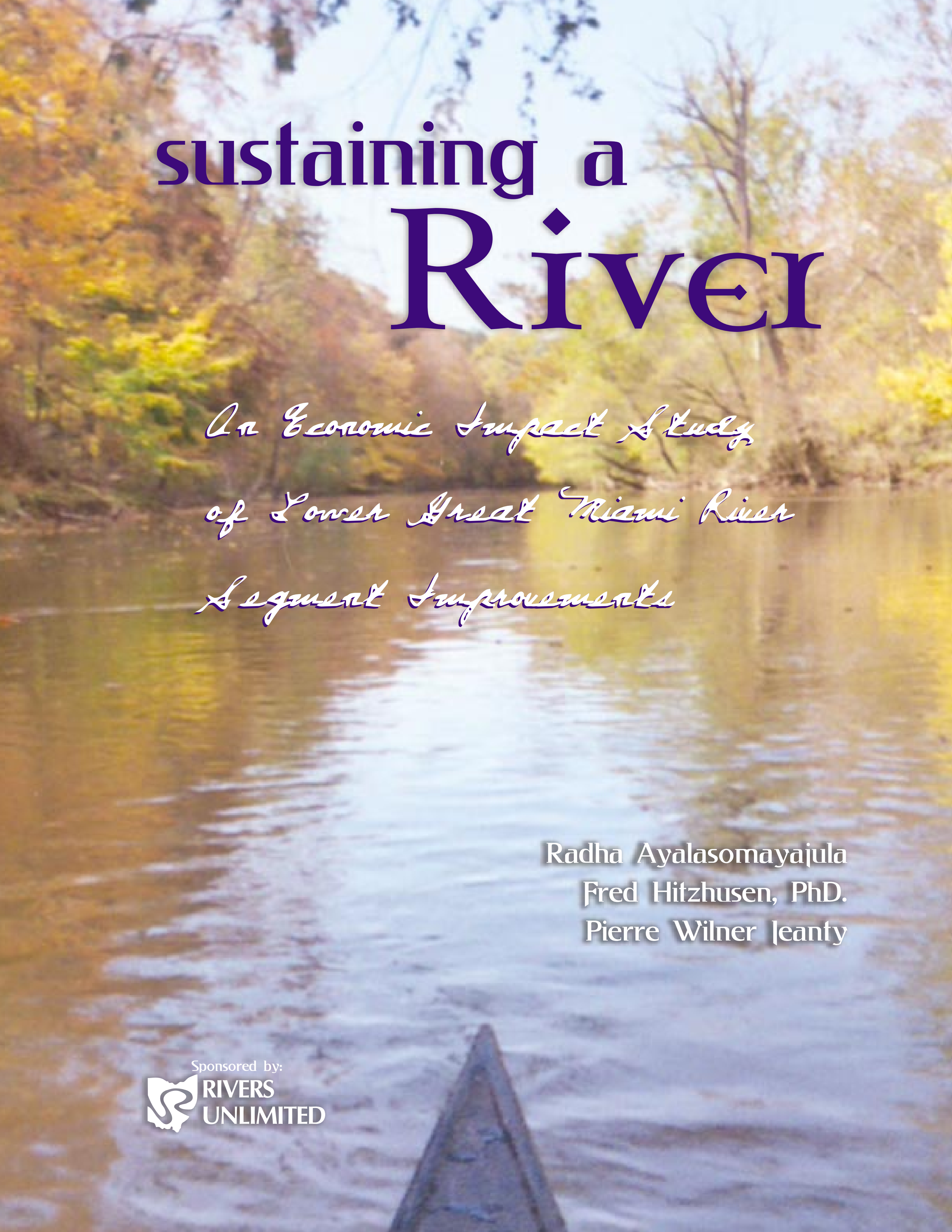

sustaining a River

An Economic Impact Study of Lower Great Miami River Segment Improvements

Radha Ayalasomayajula
Fred Hitzhusen, PhD.
Pierre Wilner Jeanty

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Photo by Marilyn Wall

Dan Vogel and Rivers Unlimited President Mike Fremont - Marathon Canoe Racers.


Photo by Marilyn Wall

A glorious section of the Great Miami River between Indian Lake and Troy.

Preface

The Great Miami is a beautiful river.

In 2001, citizens familiar with the Great Miami met to consider the direction of a River Resources Economic Study of the 27-mile stretch through Butler and Hamilton Counties to the Ohio River. They were concerned at the present rapid growth of undesirable development that could occur near to, or affecting the river, not in accord with their vision of what the river should be.

They were interested in the costs of protecting the river along scenic stretches and improving it where it was seen to be degraded. They wanted to know the potential *economic benefits* if certain actions were taken, namely:

- Extension of a greenway or bikeway along the river, mindful of the highly successful, now 20 year old trail, along the Little Miami River.
- Building access points along the river, consisting of small-boat launching ramps, restrooms and parking lots.
- Setting aside a forested buffer zone along both sides of the river where possible to filter runoff of soil and pollutants and shield the river from the view of structures and industrial/commercial activities.
- Minimizing the adverse effects of gravel mining along the river.

Within the scope of the study, we were able to establish that a bikeway would generate $2.8 million per year over a 25-year period at present prices and applicable interest rate, for a benefit/cost ratio of 7.21. Likewise, three access points would benefit the regional economy at the rate of $740,000 per year for 25 years at a benefit/cost ratio between 3.32 to 4.57. A greenway/bikeway would actually be a one-side-of-the-river buffer zone. Addressing the complexity of a border or riparian strip in this area would require a separate study.

Gravel operations along the river degrade residential values within one mile of a gravel plant by an average of $16,000, with significant effects on tax base, a decrease of $2.8 million as loss to the resource base, and hence, a loss to the local governments in the form of tax revenues, amounting to more than $100,000 per year.

This is the latest of several River Resource Economics studies at the Ohio State University sponsored by Rivers Unlimited since 1997. (See our website at www.RiversUnlimited.org) This version of the study differs from the original in being more compact, direct and citizen comprehensible. The original is in the language and format for professional economists, has been peer reviewed and will be published in economic journals.

The threat of adverse development is real. The Great Miami is on the Nationwide Inventory of Rivers as technically qualified, in this stretch, to be named a National Wild and Scenic River. Only 11,000 miles of rivers (out of 3,500,000 miles) in our country have been so designated (3/10ths of 1 percent) – in 35 years of the National Wild and Scenic Rivers Act.

If the Great Miami becomes degraded it could lose this highly valuable status.

Mike Fremont,
Cincinnati, August 2003

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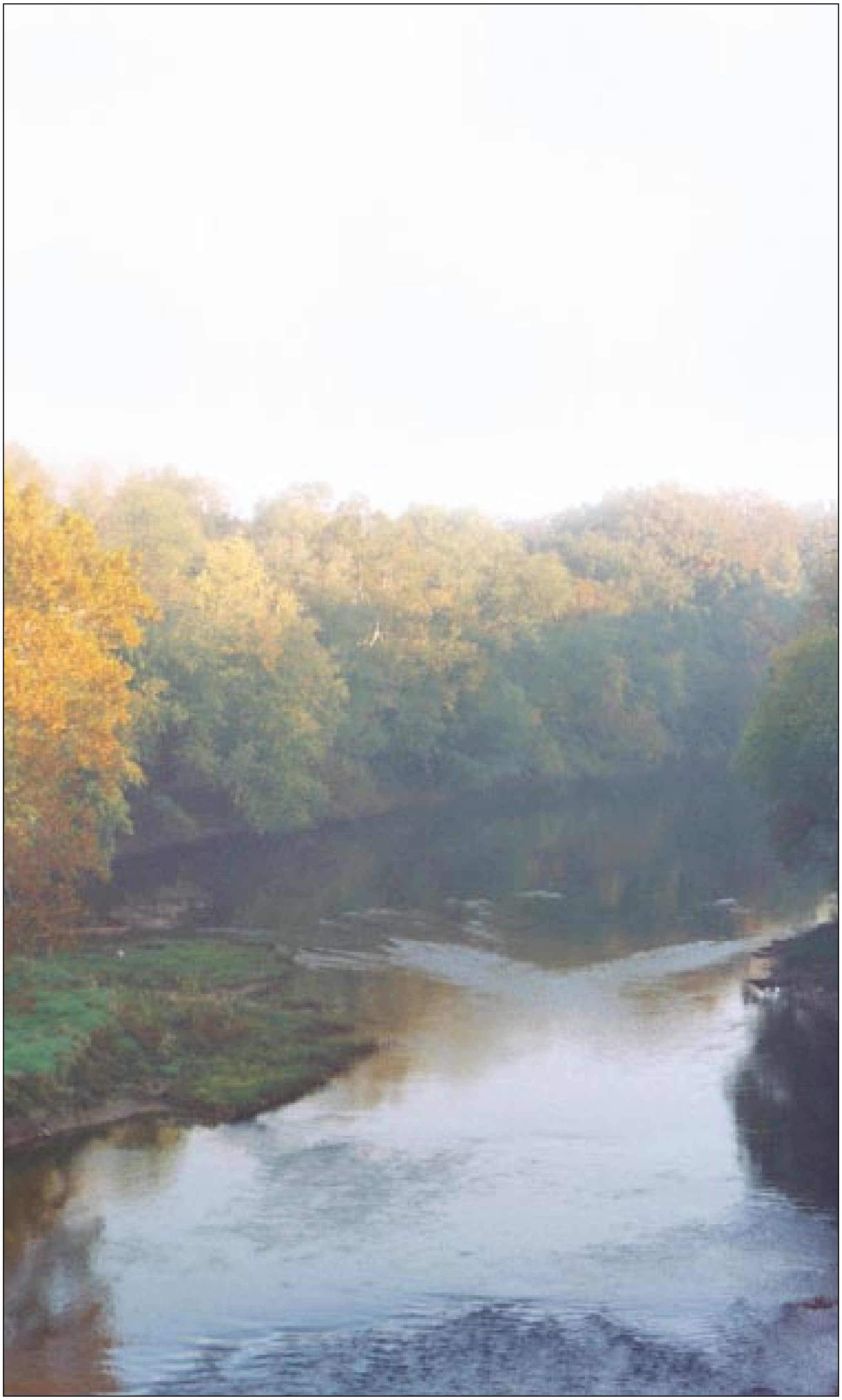


Photo by Marilyn Wall

Section 1

Introduction

Eventually, all things
merge into one,
and a river runs through it.

-Norman Maclean,
A River Runs Through It

1.1 Introduction

The Great Miami River Watershed is located in the southwest region of Ohio. This system includes the Great Miami, Stillwater, Whitewater and Mad Rivers. The drainage area of these systems in Ohio is 4,277 square miles. Total drainage area including that part in Indiana is 5,702 square miles.

The Great Miami River is 155 miles in length, and its watershed includes all or part of 15 counties with the headwaters in Hardin and Auglaize counties and the mouth in the Ohio River in Hamilton County. Interstates 70 and 75, two of the nation's longest Interstate highway systems, intersect just north of Dayton. Dayton, with a population of 190,000, is the largest city within the watershed. Other major cities within the watershed exceeding 50,000 populations include Springfield, Hamilton and Middletown. Cities with more than 20,000 people include Piqua, Troy and Fairfield. Each of these major population centers is located adjacent to one of the waterways in the watershed.

Some of the most significant water resource features in the watershed are the Stillwater State Scenic River, the Great Miami buried valley aquifer, the five major dams (dry) and flood protection system of Miami Conservancy District (MCD), and Indian Lake, a remnant of the Miami-Erie Canal system and one of the largest lakes in Ohio. Others are the C.J. Brown Reservoir and Brookville Lake on the Whitewater River in Indiana.

The Stillwater River above Englewood Dam and Greenville Creek has been designated a State Scenic River. There are 2,360 miles of rivers and streams in the Great Miami River Watershed. Water quality in the watershed's rivers and streams has shown strong improvement over the last 20 years. The following tables (1.1-1.5) provide attainment data of WWH (warm water habitat) and EWH (exceptional water habitat) use designators collected by Ohio EPA (1997) in its stream surveys:

Table 1.1

Attainment of WWH and EWH Designators for the Watershed in 1995	
Attainment	**Miles**
Full	427.3
Threatened	40.3
Partial	309.5
Non-Attainment	285.3
Total Miles Assessed	1063.0

Table 1.2

Attainment of WWH & EWH Designators for the Lower & Middle Great Miami River			
Attainment	**Year 1980**	**Year 1989**	**Year 1995**
Full	1.6 miles	6.6 miles	49.7 miles
Partial	5.9 miles	63.5 miles	49.7 miles
Non-Attainment	82.5 miles	19.9 miles	4.0 miles

Table 1.3

Attainment of WWH and EWH Designators for the Segment Between Dayton & Middletown			
Attainment	**Year 1980**	**Year 1989**	**Year 1995**
Full	1.6 miles	6.6 miles	29.9 miles
Partial	3.6 miles	20.7 miles	3.6 miles
Non-Attainment	29.8 miles	7.7 miles	1.5 miles

Table 1.4

Attainment of WWH and EWH Designators for the Segment Between Middletown to Hamilton			
Attainment	**Year 1980**	**Year 1989**	**Year 1995**
Full	0.0 miles	0.0 miles	7.0 miles
Partial	0.8 miles	16.3 miles	12.6 miles
Non-Attainment	19.2 miles	3.7 miles	0.4 miles

Table 1.5

Attainment of WWH and EWH Designators for the Segment Between Hamilton & Ohio River			
Attainment	**Year 1980**	**Year 1989**	**Year 1995**
Full	0.0 miles	0.0 miles	12.8 miles
Partial	1.5 miles	26.5 miles	20.1 miles
Non-Attainment	33.5 miles	8.5 miles	2.1 miles

The improvements in water quality correspond to substantial reductions in the loadings of oxygen demanding wastes, ammonia-N, and other substances discharged by point sources. The most significant improvement occurred in the segment between Dayton and Middletown due to the improved treatment of sewage by the county and municipal wastewater treatment plants (Ohio EPA 1997).

