Muskingum River Economic Valuation: Phase II Executive Summary

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This is the second phase of a two-phase economic evaluation of the Muskingum River corridor in Southeast Ohio. The intent of the overall study has been to develop estimates of the benefits and costs of various river corridor improvements or changes as a guide to public policy on river restoration and improvement. When the various corridor benefits or values are expressed in a common economic metric and compared to their economic costs, one has a basis for viewing river corridors and their improvements in an economic development context.

In fact, the genesis of this study was from community leaders in the Muskingum River corridor who were concerned about the depressed economic situation of their communities. They contacted Rivers Unlimited for help and Rivers Unlimited in turn contacted our resource economics group in the Department of Agricultural, Environmental and Development Economics at The Ohio State University. Jointly we explored what types of improvements in the river corridor might directly result in or are catalysts for improved economic well-being and developed methods for measuring them. We have drawn heavily on the methodological literature in resource economics known as non-market valuation and from the benefit cost analysis and benefit transfer literature.

This two-phase study has focused on one river corridor and its relevant improvements including the repair of historic dams and locks, extension of an existing bike trail, improvement of household septic systems and the past establishment of municipal zoning. However, our future intent is to explore other improvements in other selected rivers in order to develop a template and the capability to simulate benefit cost outcomes for a wide range of river scenarios.

The methods applied for estimating costs in this study are market-based opportunity cost concepts. Benefits are more difficult to observe in market transactions for each of the corridor improvements, so benefit transfer, hedonic pricing and contingent valuation survey methods are utilized. In all cases conservative assumptions are chosen to provide lower bound estimates of net benefits and to avoid overstating the economic merits of the selected corridor improvements. In order to easily compare benefits and costs that are occurring over time, we express both the benefits and costs in 1999 dollar values. This is known in the economic jargon as using a discounted present value. Simply stated, when we faced a benefit (or cost) that would be incurred in the future, we used a discount rate to express it in present day terms. Unless otherwise noted, this paper discusses the results obtained using a 10% discount rate.

A. Infrastructure Results

Earlier US Army Corps of Engineers analysis projected large increases in Muskingum River corridor recreation; the corps maintained that these values justified large future investments in lock and dam improvements. Our analysis shows that recreational use values do not offset the costs of lock and dam repair/upgrades. We demonstrated this with evidence that repairs and upgrades made in recent years have not resulted in any measurable increases in recreation use. Decreases in lock use have in fact been the norm. This evidence was combined with benefit transfer techniques and day use values for various types of recreation (e.g. boating, fishing, picnicking and visiting) common in the Muskingum Corridor.

Since use values are inadequate, we explored non-use (existence, historic preservation) values through the use of a contingent valuation survey of willingness to pay for lock and dam repair by a sample of the adult residents of Ohio. These results suggest benefits large enough to exceed the discounted present value costs of lock and dam repair. The benefit cost ratio is 1.51 and the net present value $5,876,000.

The proposed extension of the Zane's Landing bike trail was evaluated with a similar approach. Construction cost estimates were available for the proposed trail and it was possible to get information on annual operating and maintenance costs from other trails in Ohio. The benefits were estimated by aggregating the results from the aforementioned contingent valuation survey and the forecasted trail use. Once again the findings are supportive; the benefit cost ratio is 6.49 and the net present value $11,261,000.[1]

B. Zoning and Septic System Results

The costs of zoning and improved household septic systems were determined from interviewing those involved in the provision of each. The analysis of the benefits was more complex. Both zoning and household septic systems are expected to impact residential property values, so we chose a hedonic pricing method to estimate this effect. Hedonic pricing statistically decomposes the housing/property values into house, community, and environmental attributes and estimates the relative values of each of these attributes. In the case of household septic systems we felt it appropriate to assess benefits accruing to other stream users besides river corridor residents. Thus, the contingent valuation survey was utilized to approximate these values and the results were combined with the hedonic estimates.

From the hedonic model it was possible to determine the effect of the presence of zoning, central sewer system, individual household septic system and river proximity on residential property values in the corridor. The aggregate values are as follows: zoning

[1] To avoid possible confusion, it is important to point out that the trail usage values taken from the study of the trail in Dubuque, Iowa are measures of the expenditures made by the users of the trail. This is a different measure than the day use values used for boaters, fishermen, etc. taken from the Walsh study which are a measure of economic surplus. Thus, the aggregation of the trail usage values and the CV results does not pose a problem of double counting.

$912,497; central sewer $678,300; household septic systems $1,469,650; and river proximity $636,650. The hedonic benefits for zoning when compared with costs show a benefit cost ratio of 6.35 and NPV of $768,793. The combined hedonic and CVM results for household septic systems (with a local government 50% cost share of installation and full coverage of repair and cleaning) showed a benefit cost ratio of 2.78 and NPV of $8,274,812. The results of a program of full governmental subsidization were a benefit cost ratio of 1.39 and NPV of $3,633,894

C. Sensitivity Analysis and Aggregation of Results

Tables VIIa and VIIb present the results of performing sensitivity analysis by using discount rates ranging from 6 to 15 percent. This allows us to determine how robust or stable the results are as the opportunity cost of capital increases. This refers both to whether or not the various corridor attributes/ improvements continue to be economically viable as well as to whether the ranking of the attributes changes.

