for the Deckers watershed alone. Combined with spending planned for the next few years, restoration projects will generate an estimated $14.16 million in economic benefits to local businesses and workers.

The second category of benefits includes the flow of benefits that a healthy watershed yields to the local economy. Some of these benefits will accrue to community residents experiencing an improved quality of life from increased opportunities for fishing, swimming, and passive enjoyment of a restored Deckers Creek—estimated to be $1.9 million of value generated annually. Spending by visitors attracted to the area could be expected to generate an additional $1.16 million in local economic benefits annually. Given experiences of urban stream restoration in other cities, a restored Deckers Creek could become a property value boon. Currently, the color, odor, and remaining trash make the creek an expensive liability to streamside property owners. Riparian property owners could conservatively expect an immediate 13% increase in property values, generating increased local tax revenues as well.

Finally, benefits accrue to the local economy and to government budgets from future damages that are avoided by restoring the creek. These benefits can include reduced health care costs, reduced infrastructure expansion costs, and sustainable neighborhood development patterns. Understanding the scale of potential economic benefits from avoiding future damages warrants additional research. To more fully analyze this and all categories of benefits, creek restoration plans should be considered within a comprehensive and integrated analysis of relevant county and municipal growth and development. Inter-agency development planning can reduce future costs and conflict, advance public private partnerships, and leverage complementary funding sources.

Additional benefits have accrued from Friends of Deckers Creek board and volunteer hours used for water monitoring, trash clean-ups, public education, fundraisers, and advocacy. Although not estimated for this report, such benefits can be assumed to be significant contributors toward building a strong and sustainable local economy.

1. Problem Statement

The Deckers Creek watershed comprises 64 square miles in Preston and Monongalia Counties, West Virginia. The watershed's largest city, Morgantown, lies at Deckers Creek's confluence with the Monongahela River, and is home to West Virginia University. River-focused development and a popular rail-trail that parallels Deckers Creek and a tributary, Kanes Creek, for 19 miles have helped make remediation of Deckers Creek essential to the community. The local Convention and Visitors Bureau now promotes the city as a hub for outdoor recreation and nature-based tourism. Local residents walk, bike, and rollerblade on the rail-trail for exercise, and many commute on the trail to work. While Deckers Creek was once used as a waste disposal system, it is now emerging as a centerpiece of future economic development.

Friends of Deckers Creek (FODC) is a nonprofit watershed organization with a mission to improve the natural qualities of, increase public concern for, and promote the enjoyment of the Deckers Creek watershed. FODC's annual State of the Creek reports document trends in water chemistry, fish communities, and benthic macroinvertebrates at 13 sites across the watershed. According to these monitoring data, the entire watershed is not dead, but acid mine drainage (AMD) pollution is significant (FODC 2005 and 2004).

The West Virginia Department of Environmental Protection (WVDEP) identifies eight streams in the watershed as impaired by AMD, including Deckers Creek itself. Most of this pollution is caused by old coal mines abandoned before the 1977 surface mining law.

FODC's short-term goal is to work with agencies to install AMD remediation projects so that no streams are chemically impaired. The organization's long-term goals are to reestablish a healthy fishery and to make a clean Deckers Creek a centerpiece of the community and a point of pride.

A community can transform its environmental liabilities into productive economic assets. Those assets can yield a stream of positive economic returns to the local economy; as liabilities, they drain the local economy. *Economic benefit analysis* can help community leaders understand how the local economy benefits from investments made to restore environmental assets and manage the economic benefits that flow from them. This report evaluates the potential economic benefits that could accrue to Monongalia and Preston Counties by restoring Deckers Creek.

Environmental restoration, particularly when combined with on-going resource management, generates three main categories of local economic benefits (summarized in Table 1). The *first category* of benefits includes the benefits that result from restoration spending at local businesses (e.g. engineering and construction, surveying, environmental testing, and nurseries). These are considered to be local benefits of restoration rather than costs if funds originate outside of the local economy; in this case, federal and state dollars are financing most of the restoration.