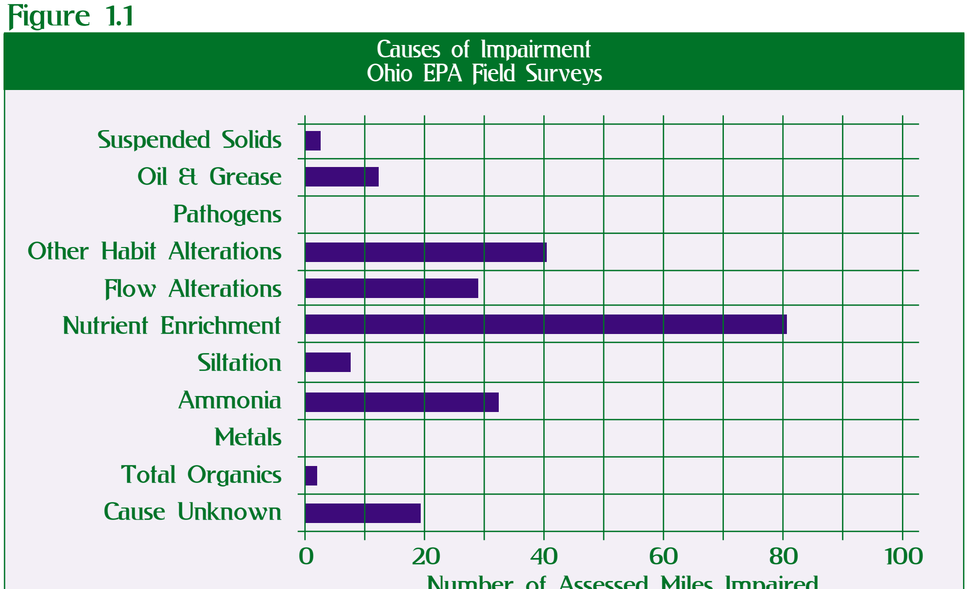
1.2 Aquatic Health of the Great Miami River

Evaluation of fish and macroinvertebrate community performance in streams and rivers draining the Great and Little Miami River Basins indicates that most streams meet basic aquatic-life-use criteria set by the Ohio Environmental Protection Agency for warm water habitat. Stream reaches whose biological community performance meet aquatic-life-use criteria defined for exceptional warm water habitat are found in Twin Creek, the Upper Great Miami River, the Little Miami River, and the Whitewater River Basins. Other streams have exhibited significant improvements in biological community performance (and water quality) that are attributed primarily to reduced pollutant loadings from wastewater treatment plants upgraded since 1972.

According to the Ohio EPA, the Lower Great Miami and Whitewater River Watershed is impaired primarily by nutrient enrichment and habitat alterations. Over 80% of the river miles are impaired by nutrient enrichment and 40% by other habitat alterations. Such severe river and stream impairments commonly result from human development, inadequate agricultural practices and land use changes in the surrounding area. General mining is included in this category, and is not presented separately.

Throughout its 155 mile length, the Great Miami flows over 20 dams. The plunge pools, eddies and runs below these dams often hold significant concentrations of fish. Almost all species of game fish seem to congregate below these low head dams. Fly anglers have been known to catch smallmouth, largemouth, saugeye, carp and channel cats.

Figure 1.1



Source: http://tycho.cfm.ohio-state.edu/front.html

The Great Miami buried valley aquifer consists of ancient river valleys filled with permeable deposits of sand and gravel capable of storing vast amounts of groundwater. The buried valley aquifer has sustainable yields of 500 to 3,000 gallons per minute. This aquifer system was designated by the U.S. EPA as a 'Sole Source Aquifer' in 1988. An estimated 97% of the population in the watershed relies on groundwater for their drinking water supply. The Great and Little Miami River Basins drain approximately 7,354 square miles in southwestern Ohio and southeastern Indiana and are included in the more than 50 major river basins and aquifer systems selected for water-quality assessment as part of the U.S. Geological Survey's National Water-Quality Assessment Program.

Land-use and waste-management practices influence the quality of water found in streams and aquifers in the Great and Little Miami River Basins. Land use is approximately 79 percent agriculture, 13 percent urban (residential, industrial, and commercial), and 7 percent forest. An estimated 2.8 million people live in the Great and Little Miami River Basins; major urban areas include Cincinnati and Dayton, Ohio. Fertilizers and pesticides associated with agricultural activity, discharges from municipal and industrial wastewater-treatment and thermoelectric plants, urban runoff, and disposal of solid and hazardous wastes contribute contaminants to surface water and ground water throughout the area.

Following the Clean Water Act of 1972 national regulators shut down dirty industries and other easily identifiable, point-source polluters. Now they are focusing on less easily managed pollutants, including the sediment dredged up by gravel mines and runoff from developed areas and farm fields.

Photo by Marilyn Wall

1.3 Sand and Gravel Mining in Ohio

Sand and gravel mining is Ohio's second largest (on a tonnage basis) mining industry, next to coal. In 1996, 52.8 million tons of sand and gravel were produced in Ohio, making it the fourth-largest sand and gravel producing state after California, Texas, and Michigan. Sand and gravel mining also is the second-largest (on a tonnage basis) nonfuel mining industry in the United States; 1996 national production of construction sand and gravel was 1.07 billion tons.

Sand and gravel are the only mineral resources to be produced in every state and are the most widely produced mineral resources in Ohio – 84 of the state's 88 counties have reported commercial sand and gravel production during the past 50 years. In 1996, Ohio had 292 reporting sand and gravel mines operating in 64 counties. The top 10 sand and gravel producing counties, in decreasing order of production, in 1996 were: Hamilton, Franklin, Butler, Portage, Stark, Greene, Clark, Tuscarawas, Warren, and Montgomery. Together, these counties accounted for more than 61 percent of Ohio's sand and gravel production

The U.S. Army Corps of Engineers can control intentional landfill operations, but not those that stir up or drop sediment back into the river stream as a by-product of mining. "Anyone can get in there and move gravel and disturb creeks and there's less law than there used to be," according to Randy Hoover, aquatic biologist with the Ohio Department of Natural Resources' Division of Wildlife. Bulldozers and backhoes lumber along the banks and plow into the Great Miami River, scooping loads of gravel from beneath the murky water and depositing them on shore. Churning the water and changing the shape of the stream, gravel-mining companies are a primary environmental threat to rivers of the post-Clean Water Act age.

From a development point of view, gravel mining provides some benefits. It provides raw construction material and jobs. Retired mines have become recreational reservoirs such as the Dayton Hydrobowl on the Mad River, just north of where it joins the Great Miami. And many operate not within the river, but on the banks or in an area sectioned off from the main flow by a dike.

However, scientists (Kondolf, 1997, Krunkilton, Nelson, E.L. 1993, Jack, 2001) say mining may stir up sediment contaminated by past industrial spills, spreading toxins downriver. Fine-grained sand and silt can impede fish and bugs, and clog water treatment plants. Mining lowers the riverbed and causes the river to flow faster and cut deeper. It creates deep pools that may attract fish, but affects their natural feeding and spawning patterns. Mining on riverbanks destroys the natural buffer zone of trees and plants. A retired mine leaves a hole extending deep into the ground over the pollution-sensitive Great Miami Aquifer – the sole source of drinking water for more than 90 percent of Southwestern Ohio residents. Its use must be carefully regulated to protect the aquifer. Gravel mines dot the length of the Great Miami River, with a concentration in Hamilton County. There are several in Whitewater Township, which has no zoning authority and little opportunity for public control of land use policy. "Because we have the river, our area is rich in gravel and gravel is a commodity just like gold or anything else. It's a fact of life and it's an enterprising business," said Whitewater Township Trustee Hubert Brown. Most local governments are trying to balance economic interests and development pressure with environmental concern. But the increasing number of gravel mines is bringing the issue to a head. A few mines here and there were OK," Mr. Hoover said. "But now there are (many) and ... they remove a lot of material, and other permits are being applied for right now. What's important to the population – being able to mine gravel cheaply out of the river, or is it the overall health of the stream?"

Professor Mike Miller, of University of Cincinnati participated in a canoe float trip in June 2002 for Hamilton County commissioners to demonstrate the effects of gravel mining on the Great Miami River. He commented that, "in Alaska, the concept of washing in a river is gone. The water they put back has to be crystal clear, but here we still allow the mining of gravel from the bottoms of rivers and the use of big backhoes to go into the middle of rivers to pull out gravel, making vast plumes of silt. It's just archaic" (University of Cincinnati News Desk, 2001).

The method of choice for mining sand and gravel is primarily a function of depth to the water table. Outwash deposits lying above the elevation of adjacent streams generally are situated above the water table and thus can be mined using large earth-moving equipment such as front-end loaders and diesel-powered shovels. The portion of outwash and alluvial deposits lying below the water table is mined using floating vacuum dredges, floating clamshell dredges, floating bucket-ladder dredges, draglines, or diesel-powered shovels with long reaches. In some instances, a sand and gravel operation will use large earth-moving equipment to remove the portion of the sand and gravel deposit lying above the water table, then convert to a dredging operation to remove the remainder of the deposit lying below the water table. Mining below the water table creates an artificial lake.

Sand and gravel are sold by the ton (2,000 pounds). A ton of dry, loose sand or gravel has a volume of about 20 cubic feet. In 1996 in Ohio, a ton of sand and gravel sold for an average of $3.93 at the mine. As with all high-volume, low-value commodities, transportation is the dominant factor controlling the ultimate cost of sand and gravel delivered to a job site. The cost to transport sand and gravel by truck over open highways is variable but has averaged about 10 to 15 cents per ton per mile (the rate is higher for distances less than about 10 miles) during the 1990's. Long-haul transportation costs by barge, freighter, or rail may be as little as one-eighth the cost of long-haul truck transport. Transportation costs in congested urban areas generally are three to four times the cost of open-highway transportation. As an example, the cost of a dump-truck load of sand and gravel mined on the south side of Columbus doubles by the time it is delivered to a job site 10 miles away on the north side of the city. In order to minimize aggregate-transportation costs, it is essential that aggregate be produced as close as possible to urban centers where most aggregate is consumed. For this reason, forward-looking land-use planners and zoning officials are using geologic maps to designate selected areas within their jurisdictions for future aggregate-mining development.

