# 3. JOBS AND ECONOMIC ACTIVITY

Local economic benefits from AMD remediation accrue to a community or region in various ways. This analysis estimates the regional economic impacts in terms of local wages, contracts, and purchases that would be generated from the remediation project expenses.[2]

**Input-Output Analysis**

Input-Output Analysis, like that described in this section, is a means of examining relationships within an economy, both between businesses and between businesses and consumers. It captures money market transactions for consumption in a given time period. The resulting mathematical models allow examination of the effects of change in an economy (Minnesota IMPLAN Group, 2004).

As described in Section 1, site-specific analyses will be required to choose the most appropriate treatment technologies at each site across the watershed; however, one-time capital costs may range between $110 and $453 million and annual O&M expenditures may be up to $16 million. The focus of this section is to calculate the financial benefits to businesses and families in the WBSR watershed and in Pennsylvania, should these expenditures be made.

A computer tool called IMPLAN estimates how expenditures benefit an economy by tracking the way they circulate through the regional economy from the purchase of locally produced inputs and provision of local employment. For example, a dollar spent to remediate AMD circulates in the regional economy approximately 1.5 times—this is called the "multiplier." The multipliers from this analysis actually range from 1.36 to 1.87, depending on the scenario. Multipliers are higher if the goods and services required to complete the remediation are available locally, and smaller if the goods and services must be brought in from elsewhere to accomplish the work.

More specifically, the IMPLAN model uses real economic data from the study area to estimate how funds spent in various economic sectors are used to purchase additional goods and services and to what degree those purchases are likely to be local. For example, a construction firm may receive a contract to grade and prepare land on a site. Based on business data collected in the central Pennsylvania counties, regional construction firms are expected to spend set portions of those funds to purchase local labor and gasoline, rent equipment, and buy grass seed. Workers on the project then spend portions of their wages locally to purchase daycare, food, and other household items. The expenditures circulate through the local economy in that way until they are eventually used to purchase goods and services from outside the study area (e.g., surveying equipment from Ohio, imported clothes, or a vacation to Las Vegas).

Another way to consider this concept is that for every $1 of external funds spent on local AMD remediation, local economies actually *receive* $1.36 to $1.87 in local economic activity in addition to healthy streams. In other words, the businesses and workers in the watershed not only gain economically from the cleaner, safer environment; they also receive wages and make purchases from regional businesses that amount to more than the remediation expenditures. New treatment systems create direct green-collar jobs to build and maintain the systems, as well as

[2] The estimates in this section represent gross, not net benefits from remediation. The funds for remediation expenditures are assumed to come from outside the watershed; therefore, the corresponding economic losses due to taxation needed to generate these remediation funds are not included in this analysis.

indirect jobs based on the cycled or multiplied spending of wages and the secondary purchase of necessary inputs.

From a local government perspective, that also means that additional tax revenue would be generated from the restoration economy. Each business or worker that receives payment for remediation work will pay taxes as the investment dollars circulate through the local economy from construction firm income, to employee paycheck, to daycare, and so on. This boost in local tax revenue would be a timely and significant boost to county and local governments hoping to build parks, greenways, or other kinds of recreational support networks to help people take advantage of newly restored streams and land.

IMPLAN can also be used to estimate the economic benefits from increased tourism, increased recreation expenditure, and other benefits derived from newly restored environmental amenities (Prato, 2006; Weisskoff, 2000; Minnesota IMPLAN Group, 2004). For the West Branch analysis, these other benefits were estimated with different methodologies and IMPLAN was used only for estimating the benefits from increased restoration expenditures in the study area.

## 3.1 Methodology

We based this analysis on the range of estimated remediation costs for the entire WBSR watershed, as described above.

IMPLAN was used at two levels. At the watershed scale, IMPLAN estimates a multiplier based on the structure of the economies of the 13 main watershed counties.[3] IMPLAN was used a second time to estimate the benefits to the entire state. Regional purchase coefficients (RPCs)—the percentage of the initial direct demand that is supplied within the modeled region—were based on the model's assumptions.[4] "Regional" is defined by the 13-county watershed area in the first case, and by the state of Pennsylvania in the second case.

For the state-level analysis, the model-derived RPCs are higher, resulting in additional overall benefits to the entire state. This occurs because some materials not likely to be supplied in the WBSR watershed would be found elsewhere in the state, ensuring that more expenditures benefit the state economy.

The cost data and descriptions used in the IMPLAN analysis were based on the SRBC (2008) report and communications with two principal authors of this report (Clark, 2008a and b; Rightnour, 2008a and b). Cost estimates for that report were developed using water quality monitoring data with AMDTreat[5] and the Watershed Restoration Analysis Model.[6]

[3] Cambria, Cameron, Centre, Clearfield, Clinton, Elk, Indiana, Lycoming, Montour, Potter, Sullivan, Tioga, and Union Counties are included in the watershed-scale IMPLAN analysis.
[4] For each category, IMPLAN assumes that some portion of direct demand would be supplied within or outside of the area of interest.
[5] AMDTreat is a software package that estimates abatement costs for AMD using a variety of passive and chemical treatment types (OSMRE, 2008).
[6] The Watershed Restoration Analysis Model was developed by Water's Edge Hydrology Inc. and was used by SRBC (2008) to simulate active and passive AMD treatment systems and costs in the WBSR watershed.

**Picture 4: Examples of active and passive treatment systems**

Note: Active system on left shows lime dosers on Porcupine Run in the Bennett Branch watershed. Passive system on right is on Middle Branch in the Kettle Creek watershed. Photo credits: Amy Wolfe.