The *second category* is the flow of benefits to the local economy that are generated by having a restored stream (e.g. urban recreation opportunities, increased tourism, and increased property values). For example, boaters anxiously await the opportunity to kayak in clean, safe water the challenging stretch of Deckers Creek called the Miracle Mile, well known among boaters locally and in neighboring states.

The *third category* of benefits can be considered "costs avoided" that accrue from halting or reversing degradation trends (e.g. lower water treatment and health care costs and reduced flooding and sedimentation.). Avoided costs can also include the creation of space that is attractive for development on land that is already served by city infrastructure but is otherwise degraded; this is important particularly in cities that are experiencing rapid infrastructure expansion demands such as Morgantown. In addition to these three categories, many other valuable benefits are generated, which cannot be reliably quantified.

Section 2 provides an analysis of the first category of benefits: restoration expenditure impacts on the local economy. For this section, the local economy is defined as Monongalia and Preston Counties. Using the IMPLAN input-output model of the local economy, direct, indirect, and induced economic impacts are estimated based on past and planned restoration budgets. IMPLAN traces expenditure patterns by sector to determine how many times $1 spent in a specific type of local business will be re-spent locally in other sectors before it leaves the local economy. Specific attention is given to the planned remediation of the Richard mine, the most significant remaining sources of AMD in the watershed and the site responsible for virtually all of the AMD pollution as Deckers Creek flows through Morgantown.

Section 3 describes the potential benefits generated from a restored Deckers Creek. Economic benefits include those related to new or expanded recreation opportunities, increased production of ecological services, aesthetic improvements, wildlife habitat, and others. Potential economic benefits from increased visitor expenditures and increased riparian property values are also discussed in this section.

The final section reviews conclusions and suggests opportunities for a more comprehensive economic analysis of the Deckers Creek watershed. Among those benefits not addressed by this study are benefits from community environmental education, restoration of ecological assets, and the entire third category of benefits identified above: the benefits of costs avoided. A scenario analysis based on available Monongalia and Preston County development plans could also provide a comprehensive regional perspective on the role of creek restoration.

Table 1 Additive economic benefits of Deckers Creek restoration efforts

Type of benefit	Description	Estimation method	Potential benefits ($ Millions) One-time	Annual
1. Restoration spending				
a. Local impact of expenditure of external project funds	Federal and State dollars attracted to Preston and Monongalia County economies	IMPLAN input-output model of Monongalia and Preston Counties	14.16	N/A
2. Economic benefits from a restored Deckers Creek				
a. *Non-market quality of life value*	Estimate of the value people hold for goods (non-use values of creek heritage, beauty, existence, etc.); usually a perceived financial estimate of ethical value	Contingency Valuation Method: survey of various groups' willingness to pay higher utility bills to finance improvements to creek	N/A	1.9
b. Local expenditure by increased visitors	Local spending by visitors attracted to new or improved opportunities on and around Deckers Creek	NRCS estimate	N/A	1.16
c. Increased property values	Improved value of streamside properties and nearby neighborhoods	Potential property value gains for streamside properties along Deckers Creek downstream of I-68 (streamside neighborhood properties excluded)	0.95	N/A
3. Costs (damages) avoided				
a. Costs avoided by changing status quo.	Avoiding further reduction in visitor enjoyment and expenditures, reducing associated health costs, and improving streams' abilities to resist and recover from future disturbances	Not estimated	N/A	N/A
Total			15.11	3.06

2. Economic Impact Analysis of Deckers Creek Restoration Projects

AMD remediation projects require either passive or active treatment systems. Passive systems are installed, and remediation occurs largely without further intervention. More severe AMD sites require active systems that require continual, often expensive, operation and maintenance activities.