After mining, sand and gravel pits are among the least expensive mining sites to reclaim and commonly are converted into aesthetically landscaped golf courses and attractive building sites for new houses. Post-mining land values commonly exceed pre-mining values when compared to non-mined land because of terrain improvements and the creation of wetlands and lakes and ponds for boating, fishing, and swimming. However, the appreciation of property values of most mining occurs only after reclamation of the mines as parks and golf courses.
(http://www.ohiodnr.com/geosurvey/geo_fact/geo_f19.html)

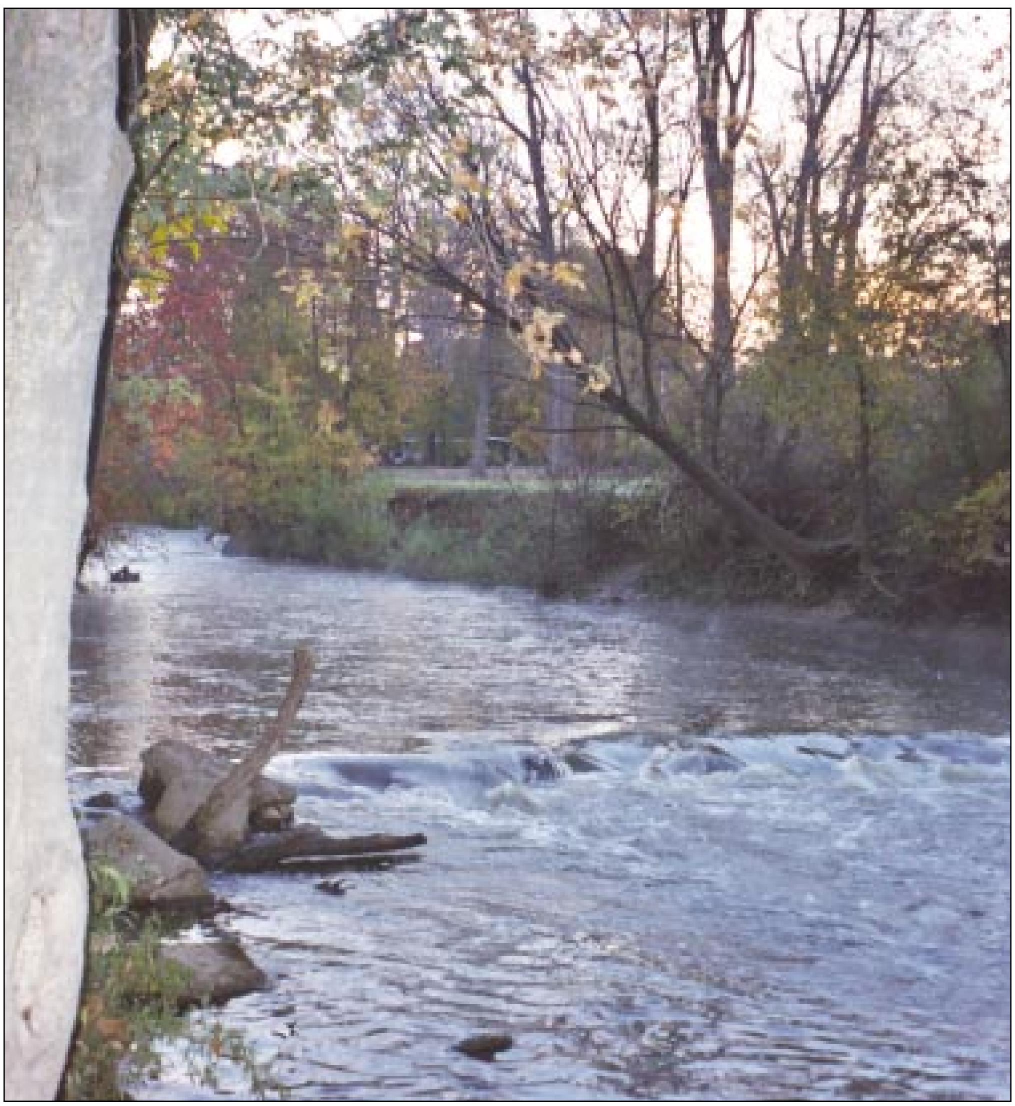


Photo by Marilyn Wall

1.4 Study Objectives

The objective of the study was to perform a comprehensive inventory of existing economic conditions of the corridor such as property values, recreation and tourism and estimate economic impacts of variations in water quality improvements and infrastructure from selected improvements to the community thus providing a rationale for investments in these improvements.

The study estimates through empirical analysis the effect of the following improvements of river corridor attributes:

- Installation of a buffer strip/zone and a bike trail along the river
- Installation of more access points to the river
- Regulation of gravel mining, operation and reclamation on the banks of the river

Photo by Marilyn Wall

1.5. Methodology

Methodologies to estimate the impact of property, community and environmental attributes on values of residential properties along the river, and the recreation and tourism value of the river are the hedonic pricing (HP) method and the benefit transfer (BT) method to determine the benefits and costs of buffer zones and new boating access points. Types of gravel mining regulation and reclamation from other states are summarized. HP and BT methods as well as information from interviewing local people and gravel mining officials were used to get rough estimates of impacts.

Section 2

Estimating the Economic Benefits of Buffer Strips

Conservation is the foresighted utilization, preservation and/or renewal of forests, waters, lands and minerals, for the greatest good of the greatest number for the longest time.

-Gifford Pinchot

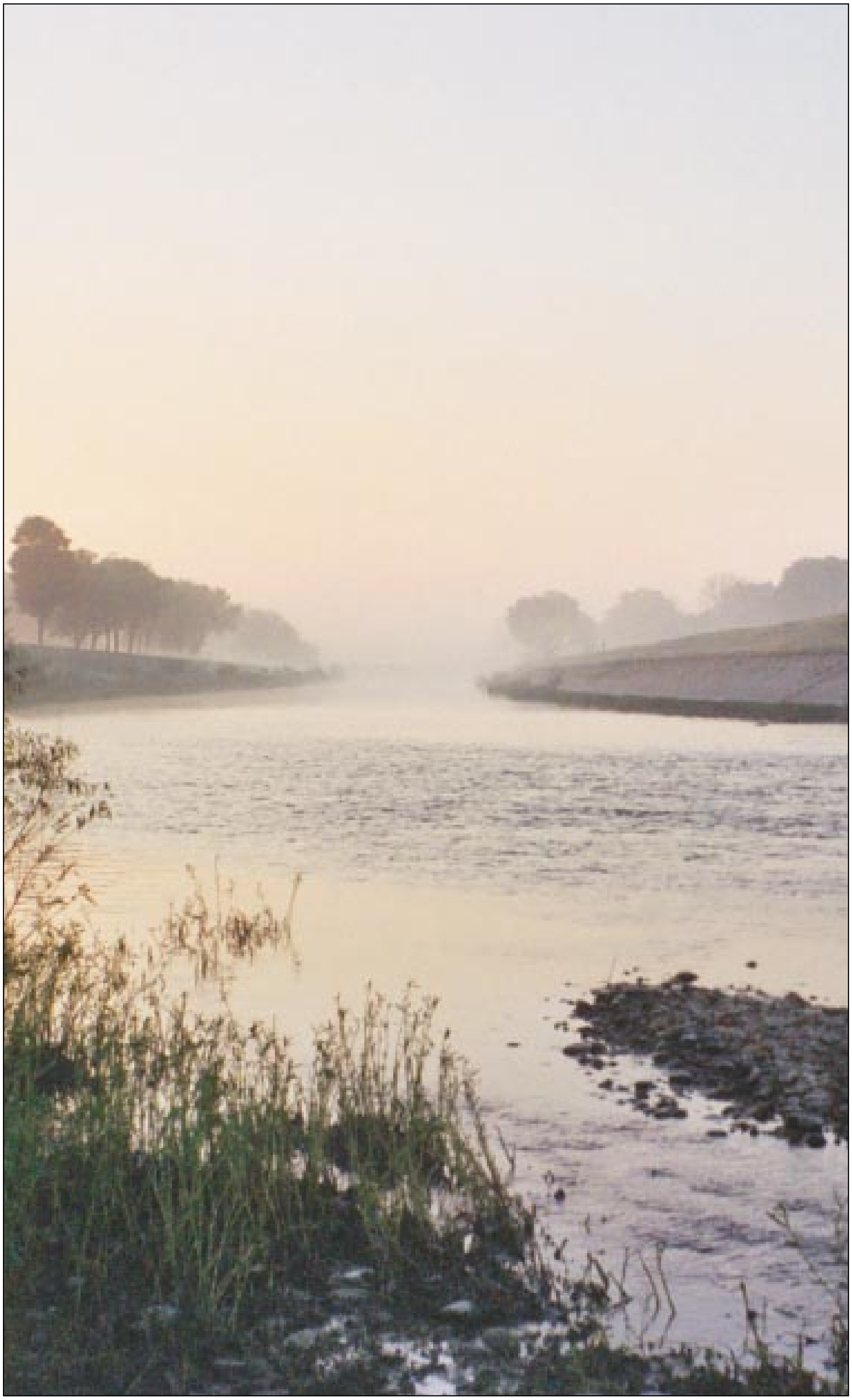


Photo by Marilyn Wall

A channelized stretch of the Great Miami River.

2.1 Introduction

Within a watershed, generally the stream channel and adjacent land areas are divided into three zones: aquatic, riparian, and upland. The *aquatic zone* includes the stream and the area of the streambed that is normally underwater, i.e., the area below the high water mark. The *riparian zone* lies between the aquatic and upland zone and is an area of transitional vegetation influenced by its nearness to water. Riparian areas sometimes include other types of wetlands and may have distinctive soil characteristics (Helm 1985). *Upland areas* adjoin the riparian zone and are usually characterized by vegetation and soils different from those in the riparian zone.

To protect aquatic and riparian resources, buffer strips are established in the riparian zone directly beside the stream, and may extend to the adjacent upland zone. Buffer strips are defined as strips of vegetation left beside a stream or lake after logging (Helm 1985). Buffer strips are also referred to as filter strips or protection strips. Appropriately designed and managed buffer strips can contribute significantly to the maintenance of aquatic and riparian habitat and the control of pollution.

Riparian buffer strips fulfill at least three basic roles. First, they help to maintain the hydrologic, hydraulic, and ecological integrity of the stream channel and associated soil and vegetation. For example, riparian vegetation helps maintain stream bank stability and channel capacity. Riparian vegetation also contributes the large organic debris (dead leaves, broken branches) that provides hydraulic structure to the channel. Buffers trap fertilizers, pesticides, pathogens, and heavy metals, and they help trap snow and cut down on blowing soil in areas with strong winds. In addition, they protect livestock and wildlife from harsh weather and buildings from wind damage.

Second, buffer strips help protect aquatic and riparian plants and animals from upland sources of pollution by trapping or filtering sediments, nutrients, and chemicals from forestry and agricultural activities. Third, buffer strips protect fish and wildlife by supplying food, cover, and thermal protection, and in some cases providing unique habitat. An improved fish habitat also can improve fishery production, catch rates, and recreational fishing opportunities. A 1998 study of the Great Lakes trout and salmon fishery by Lupi and Hoehn suggests that a 10% increase in catch rates could lead to a \$3.4 million increase in recreational value for sport anglers. In addition, MacGregor (1988) found that Ohio boaters would benefit \$0.01 to \$9.00 per one ton reduction in sediment, and Bejranonda (1996) found that house values near Ohio lakes could increase \$0.04 to more than \$25.00 per ton of sediment reduction.

Conservation buffers slow water runoff, trap sediment, and enhance infiltration within the buffer. If properly installed and maintained, depending on width, they have the capacity to:

· Remove up to 50 percent or more of nutrients and pesticides.
· Remove up to 60 percent or more of certain pathogens.
· Remove up to 75 percent or more of sediment.

(NRCS, 2001)

Conservation buffers work economically because of financial incentives available through USDA conservation programs--the continuous Conservation Reserve Program (CRP) sign-up, Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), general CRP, Wetlands Reserve Program (WRP), and Stewardship Incentives Program (SIP).

Following are the financial incentives available through the continuous CRP sign-up:

· A signing incentive payment of $100 to $150 per acre for riparian buffers, filter strips, grassed waterways, shelterbelts, field windbreaks, and living snow fences.
· Up to 50 percent cost sharing for practice CRP installation.
· A practice incentive payment equal to 40 percent of eligible practice CRP installation costs.
· A 20 percent rental rate (land rental) incentive for riparian buffers, filter strips, grassed waterways, and field windbreaks.
· A 10 percent rental rate (land rental) incentive for wellhead protection areas.
· Higher annual maintenance payments per acre for certain activities.
· Updated rental rates nationwide for installing riparian buffers on marginal grazing land.

For farmers planning to participate in the program, no competitive offer is required in the continuous CRP sign-up, and there is no waiting period. Offers are accepted automatically if eligibility requirements are met, the land offered for enrollment is suitable for the buffers landowners want to install, and they are willing to accept the going rental rate, plus any incentives that might be offered.

Conservation buffers may help farmers meet Federal, state, or local pollution control requirements. Many state and local governments, and some private organizations, offer additional financial incentives to install conservation buffers.

2.2 Cost Effectiveness of Buffer Strips

Consistent with most analyses of the costs and benefits of natural resources management alternatives, the costs of buffer strips are relatively easy to quantify, but the benefits are not. Establishment of buffer strips normally results in additional costs to the landowner, public or private. Costs incurred include the loss of stumpage, higher costs of logging and road construction, and additional administrative costs (Streeby 1970). Benefits from buffer strips accrue largely to the public and include improved bank stability and water quality, enhanced fish and wildlife habitat, and greater aesthetic value.

Bollman (1984) noted that the costs of specific buffer strip prescriptions vary with market conditions, the type of stand, and other variables, but were relatively easy to evaluate. Conversely, benefits from the prescriptions were frequently non-market values--e.g., fish habitat, species diversity, and water quality – that were much more difficult to evaluate. The question of equity arises when private land owners or logging firms must bear the costs of operating in or around buffer strips that benefit sport fishermen, other industries such as commercial fishing, or the general public (Gillick and Scott 1975). The optimal width is by their definition the most cost-effective width. Considering only the values of fish and logs, they found the "zero foot" buffer strip – i.e., no buffer strip at all – to provide the greatest net economic value.