Even at 15% all of the corridor improvements have benefit cost ratios greater than 1; in other words, they remain economically viable. Stated alternatively, the internal economic rates of return for all of the corridor improvements are greater than 15% (see Table VIIc). However, the ranking of the alternative improvements does change with increases in the discount rate (between 8 and 10 and between 10 and 12%) as shown in Table VIIb.

Table VIIa: Benefit Cost Ratios at Alternative Rates of Interest

	Benefits over Costs					
Attribute	**4%**	**6%**	**8%**	**10%**	**12%**	**15%**
Zoning	4.70	5.27	5.82	6.35	6.86	7.58
Septic (Fully Subsidized)	1.39	1.39	1.39	1.39	1.39	1.39
Septic (Cost Sharing)	2.78	2.78	2.78	2.78	2.78	2.78
Bike Trail	8.01	7.35	6.86	6.49	6.22	5.94
Dam & Lock	0.88	1.06	1.27	1.51	1.75	2.16

Table VIIb: Ranking of the Attributes (on the Basis of Benefit Cost Ratio) at Different Rates of Interest

Attribute	4%	6%	8%	10%	12%	15%
Zoning	**2**	**2**	**2**	**2**	**1**	**1**
Septic (Fully Subsidized)	**4**	**4**	**4**	**5**	**5**	**5**
Septic (Cost Sharing)	**3**	**3**	**3**	**3**	**3**	**3**
Bike Trail	**1**	**1**	**1**	**1**	**2**	**2**
Dam & Lock	**5**	**5**	**5**	**4**	**4**	**4**

At a 10% discount rate (a discount rate commonly used in this type of analysis) it is instructive to compare and aggregate the net present value and benefit cost ratio results for the corridor improvements. Table VIIc presents these results.

Table VIIc: Summary of Aggregate Benefit Cost Results in 1999 Dollars (Using a 10% Discount Rate)

Improvement	Present Value of Benefits	Present Value of Costs	Net Present Value (B-C)	Benefits/ Costs (Ratio)
Zoning	$912,000	$144,000	$769,000	6.35
Septic (Fully Subsidized)	$12,916,000	$9,282,000	$3,634,000	1.39
Septic (Cost Sharing)	$12,916,000	$4,641,000	$8,275,000	2.78
Bike Trail	$13,311,000	$2,050,000	$11,261,000	6.49
Lock & Dam	$17,511,000	$11,635,000	$5,876,000	1.51
Total (Fully Subsidized)	**$44,650,000**	**$23,111,000**	**$21,539,000**	**1.93**
Total (Cost Sharing)	**$44,650,000**	**$18,470,000**	**$26,180,000**	**2.42**

When using the benefit cost ratio efficiency criterion and a 10% discount rate, the bike trail extension and zoning rank first and second followed by cost sharing of upgraded household septic systems and lock and dam operation and repairs. Full subsidization of septic systems ranks last but does have a benefit cost ratio greater than one. With the net present value criterion, which is influenced by the scale or size of investments, the bike trail ranks first, followed by the cost sharing of upgraded household septic systems, the locks and dams, the full subsidization of household septic systems and zoning respectively. In total, the four improvements have a net present value of $26.2 million and a B/C ratio of 2.42.

D. Limitations and Further Research

Any research endeavor has limitations and this study of the Muskingum River is no exception. In an ideal world, better water quality data and higher response rates on the CVM survey would have been preferred. More evidence on establishment costs for zoning, and the economic and environmental value of river water for AEP's cooling needs in electric power generation would all improve the study results. More detailed second stage estimates of actual demand functions in the hedonic price analysis, estimation of economic internal rate of return and development of bid functions for the CVM survey results would improve the accuracy, generalization and explanation of results. Several of these issues will be addressed in the thesis research of Sarah Lowder and Radha Ayalasomayajula.

E. Policy Implications

These research results have some important policy implications in spite of the limitations highlighted in the previous section and the need for further research. First, the methods and results demonstrate that it is possible to develop economic metrics for the costs and benefits of selected river corridor attributes. In addition, these results provide evidence for ranking corridor improvements based on the benefit cost ratio and net present value of each attribute. However, if magnitude or scale of the attribute improvements varies considerably, the ranking of attributes according to benefit cost ratio and net present value may be different.

Benefit cost ratios greater than one and positive net present values were evident for all Muskingum River Corridor attributes and improvements even though fully subsidized household septic systems were not considered politically viable. So, in general, the economic rationale for river improvement and restoration is supported. As an investment strategy one might propose to proceed by implementing corridor improvements on the basis of their relative economic efficiency based on their benefit cost ratios. Some caution must be exercised. One might expect improved septic systems, lock and dam restoration and the bike trail extension to result in increased economic well being in the Muskingum River Corridor. However, limited opportunity may exist for additional municipal zoning and hence it is unlikely that additional benefits from zoning will occur in the future.

One potential benefit of these economic methods and results is to reduce conflict and transaction costs in the policy process. For example, applying a common economic metric to river corridors and other natural systems may make it possible for state departments of natural resources and economic development to find more common ground in improving the well being for state citizens. Business and environmental interest groups may also be able to build more consensus and lower decision making (e.g. litigation) costs.

The future challenge is to build more public support for additional resource economic analysis of rivers and other natural systems. Our intent is to expand the river economic analysis to other corridors where we can study water quality variations, toxics and dam removal and restoration of channelized streams. We feel confident that as additional economic evidence is generated, we will be able to develop templates that allow us to simulate results for other issues and river corridors.