Since its beginning 10 years ago, Friends of Deckers Creek (FODC) has already helped to attract almost $2 million in direct external funds through July 2005 for passive system remediation in the Deckers Creek watershed. Using the IMPLAN model of the local economy, that spending on passive treatment projects is estimated to have generated $2.52 million in benefits to local businesses and families. More than $8 million more direct funding is expected in the next few years.[1]

Table 2 Deckers Creek watershed restoration spending as of July 2005 ($)[2]

Funding source	Spent	Committed	Pending approval	Total
Abandoned Mine Land Trust Fund	1,595,000	3,205,000		4,800,000
NRCS		4,800,000		4,800,000
Clean Water Act Section 319	188,000	58,000	238,000	484,000
Office of Surface Mining WCAP	180,000	94,000	158,000	432,000
Total	1,964,000	8,157,000	395,000	10,516,000

IMPLAN estimates how expenditures will benefit an economy by tracking how funds spent recirculate through the local economy for the purchase of locally produced inputs and provision of local employment benefits.[3] For example, a dollar spent in stream restoration circulates in the local economy approximately 1.28 times—this is called the *multiplier*.[4] The multiplier size varies depending on location and nature of the economic activity question. Benefits estimated based on expenditures should be compared with potential benefits forgone from alternative expenditure options (*opportunity costs*).

In the case of Deckers Creek, remediation costs are paid by external funds brought into the two-county area; remediation funds are not being diverted from a different use in the local economy. Watersheds throughout the state and nation compete for these federal and state restoration funds. FODC and government agencies have actively worked to bring a share of those funds into Monongalia and Preston Counties. For example, organization supporters generated dozens of letters to the NRCS requesting its assistance to restore the watershed. Furthermore, the goods and services required to complete the remediation are largely available locally.[5] As a result, $1 of external funds spent in local stream restoration can be expected to yield a full $1.28 of economic benefits.[6]

2.1 Passive Treatment Remediation

Efforts of FODC and partner agencies have resulted in the partial or full remediation of at least four important AMD sites in the watershed as of 2005 (Kanes Creek, Dillan Creek, Elkins Coal and Coke, and Slabcamp Run). While the design specifications at each site are unique, the passive treatment systems installed are largely similar in terms of expenditure patterns.[7] Using the Slabcamp budget as a standard, impact estimates are made based on total expenditures in passive treatment systems.[8]

The Slabcamp budget totaled $319,306. The economic impact benefits from passive treatment expenditures at all four passive treatment sites in the watershed are estimated by applying the Slabcamp multiplier (1.28) to total passive treatment expenditures to date ($1.96 million). Economic benefits in Monongalia and Preston Counties from the installation of Deckers Creek passive treatment systems was at $409,855. This expenditure was estimated to have generated 3.6 employment years, yielding over $143,000 in labor compensation.

The results of this analysis indicate that a total of $2.52 million in local economic benefits have been generated. Of those benefits, $879,996 in employment compensation was distributed in the two counties.[9]

2.2 Active Treatment Remediation: Richard Mine

Richard Mine is the most significant pollution source remaining on Deckers Creek. Economically, its pollution impact is particularly significant because it visibly affects the stream along the Deckers Creek Trail, a rail-trail that experiences some of its highest visitor traffic from I-68 to the Monongahela River. The Richard Mine is almost single-handedly responsible for the AMD pollution visible in Morgantown, the watershed's largest population center. For most local residents, bright orange rocks and milky flows are telltale signs of an AMD-impaired stream.

FODC believes that effectively treating the polluted discharge from Richard requires the installation of an active rather than passive treatment system. Active systems require costly on-going operation and maintenance (O&M). While external funds are available for fixed costs including site preparation, equipment purchase and installation, and land acquisition, release of these funds require a secured source of funding for anticipated O&M costs into the indefinite future. FODC estimates that O&M costs will total $88,140 annually.

Installation Costs. Analyzing each line item in the fixed cost budget and aggregating impacts, IMPLAN generates a multiplier of 1.17. This means that the project installation expenditure alone ($144,887) would generate a $169,789 benefit to the two-county study area, of which $61,490 would be labor compensation. Results indicate that this spending would generate 1.5 years of employment. Externally funded land acquisition costs of $250,000 would be added to the final impact resulting in a total local economic benefit of at least $420,000.[10]

Operation and Maintenance Costs. Predicting impact benefits of annual O&M spending is less certain since the funding source is not necessarily federal or state funding. If funds come from external sources, the annual $88,140 costs could be expected to generate a $108,002 impact

locally. Income compensation would account for $36,307 of this and the generation of 0.8 years of employment could be expected for each year of O&M.[11] If this funding comes from local sources, it should be considered a cost and compared with benefits forgone (opportunity costs) from alternative use of the funds.