Based on studies in several tropical watersheds, this optimal buffer width was estimated at 22 meters (73 feet) for perennial streams and less than 10 meters (33 feet) for intermittent streams. This estimate, although not directly applicable to Ohio, illustrates an alternative approach to evaluation of buffers based on financial criteria.

These studies suggest potential difficulties in establishing buffer strip areas or widths based on economic criteria such as a benefit-cost ratio. First, as stated earlier, although costs are relatively easy to determine, important non-market benefits are difficult to evaluate. Second, the value society places on non-market riparian benefits such as biological diversity is subject to not only measurement difficulties but also considerable changes in public perception and relative scarcity, all of which are likely to be substantially greater in the future.

Sohngen and Nakao (1999) tried to estimate the private benefits of filter strips for Ohio farmers. In their fact sheet, two examples of revenue producing filter strips, hay and timber, were developed. They estimated that for hay, the average price for alfalfa in Ohio in 1996 was $134.58 per ton, and for other hay it was $75.42 per ton, using the example of a mixture of Birdsfoot Trefoil and Kentucky Bluegrass planted with a no-till system. Using a conservative price of $75 per ton, the annual returns for years 1 and 2 were $225, in years 3 and 4 they were $375, and in year 5 they were $338. The costs of installing and maintaining filter strips on cropland include: (1) land rental costs, (2) seed and fertilizer costs, and (3) equipment and labor costs.

Table 2.1

Average Annual Profits (losses) From Alternative Filter Strip Options (These values do not include land opportunity costs)				
Types of Vegetative Filter Strips	Grass & Legume	Hay	Low Timber	High Timber
($ per acre per year)				
Interest rate = 5% Annual profits (losses)	$4.81	$130.64	$10.57	$30.84
Interest rate = 10% Annual profits (losses)	$3.35	$122.82	($5.77)	($9.92)

As Table 2.1 indicates, all four options show net gains at 5 percent rate of interest, but at 10 percent rate of interest, only grass and legume and hay are profitable. Hay has a very high rate of return compared to all other options. In order for the farmers to adopt these techniques, a widespread education program on the benefits of filter/vegetative strips, along with the various options available to the landowners must be launched.

The present study is confined to the two counties of Butler and Hamilton, and data was collected accordingly. The parcel information of all land adjoining the banks of the Great Miami River was collected, classified into categories of land use, such as agricultural, residential, commercial, sand and gravel mining, land used for utilities such as electric and telephone lines and railroads, government land used for state parks and recreation, and land owned/acquired by the Miami Conservancy District for various purposes such as flood control, wetland protection, construction of bike trails, etc.

In Butler County, on the west side of the river, agricultural land is mostly confined to Madison and St. Clair Townships, and the rest of the land adjoining the river is owned by the Miami Conservancy District, State of Ohio, Butler County Metro Parks and other local government bodies. There are less than 30 residential parcels adjoining the river on the east side of Butler County, and they are mostly concentrated in Fairfield and Lemon Townships. The residential parcels are single-family dwellings, with average parcel size less than half an acre. In such cases, to construct a buffer strip may not be feasible, or cost effective for the landowner. Except for the few residential parcels, the authors do not foresee any challenges in acquiring land for constructing filter strips along the river. On the west side of the river, most residential property adjoining the river is concentrated in Lemon, Hamilton, Fairfield and Madison townships. Nearly 60% of the riverbank area is owned by several governmental agencies, and the rest is owned privately.

As mentioned earlier in this section, it is assumed that farmers will voluntarily participate in the continuous CRP sign-up program. Besides receiving the federal incentives, the farmers will also benefit from the harvesting of hay from the filter strips. It is to be noted here that only one third of the land adjoining the river is under agriculture, and the remaining land is put under several other uses. A total of 52 miles of riverbank length, (both sides of the river) is proposed to be brought under vegetative buffer strip in this study. The buffer strip would range between 33 feet and 75 feet, depending on the nature of the river bank, the flow of the water, and the topology of the land. The total area of the buffer strip would range between 208 and 384 acres.

In Hamilton County, out of the 321 parcels adjoining the river bank, 111, (roughly one third) were residential properties, with 75 of these on the east side of the river and 36 on the west side. Therefore, the pattern of more residential properties on the east side seems to be consistent in Hamilton County, too. Roughly 30 percent of the parcels were agricultural land, and the rest were divided amongst industrial, commercial, gravel and sand mining, government and other agency property and utilities and rail lines.

In order to estimate the dimensions of the filter strip, it is imperative to perform a detailed analyses on the type of crops grown locally, collect considerable data on land ownership and estimate the opportunity cost of land for each and every parcel owner on the banks of the Great Miami River. Some of the owners of smaller parcels may have a very high willingness to accept compensation for converting their present land usage to vegetative filter strips. *These analyses will take considerable time and resources, which are not available to the authors at present time.*

Photo by Rob Sanders

Floodwalls such as this one along the Great Miami River can be rehabilitated with trees and light vegetation to make it more aesthetically pleasing to a community.

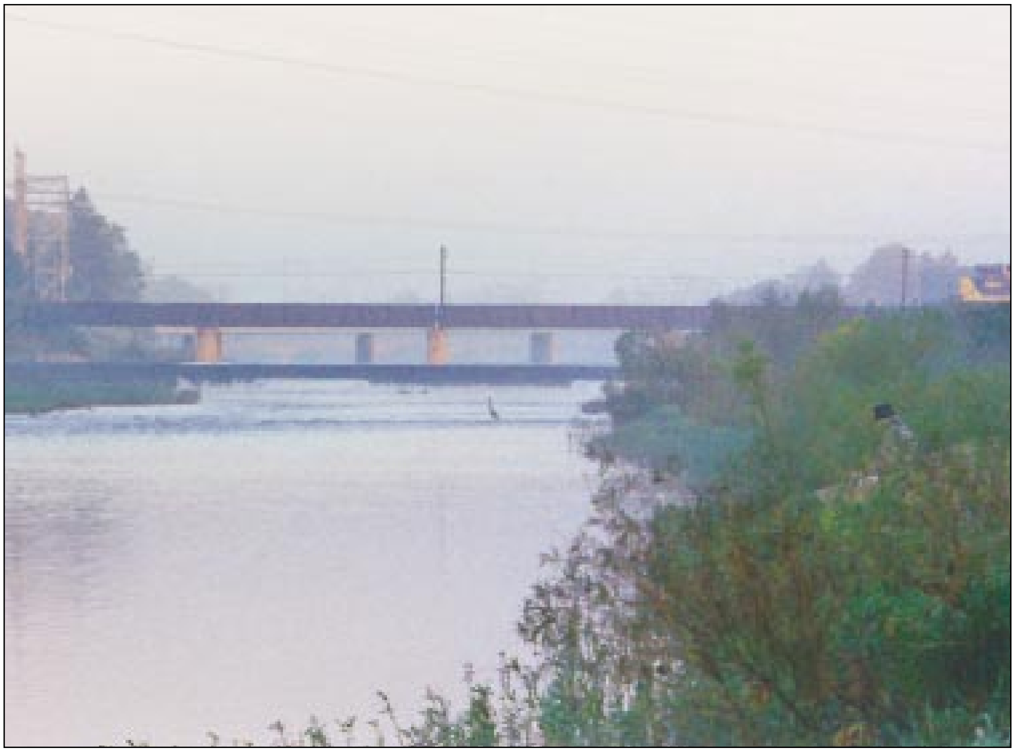


Photo by Marilyn Wall

A Great Blue Heron resting near the Troy Dam on the Great Miami River.

Photo by Rob Sanders

This floodwall running by downtown Hamilton, Ohio could be rehabilitated to make it more aesthetically valuable to tourists and prospective homebuyers visiting the community.

Section 3

Economic Analysis of the Great Miami Bike Trail

Parks and reservations are useful not only as fountains of timber and irrigating rivers, but as fountains of life.

-John Muir

3.1 Introduction

In the present study, we are proposing a 28-mile bike trail starting at the Warren-Montgomery County line, extending south to the confluence of the Great Miami River and the Ohio River. The actual cost of the 28-mile bike trail would include land acquisition costs, construction costs, and maintenance costs. For simplicity purposes, it is assumed that there shall be no land acquisition costs, since most land in the proposed bike trail site is owned by the MCD, or other governmental agencies, which have zero opportunity cost for the land, as it is idle and not put to any economic use. The cost of constructing a bike trail is estimated based on a Dubuque, Iowa Study as follows:

Table 3.1

Cost of Non Motorized Multi Use Trails (Single Treadway) Asphalt Surface, 10 Foot Width					
Trail Element	Unit	Price Per Unit	Element Width	Units Per Mile	Trail Cost Per Mile
Clearing & Grubbing	Acre	$2000	14 feet	1.7	$3400
Grading	Mile	$3000		1	$3000
Granular Subbase	Sq ft	$0.40	12 feet	63360	$25,344
Asphalt	Sq ft	$1	10 ft	52,800	$52,800
Seeding/Mulching	Acre	$1	10 ft	0.5	$800
Other Costs	10% of trail cost				$8,534
Contingency	15% of trail cost				$122802
Total Cost per Mile					$106,700
Maintenance Cost					$ 5000/year

The cost of constructing a bikeway 28 miles long in 2000 was $2.9 million approximately. The adjusted cost of the bikeway in the year 2003 is $3.2 million. Maintenance cost, discounted present value, for 25 years (expected lifetime of the bike trail) is $45,385. Total cost of the construction and maintenance of bike trail is about $3 million.

This does not include the cost of purchasing rights-of-way and major bridge structures. This estimate is based on current work for similar trails in other parts of Ohio, as estimated by the Miami Conservancy District (MCD). It is anticipated that about 75 percent of the cost will be paid by federal and state sources. The rest will be shared among local public entities and private donors.

Most of the proposed right-of-way is on property owned by public agencies including: the cities of Franklin, Middletown and Hamilton, as well as the Ohio Department of Transportation, Metro Parks of Butler County and the Miami Conservancy District. A small portion is privately held.

3.2 Benefit Transfer Results From Moore & Siderelis

The values used in the benefit transfer that follows were obtained from a 1995 study, published by Siderelis and Moore. The authors investigated net benefits of bicycling and walking on abandoned railroad beds that have been converted to a rail-trail for recreation purposes. A sample of three diverse rail-trails from across the U.S., in Iowa, Florida and California were studied. Users were systematically surveyed and counted on each trail during a period of one year, and were sent follow-up mail surveys.

In the present study, we used the results from the Iowa bike trail, since it is the closest match in demographic, trail landscape and income indicators to the Great Miami Trail. The study findings state that on average, users spend $9.21 per day as a result of their trail visit to the Heritage Trail in Iowa, $11.02 at St. Marks' Trail in Florida, and $3.87 per person per day at the Lafayette Trail in California. The findings of the Iowa trail are applied in the present study, after inflating the $9.21 expenditure to current dollars for the year 2003, using a consumer price index inflator.

The users are charged a fee of $1 per visit to the Iowa trail. Yearly visits to the trails were about 135,000, 170,000, and 4,000,000 in the Iowa, Florida and California trails respectively. Our study adopted the benefit cost method and applied the findings of expenditures from the Iowa trail, and then applied the single point estimates of average consumer surplus or willingness to pay (WTP) per activity day per person.

Table 3.2

Benefits from the Great Miami Bike Trail

	Estimate Benefits	Lower Benefits by 25%	Lower Benefits by 50%
Calculated Yearly Visits to the Trail	135,000		
Average Trip Expenditure ($ per person per day adjusted to current dollars)	$11.09		
Total Annual Expenditures	$1,497,150	$1,122,862	$748,575
Discounted Expenditures in 25 years	$11,285,938	$8,464,453	$5,642,969

Table 3.3

Benefit Cost Ratio of Bike Trail

Benefits	Benefit Cost Ratio			
	4% Interest Rate	6% Interest Rate	8% Interest Rate	10% Interest Rate
Actual	7.21	5.90	4.92	4.19
Lower by 25 %	5.41	4.42	3.69	3.14
Lower by 50%	3.60	2.95	2.46	2.09

The second set of benefit transfer values used in this study are average consumer surplus values per activity day per person from the study conducted by Siderelis and Moore. *Consumer surplus is a value of a recreation activity beyond what must be paid to enjoy it.* The benefit transfer estimate of a management, or a policy-induced change in recreation is the average consumer surplus estimate for the average individual from the benefit transfer literature. The mean, and the range of estimates for biking are provided below:

Table 3.4

Average Consumer Surplus Values Per Activity Day Per Person		
Activity	**Biking**	**Adjusted to Year 2003**
Mean of Estimates	$ 45.15	$54.36
Lower Bound	$17.61	$ 21.20
Upper Bound	$62.68	$75.71
Mean for Northeast Region	$34.11	$42.27
Total number of visitors/users: 135000		
Total Economic Benefits (lower bound): 135000 x $21.20 = $2,863,350. ($2.8 million)		
Total Average Economic Benefits (mean for northeast): 135000 x $42.27 = $5,706,450. ($5.7 million)		

Applying the mean of estimates to the usage, we obtain the recreational economic benefits provided by the bike trail. Taking the lower bound estimate, the net benefits are 2.8 million dollars, and taking the average for northeastern region, the net benefits are about 5.7 million dollars, per year.