Specific budgets, estimated with AMDTreat for projects within the study area, were evaluated. Expenditures for the budgets were categorized by percentage in each distinct North American Industry Classification System code. After detailed sectors were combined into the more general sectors used in IMPLAN, the budgets demonstrated overall consistency with the expenditure categories and percentages estimated by Rightnour for active and passive projects (2008a and b). As shown in Table 3, expenditures were ultimately classified into four general sectors: construction, engineering, materials, and remediation.

**Table 3: Expenditures by category for active and passive treatment**

| | Percent of capital costs | | Percent of O&M costs | |
|---|---|---|---|---|
| **Category** | **Passive** | **Active** | **Passive** | **Active** |
| Construction | 60% | 70% | 0% | 0% |
| Engineering | 10% | 10% | 0% | 0% |
| Materials | 30% | 20% | 0% | 0% |
| Remediation | 0% | 0% | 100% | 100% |
| Total | 100% | 100% | 100% | 100% |

Using these percentages, multipliers were then modeled for capital costs and extrapolated to the watershed estimates as a whole.[7] For annual O&M costs, expenditures were classified into the

[7] The IMPLAN model makes a variety of assumptions that allow percentages to simply be applied to total costs without added distortion to results. These assumptions include: constant returns to scale; no supply constraints; fixed commodity input structure; homogenous sector output; and industry-wide uniform technology assumptions. These assumptions are acceptable in this situation because the total amount of spending actually represents a variety of

single category called "Remediation,"[8] given the suite of activities that will be required. Annual costs will likely grow over time, but assuming they grow no faster than the rate of inflation, the estimated value of annual benefits reported here is expressed in 2008 dollars.

Materials were collectively classified as wholesale trade. While actual materials would include soda ash, lime, mushroom compost, and others, the differences among the multipliers for these items was nominal and the percentages of each that are used vary significantly based on site characteristics. The industry/commodity category in IMPLAN for wholesale trade included a variety of chemicals and input materials like lime and wholesale compost. The RPC or estimate of locally supplied demand for this industry was 50.1%, which reflects Rightnour's (2008b) estimate of the actual trends for supply of project materials.

The IMPLAN model chosen as the appropriate multiplier model for this analysis was the Social Accounting Matrix. These multipliers account for direct effects (government contract to engineering firms), indirect effects (engineering firms' purchases of equipment at retail outlets), and induced effects from labor payments that reflect social security and tax withholding, savings, commuting, and other details.

## 3.2 Results

The results shown in Table 4 are organized by expenditure type and by study area. Estimates are analyzed separately for the WBSR watershed and for the whole state. Ranges are provided based on the high and low estimates of the capital and annual expenditures required to remediate the WBSR watershed.

**Table 4: Multipliers, benefits, wages, and jobs resulting from remediation expenditures**

| | Multiplier | Benefits (million $) | Wages to labor (million $) | Jobs |
|---|---|---|---|---|
| **To WBSR watershed** | | | | |
| Capital | 1.36-1.37 | 151-616 | 42-168 | 1,038-4,120 |
| Annual O&M | 1.44-1.45 | 23 | 5 | 152-157 |
| **To state** | | | | |
| Capital | 1.80-1.85 | 204-817 | 77-300 | 1,531-5,892 |
| Annual O&M | 1.87 | 30 | 9 | 185-186 |

Note: Wages to labor are a share of total local benefits.

These results demonstrate the potential gains in economic activity that would accrue to the regional economy from AMD remediation spending. WBSR businesses and families stand to gain significantly—both directly and indirectly—from remediation efforts. Approximately 70% of direct project purchases can be supplied within the watershed, resulting in strong WBSR watershed multipliers for the project of between 1.36 and 1.45.

smaller projects with similar product/service demand patterns. Therefore it is not likely that the scale of total spending would result in a changed structure or the regional economy.

[8] This IMPLAN remediation category includes 107 types of businesses that include, among other things, mine reclamation services and remediation and clean up of mine sites. Even if O&M is performed by watershed associations, this category is the closest to capturing the pattern of expenditures expected for O&M of AMLs.

Expenditures on annual O&M are expected to permanently create between 152 and 157 new jobs within the watershed counties. This is in addition to the short term boost in employment that would occur from initial capital expenditures: between 1,038 and 4,120 jobs, depending on the treatment scenario. About 60% of these jobs are green-collar jobs because they include the people who design, build, and maintain treatment systems.

The Commonwealth of Pennsylvania stands to gain even more. Nearly 93% of the total direct demand is likely to be supplied with goods and services from within the Commonwealth. Benefits from the low estimate of $110 million in remediation expenditures can conservatively be expected to generate $204 million in economic activity, not including the additional benefits that would accrue from restored streams. Benefits from the high estimate of $453 million in remediation expenditures would generate $817 million in additional spending within the Commonwealth.

In terms of employment, about 185 permanent jobs in Pennsylvania would be created based on the annual O&M expenditures. The initial capital expenditures would generate between 1,531 and 5,892 direct and indirect jobs in Pennsylvania. An estimated 52% of these jobs are likely to be green-collar jobs.

## 3.3 Summary

When money is spent to design, build, operate, and maintain AMD treatment systems, the local region and the state as a whole stand to benefit. Thousands of jobs are created, wages are paid, goods and services are purchased, and money circulates through the local economy, providing an even greater boost.

Local benefits are greatest when funds come from outside of the watershed and outside of the state (as compared with expenditures paid for with local tax revenues). AML Fund dollars, which fund significant amounts of AMD treatment, are allocated to Pennsylvania from the federal government.

The benefits calculated in this section are in addition to the significant benefits discussed in other sections that result from cleaner streams and drinking water sources and revived fisheries.