Figure 1 The Richard Mine discharges 200 gallons per minute of acid mine drainage directly into Deckers Creek

2.3 Anticipated Remediation Projects

AMD treatment systems and other remediation projects are needed on multiple Deckers Creek tributaries as well as on the mainstem. Some of these projects have been designed and funding is committed or pending. Priorities are being set for other projects now. The estimated local economic benefits of these projects are considered in the table below.[12]

Table 3 Estimated economic benefits to Monongalia and Preston Counties from passive and active remediation projects ($ Millions)

Expenditure	Total direct benefits	Indirect benefits	Total impact
Implemented			
Passive treatment and planning	1.96	0.56	2.52
Planned			
Richard mine active system installation	0.55	0.03	0.58
Future passive treatment systems and other restoration	8.55	2.51	11.06
Total	11.06	3.10	14.16

3. Benefits from the Restored Stream

The second category of benefits generated from restoration is the flow of economic benefits that come from a healthy watershed. If the watershed is impaired, the benefit flow decreases and can even become negative, generating costs to the community rather than benefits. Benefit flows evaluated in this section include the following: 1) non-market, quality of life benefits; 2) expenditure in the local economy due to increase creek and trail use; and 3) increased streamside property values.

In the case of Deckers Creek, there are multiple sources of stream impairment. The three primary impairments to Deckers Creek are AMD, garbage, and bacteria from human sewage and animals. Correcting one issue will not proportionately improve recreation opportunities because stream use is largely dependent on comprehensive restoration. Fish may return with AMD remediation, but anglers will not choose to fish a stream impaired by sewage and garbage.

Active and passive treatment projects tackle the AMD problem. FODC volunteers have already removed tons of garbage and tires from the creek bed and banks—a significant economic value donated by the organization and its supporters. Realizing the full benefits from investment on these two issues will require investment in wastewater discharge problems. Wastewater problems are likely to require local investment. The returns on that key investment, however, effectively leverage the benefits of state and federal remediation projects and countless hours of volunteer efforts.

Author's Miracle Mile Anecdote –
While editing this report a friend called from Pennsylvania. We debated who would come to visit whom. Coincidentally, my friend explained that he would be more than happy to come to Morgantown if we would clean up Deckers Creek so he could boat the Miracle Mile without risking another trip to the hospital—a treat he experienced on his last visit after accidentally swallowing a bit of creek water in a difficult rapid. As a direct economic result, rather than attracting a visitor and his spending to the area, both of our expenditures for the weekend will be made boating in Pennsylvania.

Figure 2 Friends of Deckers Creek cleans up trash along the creekside Old Route 7 Scenic Byway

3.1 Non-Market, Quality of Life Benefits: Willingness-to-Pay

Quality of life benefits enjoyed by residents from creek restoration are commonly called non-market goods because there is no purchase price for them, but they do hold value. Residents' value for these improvements can be estimated with surveys designed to estimate their willingness-to-pay (WTP) for restoration. This section reviews a study conducted by West Virginia University professors in Agriculture and Natural Resource Economics, but many similar studies have been conducted to estimate the value of various environmental restoration benefits.[13] Combining IMPLAN impact analysis with CVM accounts for two main types of local benefits from environmental restoration but avoids double-counting benefits (Loomis, 2005).

Collins et al. (2005) sought to estimate value of improved scenic benefits (reduced trash and reduced visible effects from AMD), improved angling benefits (restored habitat for fisheries), and safe water-contact recreation benefits (reduced bacteria). Researchers used survey responses from three subsamples of Monongalia and Preston County residents, questioning users of Deckers Creek Trail, people active in restoration efforts, and the general population. Value was estimated by respondents' willingness to pay for increases to monthly utility bills that corresponded with low, medium, and high levels of stream restoration in each of the three benefit categories.