Photo by Rob Sanders

This concrete channelway along the Great Miami River in Hamilton, Ohio, could be refurbished with shade trees to accommodate a bike trail and to enhance and beautify the downtown area.

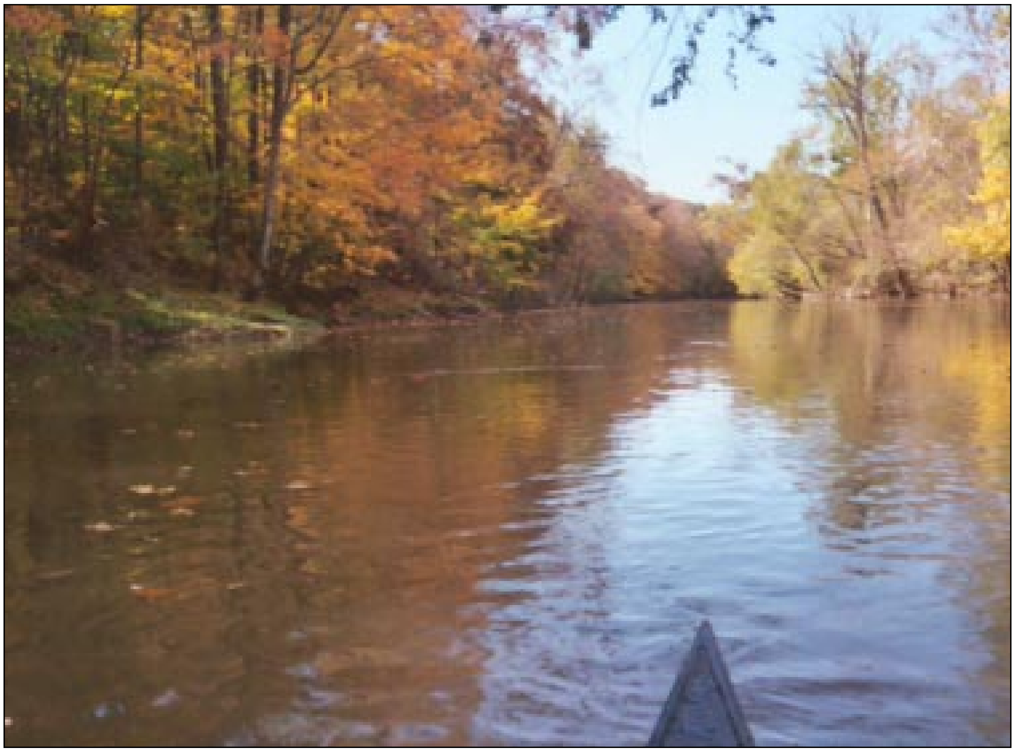


Photo by Marilyn Wall

Photo by Marilyn Wall

The Taylorsville Dam above Dayton was designed by Arthur Morgan as a Dry Dam to help with flood prevention.

Section 4

Economic Impact of Gravel Mining

If future generations are to remember us with gratitude rather than contempt, we must leave them more than the miracles of technology.

-President Lyndon B. Johnson

Photo by Rob Sanders

Dravo Park mining operation.

Photo by Rob Sanders

Welch Sand & Gravel mining operation.

4.1 Introduction

In order to fully comprehend the economic importance of gravel mining in the study area, some basic income and employment statistics were gathered from the Bureau of Economic Analysis (www.bea.gov). The following table illustrates these facts:

Table 4.1

Employment and Income Indicators in the Study Region							
Employment				Earnings by Industry (Thousand $)			
	Ohio	Butler	Hamilton		Ohio	Butler	Hamilton
Total Full Employment	6,877,576	163,594	685,506	Total Personal Income (all industry)	$317,818,321	$9,303,463	$28,819,048
Total Employment Mining	21,305	216	616	Income From Mining	$771,271	$7,761	$15,287
Total Employment Gravel & Sand Mining	1,288	N/A	N/A	Income from Gravel & Sand Mining	$73,126		

Butler, Hamilton, Franklin, Portage and Stark Counties lead the sales in gravel and sand in the state, accounting for 46% of the total gravel sales. Total value of gravel and sand sold in Ohio in the year 2000 was $252,435,626, average price of one ton of gravel was $4.53. Annual average of 1,288 employees worked on average of 181 days in the year 2000. Total wages of $73,126,187 were paid to 1,893 employees, (1,288 in production and 605 in non-production), and the average annual wage was $38,360. Gravel mining does not provide any substantial income and employment opportunities in the two counties. At the same time, gravel mines have very low assessed land value, at $12,816 per acre, compared to $30,817 for residential properties. This significantly erodes the tax base of the counties. Besides, gravel mine operations are intensive road users for transportation of gravel, which puts an additional burden on the county and township roads.

4.2 Hedonic Pricing Method

Hedonic pricing analysis begins by measuring the price differentials that arise due to quality differences across similar goods. Hedonic pricing uses the different characteristics of a traded good to estimate the value of a non-traded good. For example, the value of a piece of riverfront could be calculated by comparing the price of a house on the riverfront with the price of a similar house located elsewhere. By correcting and/or controlling for other factors that would influence the value of a particular property, economists are able to isolate the implicit price of some amenity or bundle of amenities, in this example riverfront property that has changed over time.

The price of a house may be affected by physical/structural characteristics such as number of bedrooms, finished living area, number of bathrooms; neighborhood characteristics such as proximity to schools, zoning/subdivision regulations, and proximity to, or quality of environmental attributes such as existence of a large egg farm, golf course, state scenic river, etc. Hedonic methods can be used to estimate effects of certain disamenities on the price of a residential property; for example, the price of a property adjacent to an area affected by industrial pollution, or proposed undesirable developments such as a large airport.

The process of estimating a hedonic pricing function relating housing pricing to quantities of various characteristics of a residential property is relatively straightforward and based on a regression model. However, to derive aggregate value measures from these estimated functions is more complicated, and a two-stage regression equation is required in most cases, particularly if the changes in characteristics are relatively large.

The hedonic technique depends on observable data from actual behavior of individuals. Market data on property sales and characteristics are available through local government sources such as county auditor's offices and can be used in conjunction with secondary data. However, many environmental amenities have only small, if any effects on housing prices, and may be difficult to estimate using econometric methods. Besides, many factors that influence the housing property value may be correlated, for example, local schools may not be as good in a poorer community, and the community may be located near an environmental disamenity, such as a dump or slaughter house.

4.3 Data Collection

The river flows through six Counties: Logan, Shelby, Miami, Montgomery, Butler and Hamilton. The first three were not included since gravel mining is not a serious issue there. Butler and Hamilton counties are comparable respecting gravel mining. Data were gathered regarding property parcels located in the townships along the river. There are 119 homes in the sample. This is approximately 25 percent of the population of homes. The townships not adjoining the river were dropped from the sample, since the main objective of this section of the study was to determine the effect of river gravel mining on property values. The value of the homes was recorded from the county auditors' offices. This is the market-assessed value of the property. The values for the year 2002 were taken for the study.

Information on the structural characteristics was also available from the parcel cards from the auditors' offices. Data for other characteristics, such as distance to gravel mines, distance from the urban centers, were obtained from the maps from the County Engineers' offices.

The final hedonic price function for the model is expressed as:

LnVal = _ + _$_{1}$Eastside + _$_{2}$Distance to Gravel Mine + _$_{3}$Distance to Urban Center + _$_{4}$Ln Acres + _$_{5}$Downstream + _$_{6}$LnAge + _$_{7}$StoryHeight + _$_{8}$Rooms + _$_{9}$Bedrooms + _$_{10}$Living Area + _$_{11}$Air Condition + _$_{12}$Heating + _$_{13}$Fireplace + _$_{14}$Half Bath + _$_{15}$Full Bath

Table 4.2

Hedonic Model Coefficient Estimates (A=accept, R=reject)

Variable	Parameter Estimate	t Value	20%	10%	5%	2%
Intercept	12.7	7.73	A	A	A	A
East Side	-0.13	-0.71	R	R	R	R
Distance to Gravel Mine	167.26	13.53	A	A	A	A
Distance to Urban Center	-23.38	-4.87	A	A	A	A
Acreage (lot size)	0.34	6.02	A	A	A	A
Downstream	0.01	0.08	R	R	R	R
Age	-0.22	-1.58	A	R	R	R
Story Height	-0.29	-1.21	R	R	R	R
Number of Rooms	-0.15	-1.73	A	A	R	R
Number of Bedrooms	0.18	1.33	A	R	R	R
Living Area	0.05	0.18	R	R	R	R
Air Conditioning	0.23	1.07	R	R	R	R
Heating	-0.22	-0.67	R	R	R	R
Fireplace	0.59	2.74	A	A	A	A
Half Bath	0.64	1.87	A	A	R	R
Full Bath	0.09	0.44	R	R	R	R

Structural characteristics of a house are described by: number of rooms, number of bathrooms, garage spaces, age, various utilities including water supply, sewer system, septic system and electricity. Other things equal, we expect that an additional bedroom or bathroom represent an extra amenity. The lifespan or durability of a house is associated with age and or type of construction. Since a majority of the houses were of the same type of construction, we did not include this variable. In light of the historical significance of houses more than a century old, we attempted to define age as a non-linear (inverse) variable in the model. Since the results were not conclusive, a log form was adopted. Distance to the three urban centers is intended to provide a measure of relative locational advantage. The functional form that performed the best was a log-linear mixed form. The assessed value of property (the dependent variable), total acreage of the parcel, total living area, and age of the house were specified in log form. Log-linear mixed form incorporates diminishing marginal utility. A linear model would not have been desirable because it assumes that implicit price is constant regardless of the quantity of the attribute.

The model explains 49% (adjusted R^2) of the variation in the data. Eight of the 15 estimated coefficients are significantly different from zero at the 20%, six at 10% significance and four at 5% significance level respectively, as illustrated in Table 4.2. The coefficients for living area, acreage and age are elasticities, interpreted as percentage change in the value of a property due to a 1% change in the quantity of that characteristic, other things remaining the same. The other coefficients that represent change in the price due to a unit changes in the respective variables. As the area of the property increases by one percent, the value of the property is expected to increase by approximately 0.35 percent. Similarly, as the total living area increases by one percent, the value of the property is expected to increase by 0.048 percent. As the age of the house increases by one year, the value of the house is expected to decrease by 0.22 percent. The value of the property is expected to decrease by $131 if the property is located on the east side of the river, an additional room will decrease value by $150, an additional bedroom will increase the value by $180, and an additional bathroom by $90 and an additional half bath by $640.

As an average, as distance to the gravel mine increases by one mile, the value of the property increases by $16,725. The assessed market values of the residential properties were expressed in thousands of dollars, and the coefficient, 167.25 is multiplied by 1000 to get the scale specific coefficient. It is assumed that the impact is insignificant beyond the one mile limit.

Total number of single family dwellings = 238
Total number of houses in the corridor within one mile of a gravel mine = 172
Total loss of residential property value proximity (one mile or less)
due to gravel mines = 172 x 16,725 = $2,876,700 (2.8 million, approx)

Table 4.3

Tax Revenue Implications of Gravel Mining				
County	Tax Millage	Coefficient Est	Number of Houses in the Area	Tax Revenue ($)
Butler	41.37	16725	64	(41.37 x 16725 x 64)/1000 = 44282.5
Hamilton	41.45	16725	108	(41.45 x 16725 x 108)/1000 = 74871.1
Total				119,153

The total decrease of revenues annually to the local government due to decreased property value resulting from proximity to gravel mining is estimated at $119,153.

4.4 Regulation of Sand and Gravel Mining

In-stream mineral mining is prohibited in many countries including England, Germany, France, the Netherlands, and Switzerland, and is strongly regulated in selected rivers in Italy, Portugal, and New Zealand (Kondolf 1997, 1998). In the United States, in-stream mining may be the least regulated of all mining activities (Waters 1995; Starnes and Gasper 1996) and regulations vary by state. In Ohio, Governor Bob Taft signed Senate Bill 83, in December 2001; effective March 15, 2002 giving inspectors with the Ohio Department of Natural Resources (ODNR) increased oversight of the mining of industrial minerals such as limestone, gravel and clay. Before the passing of the bill, few restrictions governed mineral mining instream channels and floodplains; counties and municipalities operated largely unregulated. Some instream mining operations do not have the necessary permits, and permitting agencies are under funded for their function of tracking compliance (Fairchild *et al.* 1997).