In this study, average WTP for full creek restoration ranged between $12 (non-anglers) and $16 (anglers) per household per month. Adding these benefits across the watershed population yielded benefits totaling $1.9 million. Restoration of Richard Mine alone would improve two of three creek attributes—aquatic life and scenic values—but not primary-contact recreation or odor.[14]

Figure 3 Restoration is improving habitat for fish like these found in Deckers Creek

The Collins quality of life study was conducted with current residents. The importance of natural amenities and stewardship on homebuyers' location decisions and on young professionals' location decisions should not be underestimated. In fact, many studies have shown that natural and cultural quality of life amenities are increasingly important factors in firm location decisions, particularly for the knowledge-based industries of the New Economy (Salvesen and Renski, 2002). The authors specifically address the unique opportunity for cities in rural regions to attract firms by offering cultural amenities while retaining natural amenities such as clean air, environmental quality, recreation opportunities, and community attitude. As Morgantown works to attract high tech businesses and retain educated young professionals, demonstrating interest in protecting its natural amenities will distinguish it from other cities.

3.2 Economic Benefits of Increased Recreation Visits

Increasing the use of Deckers Creek can be assumed to increase the number of visitors and frequency of visitor trips. It is also likely to diversify the types of visitors to the creek and its trails. The Natural Resource Conservation Service (NRCS) estimated that a restored Deckers Creek could be expected to increase trail use by 10% annually (NRCS, 2000). Based on trail use in 1999, (estimated 60,000 annual visitors) that would mean attracting 6,000 new visitors for boating, rock climbing, wading, fishing, and other water-based recreational activities annually.

Boating alone is expected to at least double in the difficult "Miracle Mile" stretch of the stream and increase four-fold in the easier stretches as health threats are ameliorated.

Benefits from this increased visitation would include the economic impacts of visitor expenditures at local businesses plus the benefits enjoyed by the visitors themselves from being able to use the river and trails. In 1999, NRCS estimated that annual recreation benefits to the local economy would surpass $1.16 million (original estimate indexed to 2005 dollars).[15]

An added benefit may be generated from encouraging increased use of the trail for health and commuting benefits. The Virginia Department of Conservation and Recreation (2001) cites the link between increased parks and recreation activity and decreased health care expenditures. The same study also credits increased trail use for commuting for reducing local commuter traffic, a needed benefit in Morgantown.

3.3 Property Values

Property values of homes on and near streams are related to the water quality of those streams.[16] *Benefit transfer* is the methodology of drawing on findings from similar case study research and applying results to a new situation. Using the cases cited below, increased streamside property values in just the Morgantown section of the Deckers Creek watershed could conservatively be estimated to surpass $568,000.

Estimating the impact of water quality changes on property values presents a few significant challenges. The first is the role of homeowners' and homebuyers' awareness of different water quality levels. The decision makers must be able to observe water quality changes either by perceptible changes in odor, clarity, or color or by regularly published test results. Additionally, the effect of stream impairment may not necessarily register as a change in property value but rather as a shift in the community's socio-economic or demographic characteristics. AMD, bacteria-related odors, and garbage in Deckers are all perceptible sources of water quality impairments. The direction of demographic trends in many streamside neighborhoods in Morgantown is arguably still being defined; stream improvements could help riparian communities retain single-family dwellings among the rental properties.

Many studies have examined the relationship between environmental restoration and increased property values. Studies can predict how property values would improve after restoration based on similar housing markets near pristine streams or lakes. Research can also follow changes in property values throughout the restoration process, tracking actual improvements. *Benefit transfer* applies findings from existing case research in other watersheds to estimate how a local property values may change after restoration.

Table 4 Summary of studies on property values and restoration in other watersheds

Study	*Restoration Effort*	*Benefit / estimated benefit*
Streiner and Loomis (1996)	Bank stabilization and trail construction on urban stream stretches in three California counties	Property value increases of 3-13%
Epp and Al-Ani (1979)	AMD remediation in rural residential area of Pennsylvania	1 point of stream pH improvement, increased property value by 5.9%
Cameron and McConnaha (2004)	Remediation of area superfund site	Neighborhood returned to pre-Superfund site demographics, attracting families with children
Legget and Bokstael (2000)	Fecal coliform levels (bacteria from sewage) ranged from 4 to 2,300 counts per 100 mL along shores of same waterfront community. Study on variation in housing market	Bacteria counts per 100 mL changed property values decreased by 1.5% per additional 100 counts, with value impacts as high as 34.5%
Earnhart (2001)	Long Island Sound restoration of degraded marshes in residential areas	Marsh restoration increased property values by 16.6 %
University of Minnesota (2003)	Water and land management around residential lake to improve water quality and clarity	Increased property value for lakeside homes of $423 per frontage foot after remediation improved lake clarity by 3 feet (home with a 40 frontage foot parcel increased by $17,000)

Figure 4: Brockway Avenue home along Deckers Creek that suffers from bacteria-related odors and health threats

Property values in the Deckers Creek watershed. Approximately 85 parcels border Deckers Creek below I-68. Of these properties, 62 have assessed property values on file with the Sheriff's Department. The aggregate assessment value of these properties is $4,366,000 (estimated to be 60% of the market value). Given Morgantown's current growth patterns, transferring a moderate property value increase of 13% would be conservatively appropriate and would generate $946,000 in property value increases.

Even the moderate estimate, however, yields a conservative value. Assessor property value visits are made only every three years, and at least 20 parcel values were not listed. Furthermore, the aggregated property values considered in this estimate include only properties directly bordering the creek; spill-over benefits to properties slightly further from the creek were not included. Additionally, property value benefits would be expected to accrue to the communities of Richard and Dellslow. Given the communities' proximity to two major highways and to downtown Morgantown, growth and property value increases would likely be significant if the local AMD source were remediated and natural amenities restored, turning an environmental liability into an economic asset.

4. Costs Avoided

The third category of benefits from stream restoration is the benefit of costs or damages avoided. Estimating costs avoided is beyond the scope of this report. Areas can be identified, however, where potentially significant costs that could be avoided. Health care, community infrastructure, and community development costs are among those that could be reduced if Deckers' water quality improved.

Healthcare costs avoided as a result of remediation of bacteria contamination is another type of cost that could be avoided by a full stream remediation. Estimating these benefits would be difficult since estimates of current creek-related health problems are not available.

Additional costs avoided could be analyzed relative to community planning goals. Based on the Cameron and McConnaha study of pollution and demographic trends (described above), Morgantown planners' interest in fostering mixed income neighborhoods and in retaining single-family housing throughout neighborhoods like Second Ward and South Park would be advanced by creek restoration.

Finally, environmental restoration and remediation are expensive activities. While external spending may generate economic benefits to the economy in the short run, investing in environmental degradation prevention allows more costly degradation-related problems to be avoided entirely. Investing now in creek restoration can change public awareness and aversion to activities that degrade the creek by encouraging a greater sense of ownership and protection for the creek among enforcement officials and local users. This type of shift in public awareness and attitude can have important and valuable implications for avoiding future costly threats to the creek quality.

5. Final Conclusions and Recommendations

This report has reviewed estimates of the potential benefits from remediation efforts in Deckers Creek. Economic benefits accrue to the local community (Monongalia and Preston Counties) from remediation expenditures just focused on reducing AMD impairments (already $2 million). Combined with funds already slated for watershed remediation projects ($8.2 million), spending to restore the watershed will actually generate $14.16 million in economic benefits to local businesses and workers.

Additional benefits to the population within the watershed accrue to individuals experiencing quality of life improvements from increased opportunities for fishing, swimming, and passive enjoyment of a restored Deckers Creek (between $1.02 to $1.9 million annually depending on degree and nature of restoration). Streamside property owners could conservatively be expected to see a 13% increase in their property values. Increased recreation-related expenditures are estimated to generate an additional $1.16 million in local economic benefits annually.