ODNR Director Sam Speck said the legislation (Senate Bill 83) represents the first comprehensive overhaul of the state's industrial minerals law since 1974. According to Speck, "This law significantly strengthens our ability to protect groundwater supplies through increased regulation of in-stream and near-stream mining. It also provides local communities with a stronger voice in decision making as to the location of proposed mines or quarries… And this legislation has considerable support from the mining industry as it brings the regulatory process up to date and makes it more efficient and timely." (For details, see Fiscal Note & Local Impact Statement 124th General Assembly of Ohio, Ohio Legislative Service Commission Internet Web Site: http://www.lsc.state.oh.us)

Photo by Rob Sanders

4.5 Detailed Fiscal Analysis

Ohio Senate Bill 83 changes the requirements for applying for permits for the surface mining of minerals and creates requirements for applying for permits for in-stream mining. The bill also establishes additional requirements such as changing the duration of surface mining permits, revising the renewal and annual permit fees, requiring an advertisement to be published for initial permits, and establishing civil penalties. The state would see increased revenues from the rise in fees, however, there would also be an increase in expenditures due to the new requirements. The bill also specifies the qualifications of a deputy mine inspector for surface mines.

Photo by Rob Sanders

Dravo Park. Bridge piers that were altered due to sand & gravel mining.

4.6 Surface & In-stream Mining Permits

Ohio Senate Bill 83 increases the fee for a surface mining permit from $250 to $500, as well as increasing the fee for each affected acre from $30 to $75. The $1,000 cap on acreage fees is eliminated. The fee for an in-stream mining permit is $250. The annual fee is also increased for surface miners, except for small operators. This fee is increased from $250 to $500. An in-stream operator's annual fee is $250. An acreage fee of $75 per affected acre is also required for both in-stream and surface mine operators. The renewal fee for surface mining is also raised from $250 plus a $30 acreage fee to $1000. The renewal fee for in-stream mining is $500. The surface permits are extended from 10 to 15 years, while the in-stream mining permits have a two-year duration. The Department of Natural Resources expects an increase in revenue to be approximately $250,000 to $325,000 per fiscal year.

4.7 Surface & In-stream Mining Administration

Provisions in the bill require the OhioDepartment of Natural Resources to make significant improvements to existing practices dealing with surface mining. The department already does some provisions within the bill such as upgrading blasting standards and certification. There are also additional requirements such as groundwater modeling. The department will also have to implement procedures dealing with in-stream mining. The department does not currently regulate in-stream mining in Ohio. It is currently only regulated by the Army Corps of Engineers. The department estimates that 3 to 6 employees will be needed due to the addition of groundwater modeling requirements, additional permit reviews, enhanced inspection, and added bonding administration costs. These positions will deal with the following: hydrology, application manager, blasting specialist, and inspectors. Overall, the department estimates that the costs to implement this bill will be between $750,000 to $900,000. The increased revenues from surface mining fees will offset a portion of this cost.

The bill also calls for phased reclamation, which is applied to both in-stream and surface mining. This allows the mining operator to file a request for inspection of land that has completed a phase of reclamation. After inspection from each phase, the Chief must issue an order to the operator and the operator's surety releasing them from liability on an applicable amount based on the reclamation completed. This may lead to more reclamation inspectors, which will be a minimal increase in expenditures.

The Ohio Senate Bill 83 requires an advertisement to be published before an initial permit is issued. It is also required for a renewal permit and any amendments that significantly affect a permit. The bill allows written comments and objections to the issuance of a permit. The bill also establishes civil penalties and provides for civil actions for the relief of violations to the Surface Mining Law. There are approximately 50 violations annually of the Surface Mining Law. These cases are generally resolved before any court proceedings are necessary. There are expected to be no fiscal effects on political subdivisions due to these provisions.

Photo by Rob Sanders

Welch Sand & Gravel mining operation.

Section 5

Economic Analysis of Proposed Access Points

Wilderness areas are first of all a series of sanctuaries for the primitive arts of wilderness travel, especially canoeing and packing.

-Aldo Leopold

Photo by Marilyn Wall

Photo by Marilyn Wall

5.1 Introduction

In order for local and state governments to allocate funds efficiently in recreational waterway activities, they need to know how beneficial these activities are likely to be. Recreational boating for example has been identified to provide not only a significant economic impact but also a wide range of social and psychological benefits. As a result, expanding boating opportunities by constructing new boat ramps where needed is expected to not only enhance the recreational options of a given region but also to boost the local economy. In this perspective, the Great Miami River remains a potential valuable natural asset for the counties it flows through. The economic potential of the river is due to the scenic beauty of its corridor and the quality of its water. The Great Miami River water quality is far better than the average river in Ohio. According to the National Park Service, this part of the river is qualified to be a National Wild and Scenic River. However, because access points are lacking, the river is inconvenient for most recreational users, making it a greatly undervalued and underused natural resource. Such underutilization creates rationale for improving the Great Miami River segments by increasing the number of access points. We define an access point as any area that borders the river and may be accessible by car. An access point could be positive, such as a bike path, park, or boat launch; or negative, a place used for illegal dumping; or potentially positive, an area that could be developed for community recreational use.

The purpose of this section is to determine the benefits and costs from the allocation of funds to construction of new access points in Butler and Hamilton counties, Ohio through an ex-anti analysis of the potential behavior of Great Miami River users. An attempt to identify the benefits is the first step in valuing them. The potential benefits of improving the Great Miami River can be summarized as follows:

- Increase in recreational opportunities
- Increase in real estate value such as land and housing
- Increase in employment in the production and service sectors
- Tourism development
- Increase in the government tax base
- Increase in the surrounding population welfare

The costs to bring these benefits into existence include building the new access points, making them operational, and maintaining them. Methodologically, it would be ideal to use survey-based methods such as contingent valuation or contingent choice. However, these methods would generally be expensive and more difficult to apply given the time and funds allotted for the study. Alternatively, the benefit transfer method appears to be more appropriate because it allows the researcher to obtain economic estimates for a particular study using secondary data and previous studies at other sites.

In applying the benefit transfer method the first step is to identify existing studies or values that can be used for the transfer. The second step is to determine based on relevant criteria whether these values are transferable. The next step is to assess the reliability of the previous studies. Finally, using available and relevant information, the existing values need to be adjusted to better mirror the values for the policy site (Desvouges *et al.* (1992).

To the best of our knowledge, in the literature, there is no particular study that looked at how river users would change their behavior if new river access points were to be brought into existence. In order to quantify the benefits resulting from additional access points, the following data are required:

- Total number of users, and increase in users, particularly boaters due to installation of access points,
- Average amount spent per user per trip to the river.

The analysis adopts two studies, authored by Hitzhusen *et al.* (2000), and Silva *et al.*, for benefit transfer. Hitzhusen *et al.* estimated the number of users and estimated benefits accruing from river use in the Muskingum River. Silva *et al.* (1997) analyzed the behavior of Ohio boaters at newly constructed ramps on Ohio rivers and lakes using a survey-based method. As a result, these studies provide a good basis for benefit transfer. As well established in the literature on the benefit transfer approach, using these figures for transfers requires their adaptation to the policy site characteristics (Rosenberger and Loomis, 2000). The lack of information on the Great Miami River policy site has motivated the need to collect some baseline data. The method used is similar to the Delphi technique in the sense that it involves collecting opinions of a group of 10 people knowledgeable about the river use (see Appendix I at end of this document for details). As the Delphi method is contingent upon the judgment of knowledgeable experts (Martino, 1970), the results of the survey rely heavily on the opinion and information released by the respondents.

The questionnaires contained two types of questions. The first set of questions address the respondents' own use of the river and the second set asks for the respondents' opinion about how other people use the river. The questions concern types of use, frequency of use, trip supplies, expenditure on trips, additional visitation in response to potential installation of new access points to the river, and inhibiting factors to increased use. Based on the survey results and findings by other studies, new estimates are calculated. It is noteworthy that the outcomes of this survey do not establish strong and generalizable statistical evidence, they just report opinions of a small group of knowledgeable users of the river, and should be considered and interpreted as such.

This study is not the first to aim at estimating recreation demand when user counts are unknown even if the number of visits is estimated by adding gate counts, tickets, or direct observations. A study by Johnston and Tyrrell (in AJAE August 2003) highlighted the problems inherent in lack of information on user counts and proposed an estimation method. However, since it is based on the known total number of visits, their method is not applicable here.

5.2 Types of Use of the River

Questionnaire respondents were asked to indicate their primary activity when taking trips to the river. Most of them point out that they use the river mostly for walking/jogging, boating, fishing and wildlife viewing. When asked about what they see other people use the river for, almost all respondents point to walking/jogging and fishing.

The respondents were also asked how often they use the river in a month during the Spring to Fall season. The answers vary according to whether the respondents live close to or far from the river or depending on whether they have easy or difficult access. Those who live close indicate that their use of the river ranges from 8-10 times to 12-15 times in a month, whereas those having limited access report to have used the river between 1-2 times to 3-5 times. Combining all respondents, the number of trips taken to the river averages five trips in a month. Since any outdoor activity is weather or temperature driven, these trips are typically taken from Spring to Fall with the peak use time in Summer. For hunters, the peak use time would coincide with the duck/goose season.

Regarding the use of the river by users other than the respondents on a typical sunny weekday and weekend day, the number of trips taken varies according to locations and facilities available at each location. Respondents indicate that North of Dayton, or at the West Carrollton Pool, 50 visitors may be observed on a weekend day and very few on a weekday. However, in Miami County where walkways and bike trails are typically lacking one can see 10 to 20 users. At other locations where access to the river is much easier, the number of people may vary from hundreds to thousands.

Photo by Marilyn Wall

5.3 Trip Expenses

A specific question asks the respondents to estimate the amount of money they spend on average when taking trips to the river. Since most of them live close to the river, their trip costs appear to be relatively small compared to results of other studies. However, almost everyone has reported expenditures on food, gas and fishing supplies. Those whose trip purpose is hunting as well as fishing spend some money on fishing and hunting licenses. The amount of money reported spent on purchases for a trip varies between 5 and 10 dollars. This figure, however, does not include canoe and boat rentals, which makes the estimate a low-bound estimate.