Additional benefits have accrued from FODC board and volunteer hours donated for events such as garbage removal activities, public education about creek-related environmental issues, fundraisers, and advocacy. As well, the scale of benefits avoided has gone unestimated by this study. Restoration not only increases the stream resistance to and resilience from unanticipated natural disasters like severe flooding and drought, but it also increases the population's interest in protecting the creek from future harmful activities. Understanding the scale of these benefits warrants additional research, but they can be assumed to contribute significantly to building a strong and sustainable local economy.

To more fully analyze all types of benefits, creek restoration plans should be considered within a comprehensive and integrated analysis of relevant county and municipal growth and development strategies. In fact, coordinating such an analysis with interagency development planning can reduce future costs and conflicts by promoting public-private partnerships, improving collaboration, and helping with appropriate timing and project prioritization.

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Endnotes

[1] Funds spent as of July 2005 include the following projects: Kanes Creek South, Dillan Creek, Elkins Coal and Coke, Slabcamp Run #2, Deckers Creek Doser and Limestone Fines Study, and Deckers Creek Watershed Based Plan. Funds committed as of July 2005 include the following projects: the rest of the projects described by NRCS (2000) and Valley Point #12. Funds pending approval include the following projects: Valley Highwall #3 and Kanes Creek South Site #1. AML Trust Fund figures are from the Abandoned Mine Land Inventory System electronic database (OSM, 2005), except for Slabcamp Run #2, which is from FODC's grant proposal. NRCS figures reflect its full commitment in NRCS (2000), even though an unknown amount has already been spent. 319 and OSM figures are from FODC proposals.

[2] Totals may not equal sum of funding sources due to rounding.

[3] IMPLAN estimates Regional Purchase Coefficients (RPCs) for each economic sector in each county. RPCs are the amount of local demand that is met by local suppliers and are the basis for estimating economic *multipliers*. Industries have higher RPCs if most of their demand is met locally and lower RPCs if most of their supply comes from regional, interstate, or international sources.

IMPLAN multipliers are static snapshots of how an economy functions. Economies, however, are highly dynamic and IMPLAN multipliers are generally considered to be relevant for three to five years. Predicting long-term annual benefits would require a dynamic model and more detailed sector data. Dynamic models such as REMI are generally used when a very large project-related expenditure is expected to have a significant immediate impact on the structure of the local economy or key investments are expected to alter economic patterns over time. While a restored stream may change the structure of the local economy in the long run, the change will result from the restored stream and not from the restoration expenditures, making IMPLAN an acceptable model to use for a rough estimate of immediate expenditure impacts.

The Social Accounting Matrix (SAM) *multipliers* generated by this analysis account for direct, indirect, and induced spending and employment (defined below). The multiplier is a ratio between the direct effects of a change in sector demand and the sum of direct, indirect, and induced effects of that spending. *Direct effects* include the first round of expenditures made to carry out the project. *Indirect effects* account for the effects on other local businesses as a result of the initial recipients' need for locally provided goods and services. *Induced effects* describe the demand created in all sectors as a result of any new household income from direct and indirect employment generated by the restoration expenditure.

[4] Budget line items for passive and active treatment expenditures were allocated North American Industry Classification (NAIC) numbers based on assumed industry sector matches to determine the relevant IMPLAN model sector RPC (for example, lime purchases were assumed to match IMPLAN's "mining and quarry" sector). Contacting each good or service vendor to request its actual NAICS number could provide more precise estimates.

[5] In the case of the passive treatment system costs, a datalogger valued at $9,521was ordered from outside the study area. This cost was assigned a zero multiplier in the impact analysis, assuming that the initial purchase will not benefit any business in the area.

[6] NRCS contracts must be distributed through open bidding. According to one official working on the Deckers watershed, however, the area's problems with AMD have generated significant local expertise, making it likely that contracts will remain in the area (Yost, 2005). This cannot be guaranteed, however. Construction contracts for at least two Deckers watershed projects—Elkins Coal and Coke and Slabcamp #2—were awarded to a Fayettte County company.

[7] Passive treatment systems are those that do not require significant annual operations and maintenance costs, and are the preferred type of AMD treatment funded by the AML Trust Fund, NRCS, and Section 319 funds.

[8] Each line item in the Slabcamp budget was analyzed by sector and then aggregated in the model as single but mixed economic event.

[9] These calculations assume that construction was performed by a company in the local two-county area. While the Elkins Coal and Coke and Slabcamp #2 projects were actually constructed by a Fayette County firm, it is likely that local firms would construct future projects.

[10] It is likely that the land purchase estimated at $250,000 would have additional local economic benefits. However, because there is not information on how or where the recipient would spend those funds, it is impossible to estimate their added local impact. Indirect and induced benefits are therefore assumed to be zero.

[11] If funds for O&M expenses were generated locally, then O&M-related benefits listed above would have to be compared against benefits forgone from alternative uses of those funds. All other benefit estimates would remain unaffected.

[12] Because specific budget information was not available at the time this report was written, the impact estimates are based on multipliers generated by the standardized passive treatment budget analysis.

[13] Willingness to Pay estimates are derived from what is known as the Contingent Valuation Method (CVM) approach to measuring benefits. In this case, this method provides an estimate of what economists call *consumer surplus*. Consumer surplus is the value consumers receive above and beyond the price they pay for a good. Because, in the case of Deckers Creek, restoration funds would be financed by external funds, respondents receive the good they value at no actual restoration cost. WTP figures, however, can be used as guides for setting access fees or use rates when appropriate or necessary. They can also be used as a guide to determine if investment of public funds will generate an equal or greater public benefit.

The last U.S. Fish and Wildlife economic survey in 2001 estimated the net economic value of an average bass fishing trip in WV at $25 per day. According to FODC (2005), a restored Deckers

would potentially support various types of bass as well as other fish. The average wildlife-viewing trip was estimated to generate $47 of economic value to the visitor. Phaneuf (2002) surveyed anglers to estimate the value of a statewide water quality improvement program in North Carolina and found that anglers' mean willingness-to-pay for overall water quality improvements was $5.90 per trip.

[14] The value of remediation of AMD and garbage but not bacteria problems was estimated to be less than $1 million annually. Respondents expressed a higher value for full restoration than for the sum of each individual restoration benefit. In other words, respondents were willing to pay more for a full stream restoration than a moderate stream restoration. Anglers had the highest value for stream restoration. This underscores the point that benefits from different restoration projects are not simply additive. Restoring aquatic life to Deckers while ignoring bacteria contamination would undermine many users' expected benefits from fishing activities. By the same token, providing a fishable and swimmable stream may encourage more public participation in organized garbage removal activities and discourage dumping and littering along streambanks—an example of future costs reduced or avoided.

[15] Economic impact studies of fishing and recreation benefits often attempt to estimate the benefits of new recreation-related expenditures in the community by multiplying the expected number of increased visits by the average spending on a stream-use trip (fishing, boating, etc.). The travel cost method (TCM)—an accounting of the variable costs stream users' pay to reach different destinations that are characterized by different attributes—estimates the marginal value of, for example, more fish, better stream quality, increased convenience of amenities, etc. With these estimates, a demand curve can be derived for users' value of one additional unit of stream quality or one additional unit of fish population.

Using estimates of increased angling use of Deckers Creek to anticipate the impact of increased fishing expenditures or visits in an entire county can be complicated when factoring in substitution effects. Anglers, for example, may make more fishing trips if the opportunity to fish is more conveniently located and surrounded by other activities amenable to a full day of family activity. Alternatively, they may make more trips to a restored Deckers Creek but they may be trips that the angler substituted in place of, for example, a trip to the nearby Cheat River. Reliably teasing out these behaviors can require extensive and costly surveying even after the restoration, when actual rather than just expected behaviors can be evaluated.

[16] Hedonic price models are used to estimate the effect of water quality on housing prices. Estimates can either be based on price differences between comparable homes on different quality streams or the analysis can be based on changes in property values as a result of changed stream quality over time.