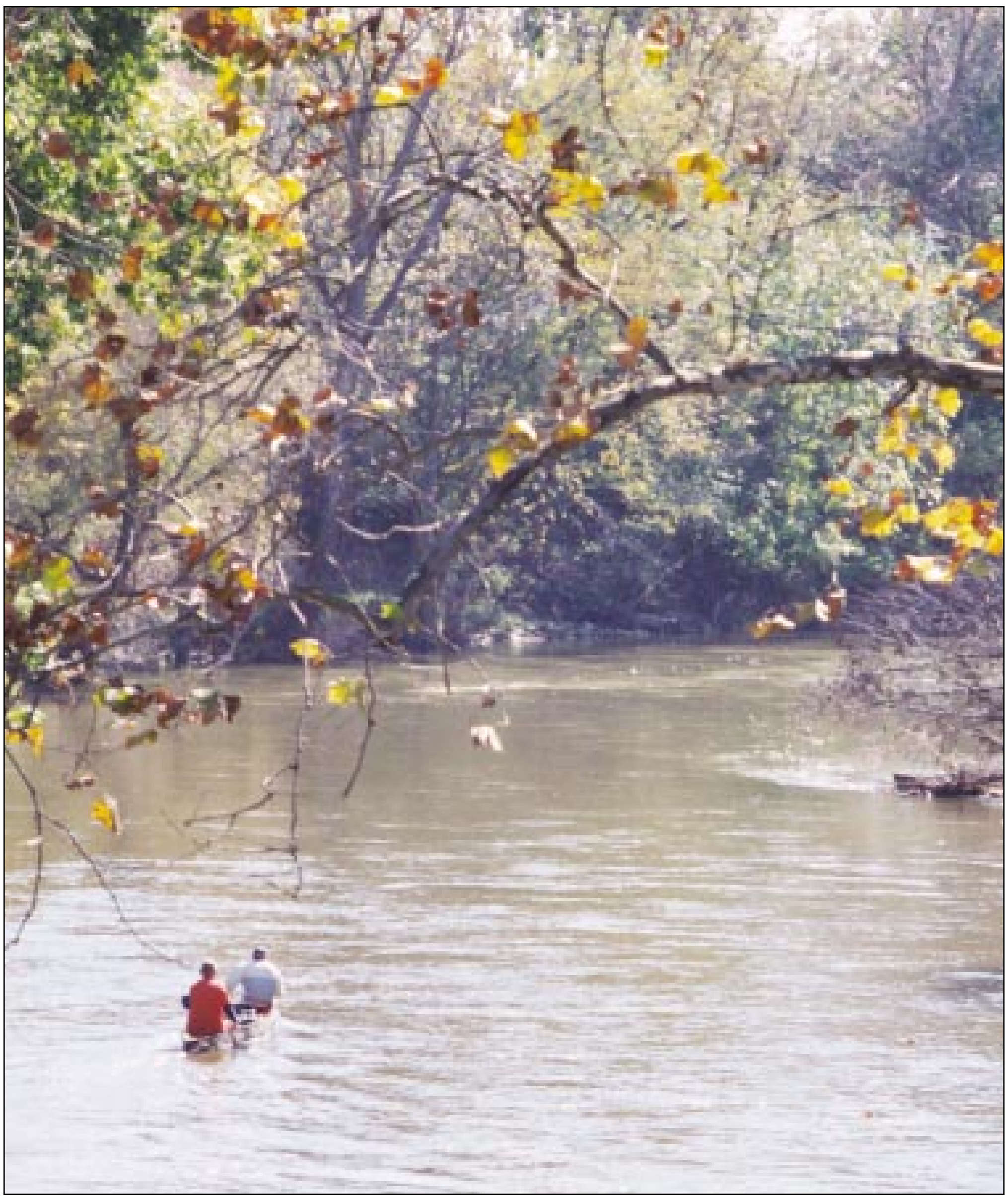


Photo by Marilyn Wall

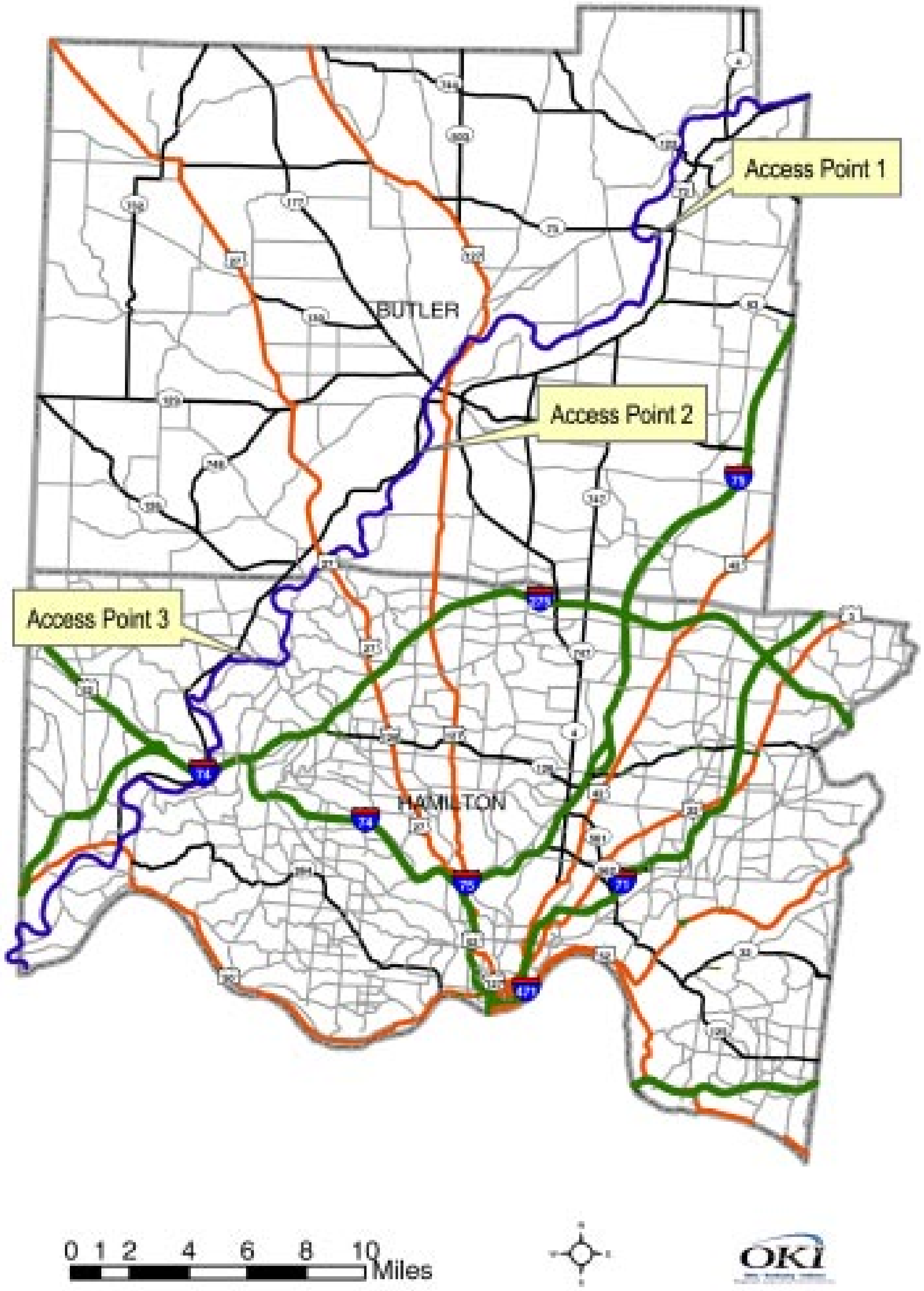
5.4 Increase in River Use

To address the issue of additional trips to the river due to an improvement in access, respondents were asked to indicate whether they and other users would increase their visitation if more access points become available. If the answer is affirmative, they were asked by how much they would be willing to increase their use. As expected, those who have easy and close access to the river argue that they would be less likely to increase their use. Whereas, those who live further from the river and who have very limited access report that they would double their use if more access points become available.

They seem to be relatively knowledgeable about the current access conditions of the river. They state that access to the river is a major problem specifically when it comes to fishing from canoes. Increasing trips of course depends on the type of access points provided and the need for each type at specific locations. For some respondents, road and parking access would imply increase in use. For others, an increase in ramps for small boats would enhance boating traffic. Apparently, given the current access conditions, provision of access points should primarily target two areas: fishing (access for small boats) and walkway and bike trail. Although the respondents were cautious in making an educated guess about additional use by other users, they all agreed that new access points mean new places, more variety and more choices. Consequently, if they are made available, people will use them, as they will make access easier. In addition, the respondents were invited to identify some inhibiting factors that would restrain them from increasing their use even if more public access points are provided. Among others, poor aquatic habitat was mostly mentioned.

For installing the access points, three locations were identified based on distance to major artery/road, distance to food and water facilities, proposed bike path locations, distance to current access points and distance to clusters of gravel mines. We suggest placing two access points in Butler County and one in Hamilton County. Access point 1 would be located in the Burnet Woods park and recreation area, on the East side of the river along Middletown Road. Access point 2 would be installed nearby Avon Woods outdoor Education Center, on the east side of the river, along Neilan Boulevard. Finally, access point 3 would be placed on the west side of the river near Haven Road (See Figure 5.4 on the following page for location of the proposed access points).

Figure 5.4
Location of Proposed Access Points Along the Great Miami River



5.5 Estimated Benefits of Proposed Access Points

The purpose of conducting the survey was to adjust the estimated benefits calculated from an earlier study of the total visitation to the Muskingum River. It is evident from the survey results that visitation to the river is related to whether the respondents live distant from or close to the river. The total visitation reported averages five trips a month, implying an average use of about one time a week. The relative dependence of this outcome on the location of the respondents' residence calls for a conservative but reasonable assumption that people take trips to the river two times during two weekends in a month and devote the other 2 weekends to other activities. Based on the idea that outdoor recreation is seasonal, there is a need to account for seasonality effects. Consequently, annual average visitation per user is assumed to be 18 (2x9) trips.

Relying on the Delphi survey respondents for the total visitation estimate would be inappropriate since this estimate would not result from a truly random sample. Alternatively, the study by Hitzhusen *et al.* (2000) on the Muskingum River is used for benefit transfer. In this study, data on the annual river use were collected on a daily basis by lockmasters at each lock and maintained by Blue Rock State Park in Muskingum County. Between 1983 and 1997, total visitation to ten locks and dams averages 190,000 annually. Although the population living in Butler and Hamilton counties is almost twice the population of the counties comprising the Muskingum River watershed, half of this number, i.e., 95,000 visits is used as a conservative assumption. This is because the Muskingum River has more access points.

In order to estimate additional spending by river users assuming availability of new access points, we need to estimate increase in visitation to the river. The results of the survey are very informative but not sufficient to precisely estimate the increase in visitation, creating the motivation for applying benefit transfer. Instead of using four additional visits a year as reported by Silva *et al.* (2000), a conservative amount of three visits is used. However, to value visitation to the river, the conservative $10 from the Delphi survey is used as average expenditure per user and per trip, which is reasonable as compared to estimates of $13.50 for the Northeast region (Region 9) provided by the U.S. Forest Service. Increase in visitation is determined by drawing upon findings by Sylva *et al.* (2000) that 26.1% of users would increase their use by three visitation days if more access points were installed.

Table 5.1

Annual Estimated Benefits of Three New Access Points					
Estimated Number of Visits	Increase in Visitation	Annual Increase Per User	Annual Expenditure for 3 Visits	Total Annual Estimated Benefits	Total Local Annual Benefits
95,000	24,795	3	$30.00	$ 743,850	$ 325,806

Table 5.1 shows the estimated increase in visitation to the river and the related estimated benefits. The table indicates a total annual economic benefit of $743,850 for the entire region. Based on the Silva *et al.* 2000 study, $325,806 representing 43.8 percent would be spent locally. These estimates rely on a very strong assumption that the number of visits is equal to the number of visiting individuals.

Annual estimated visitation to the river = 95,000 visits
Annual estimated increase in visitation = 26.1% of visitors
    increase visitation = 95,000 x 26.1 = 24795
Annual Expenditures for increased visitation = 24,795 x10 x 3 = $743,850

The study by Sylva *et al.* provides estimates for a one-time capital outlay and maintenance and operating costs for one boat ramp. To estimate the costs of building the access points, these figures are adjusted above by 50% to account for inflation and any other discrepancies such as unexpected additional costs. However, to avoid double counting, the mowing costs are taken into account in the Great Miami bikeway economic analysis. To easily compare the costs and benefits over time, we express both costs and benefits in present day terms. The adjusted costs and their discounted present value are depicted in Table 5.2.

Table 5.2

Costs of Building the Three Access Points			
	Cost Per Access Point ($) of Visits	Cost for Three Access Points ($)	DPV ($)
Annual Maintenance and Operation Cost	$4425	$13,275	$120,497
Initial Capital Outlay	$637,500	$1,912,500	-
Total DPV of Costs		$2,032,997	

Based on the estimated cost and benefits, benefit/cost ratios are computed as follows:

$$\text{Ratio} = \frac{DPVB}{DVPC} = \frac{\sum_{t=1}^{T} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{T} \frac{O^t}{(1+i)^t} + K}$$

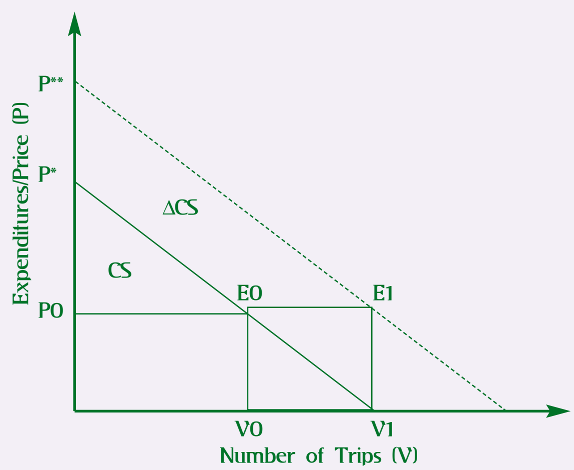
where:
DPVB = Discounted Present Value of Benefits
DPVC = Discounted Present Value of Costs
T = Time Horizon (25 years)
Bt = Benefit in Year t
Ot = Operations and Maintenance Cost in Year t
K = Initial Capital Outlay
i = Discount Rate

Table 5.3

Discounted Benefits and Costs of Three Access Points								
Estimated Annual Benefits	Costs Estimates of Three Access Points: Initial Capital Outlay	Costs Estimates of Three Access Points: Annual Maintenance & Operation Costs	DPV of Benefits at 10%	DPV of Costs at 10%	DPV of Benefits at 8%	DPV of Costs at 8%	DPV of Benefits at 6%	DPV of Costs at 6%
$ 743,850	$1,912,500	$13,275	6,751,926	2,032,997	7,940,599	2,054,211	9,508,635	2,082,194
Benefit/Cost Ratio			3.32		3.87		4.57	

Figure 5.1

Change in Consumer's Surplus



Instead of being economic surplus or **consumer's surplus**, these estimates merely represent direct expenditures in the regional and local economies. As indicated in Figure 5.1, consumer's surplus is the surplus benefit (triangle P*PE) over and above the cost (rectangle OVEP). The area abVO represents local expenditures. The key assumption behind the demand curve is that as costs/prices increase, the number of visits falls. There exists a price/cost P* at which no more visits will be made. This is called the 'choke price'. On the other hand, when costs are zero, the number of visits will be the highest (VT). At any price higher than zero, the number of visits will drop, e.g. at a positive price P visits will drop to V. From Figure 5.1, we know that at a cost P an individual would make V visits. However, the individual is willing to pay almost P* for the first visit and any amount between P* and P for the following trips (up to V). From that point onwards, the cost of a visit is higher than what the individual is willing to pay for the trip.

Estimating the consumer's surplus for taking additional trips requires either the knowledge of the width and height of the triangle P*PE or an estimated demand function. Based on the total visitation estimates, the consumers' surplus can be estimated if the choke price is known. Again, lack of information on the choke price compels using a study by Earnhart (2000) for benefit transfer. In this study, 310 survey respondents were asked to state the travel cost increase (in terms of access fee, travel time, and travel distance) needed to choke off demand for in-water recreation.

The responses identify each respondent's choke price. The results indicate an average demand-choking distance-related cost of $58.634, which we use as a choke price, since it is the largest demand-choking cost in the study by Earnhart. Assuming a linear demand curve, this results in a total annual consumer's surplus of $602,940, implying an annual per-trip consumer's surplus of $24, which is equivalent to $25.60 in 2003 dollars. This amount, which represents the annual per-trip economic benefit of installing new access points to the river, is consistent with findings by previous studies. For example, a study by Sommer 2001 found that large improvement in water quality results in an average increase in annual per-trip consumer's surplus of $29.23 for boaters.

However, the ideal way of conducting the analysis would be to estimate the change in consumer's surplus that would result from making new access points available. This type of analysis is presented in Figure 5.1, where V1-V0 represents additional trips and the area $E_0E_1P^{**}P^*$ would be the change in consumer's surplus. Lack of information precludes such an analysis. This paper only assesses the economic surplus of taking additional trips assuming availability of new access points.

Table 5.4

Sensitivity Analysis							
Scenarios	Estimated Benefits ($)	DPV of Benefits ($)		DPV of Costs ($)		Benefit/Cost Ratio	
		At 10%	At 12%	At 10%	At 12%	At 10%	At 12%
Lower the Annual Benefits by 25 %	557,888	5,063,949	4,375,516	2,032,997	2,016,616	2.49	2.17
Lower the Annual Benefits by 50 %	371,925	3,375,963	2,917,008	2,032,997	2,016,616	1.66	1.45
Lower Benefits by 75 %	185,963	1,687,986	1,458,508	2,032,997	2,016,616	0.83	0.72
Lower Annual Benefits by 50 % and Raise the Costs by 50 %	371,925	3,375,963	2,917,008	3,049,496	3,024,924	1.11	0.96
Lower Annual Benefits by 75 % and Raise the Costs by 50 %	185,963	1,687,986	1,458,508	3,049,496	3,024,924	0.55	0.48

Table 5.4 reports the discounted present value of benefits and costs and the corresponding benefit/cost ratios at the discount rates of 6%, 8%, and 10%. The benefit/cost ratios are nearly identical and are larger than unity, indicating that the benefits outweigh the costs. So, a sensitivity analysis was performed and the results are presented in Table 5.4. As depicted in Table 5.4, not all scenarios still yield a benefit/cost ratio that is greater than unity. For example, simply lowering the benefits by 75% results in benefit/cost ratios less than unity regardless of the level of the discount rate used. So does decreasing the annual benefits by 50% and increasing the costs by 50% when using a discount rate of 12%. These are poor expectations and perhaps based on unreasonably pessimistic assumptions. For more likely results, access for in-river recreation in the Great Miami is a potentially high paying investment.

5.6 Estimated Benefits of Proposed Access Points: Analysis by Relaxing Assumptions

The Benefit Cost estimates presented so far are based on conservative assumptions on visitation and expenditures. Besides examining the BC ratios at different rates of interest, the effect of relaxing some of the assumptions was also explored. The total visitation reported averages five trips a month, implying an average use of about one time a week. The relative dependence of this outcome on the location of the respondents' residence calls for a conservative but reasonable assumption that people take trips to the river twice during two weekends in a month and devote the other 2 weekends to other activities. Based on population of Butler and Hamilton Counties of the age of 40-49, and taking into account unemployment rates in both counties, the total annual visitation to the river would amount to 1,153,512 trips for these two counties.This figure exceeds the total annual visitation reported by Hitzhusen *et al.* (2000) for the Muskingum River. Instead of using four additional visits a year as reported by Silva *et al.* (2000), a conservative amount of three visits is used. Drawing upon Hitzhusen *et al.* (2000), the amount of $32.22 is used as average expenditure per user and per trip. However, to account for inflation, $34.33 is used instead when valuing the additional trips. Increase in visitation is determined by drawing upon findings by Sylva *et al.* (2000) that 26.1% of users would increase their use if more access points were installed. Table 5.5 shows the estimated increase in visitation to the river and the related estimated benefits.

Table 5.5

Total Visitation Estimate				
	Butler	Hamilton	Total	Estimated Visitation
Total of Age 40-49	15.53% = 52,886	15.23% = 126,976	179,862	
Total Employed	95% = 22,360	94.5% = 41,724	64,084	1,153,512

* *July 1, 2002 population estimate, Source: US Census Bureau*

Table 5.6

Annual Estimated Benefits of New Access Points				
Estimated Number of Visits	Increase in Visitation	Annual Increase Per User	Annual Expenditure for 3 Visits	Total Annual Estimated Benefits
1,153,512	301,066	3	$103	$ 31,006,787

Table 5.7

Benefits & Costs of Three Access Points				
Estimated Annual Benefits	Costs Estimates of Three Access Points		DPV of Benefits	DPV of Costs
	Initial Capital Outlay	Annual Maintenance & Operation Costs		
$31,006,787	$1,912,500	$13,275	$281,448,608	$2,032,997
Benefit/Cost Ratio			136.44	

The BC ratio presented in Table 5.7 reports the discounted present value of benefits and costs and the corresponding benefit/cost ratio, which is remarkably high, indicating that the benefits outweigh the costs, suggesting that increasing access for in river recreation in the Great Miami is a potentially high economic payoff investment. However, it is imperative to mention here that the high Benefit Cost Ratio is not a true indicator, but a possibility if the assumptions regarding the number of users and expenditures are relaxed.

However, a number of issues remain to be addressed. Risk and uncertainty associated with using the river may preclude boaters from increasing boating. For example, in the event the water quality in the river deteriorates or boaters' preferences have changed, they may become less likely to increase boating even though new access points have been built. Discontinuity of maintenance,difficulty of portaging around dams, natural disasters, and changes in boating population may also represent unpredictable factors that may affect the benefits. Therefore, in investigating the change in boaters' behavior due to installation of new access points, it would be important to bear in mind the inhibiting factors that would prevent them from increasing their trip to the river. Also adding the new access points may lead to congestion on the river segments, implying some opportunity cost.

However, installing the new access points could be more beneficial to anglers. If no fish are caught using a particular ramp, anglers could go somewhere else. The benefit flows and costs may vary also during the lifetime of the new access points. Benefits may be affected by location effects because river users could be from townships closer to the river, relative distance of access points from nearest counties or townships may affect the distribution of the economic benefits in those counties or townships.

Photo by Rob Sanders

Only access point to Dravo Park canoe put-in area.

Section 6

Summary and Conclusions

...every river is a world of
its own, unique in pattern
and personality. Each mile
on a river will take you
further from home than a
hundred miles on a road.

-Bob Marshall

Photo by Marilyn Wall

6.1 Summary and Conclusions

The need for research came from a request for economic valuation of benefits derived from a natural resource, the Great Miami River. Township trustees, Miami Conservancy District, citizens' action groups such as Friends of the Great Miami River and Rivers Unlimited wanted to explore possible solutions to enhance economic activity and recreation in the river corridor. One of the objectives of the study was to estimate the feasibility of buffer strip/zones along the river. Specifically, the goal was to determine the impacts of gravel mining on residential property values. If gravel mining affected property value, regulation of mining activity along the corridor would suggest a higher tax base and revenue for the region, besides enhancing the scenic beauty of the river. One of the objectives of the study was also to determine economic impacts of expanding boating, fishing and other instream recreation opportunities by constructing new boat ramps where needed to not only enhance the social capital of a given region but also to boost the local economy and increase recreational opportunities for river users.

- The estimation of the costs and benefits of constructing a bike trail proved to be a challenge since we did not have a benchmark for estimating these figures. Besides, there was an ambiguity regarding the length and the location of the bike way, since some properties located adjacent to the river were privately owned residential, commercial and industrial parcels. Therefore, benefit transfer values were simulated from the Heritage Trail, in Dubuque, Iowa, prepared by Siderelis and Moore 1996. The trail extends for 27 miles, and estimates that on average, per trip, a person spends approximately $11.09 on the bike trail. The aggregate benefits relevant to the local economy from the bike trail are estimated by multiplying the average amount spent by number of visitors per day. This study develops a methodology to estimate opportunity cost of acquiring land for the bikeway and buffer strips, and also develops methodology to estimate the total Willingness to Pay, not just expenditures for construction of a bike trail.
- To estimate the impact of access points, again, the BT method was adopted. A study by Kythrie Silva *et al*. (2000) which analyzed the behavior of Ohio boaters at newly constructed ramps using a survey-based method was used as the benchmark. The total annual visitation was estimated using benefit transfers from a study on the Muskingum River. The goal was to assess the economic benefits of installing new access points to the Great Miami River. Since applying the benefit transfer method requires adjusting the benefit estimates based on the policy site characteristics, the main problem encountered in conducting the analysis was finding baseline data on the use of the Great Miami River. As a result, a preliminary survey was administered. Rather than detailed estimates on quantitative use of the river, the results of the survey give approximates of both quantitative and qualitative characteristics of the river use.

For example, the type of activities for which people mostly use the river as well as some inhibiting factors to additional use contingent on more access points were identified.

Based on benefit transfers from previous studies and the results from the preliminary survey, total estimated annual economic surplus of installing new access points were a reasonable amount of $602,940. The analysis relies heavily on a number of assumptions which when relaxed will yield different results. One of such assumptions is that only three access points will be installed. Using more access points in the calculation would change the benefit/cost ratios presented in the sensitivity analysis. Further refinement of the analysis can be made through a more comprehensive survey for which some insights in terms of sample frame construction are collected from the preliminary survey.

- In case of the effect of gravel mining on property values, a hedonic pricing method was used. The total decrease in property tax revenue accruing to the local government from decreased property value resulting from proximity to gravel mining is estimated at $2 million resulting in a tax revenue loss of more than $100,000 annually to the local governments.

Photo by Marilyn Wall

Indian Lake, the source of the Great Miami River.

6.2 Limitations of Research

There are some concerns about the accuracy and consistency of data in this research. The parcel cards information provided by the auditors' offices in the two counties were not uniform, in the sense that a singular method of classification was not followed by the offices. Ideally, sale prices of properties taken over time would be the best choice for the dependent variable. The number of sale transactions in the area was very limited; therefore market-appraised values were used as a proxy. Concessionary sales were deleted from the sample to rule out outliers.

For estimating marginal implicit prices and demand equations for the environmental/community amenities, the variables have to be specified in natural logarithmic form that requires that the variables are continuous, which was not possible. We calculated approximate distance from gravel mines to the residential properties, however, due to the presence of many gravel mines, several of them clustered together, we had to adopt a binary form of identification, whether the parcel was within one mile of a gravel mine or not.

The data used in the research are secondary data, thus some information regarding the property owners was not available. More demographic and community variables reflecting migration, school districts, crime rates might be instructive.

The sample contains only residential property parcels and not commercial and industrial properties. Therefore, the results are at best lower bound estimates, and should be interpreted accordingly. Some industrial properties such as gravel mining, weighing and or processing plants may actually benefit from locating very close to the mine.

6.3 Further Research Needs

Several areas of potential further research can be identified. One of them is primary data collection. The data could be improved if further and more in-depth research could be carried out. Household demographics were not available from the parcel cards, and hence could not be included in the data set. Using only county auditors' parcel cards for measuring structural characteristics may have resulted in exclusion of some important characteristics such as architectural features, landscaping, elevation of the parcel, type of construction, other additions and built-in structures etc. Personal interviews and individual assessments of homes would have allowed for more information regarding septic system facilities and variation between homes. This would allow for better estimates of the coefficients. With more time and financial resources, this additional data collection would be advantageous to the study.

Further research on distance from river to parcels, and elevation/topography would have resulted in a specification of a continuous variable for river proximity and estimation of marginal implicit price for this variable.

Further research in estimating the second stage of the hedonic price function would be beneficial in estimating gains and losses in total economic welfare. The different legal, social, and institutional rules that are critical in understanding the regulation of gravel mining, and ownership and stewardship of these industries could be useful. By using the marginal implicit prices and income, a demand function for these amenities could be estimated. Finally, the results from this research might be used to predict benefits accruing from such improvements in other river systems in other parts of Ohio.
We look forward to discussing these results and further research implications with interested parties in the Great Miami region.

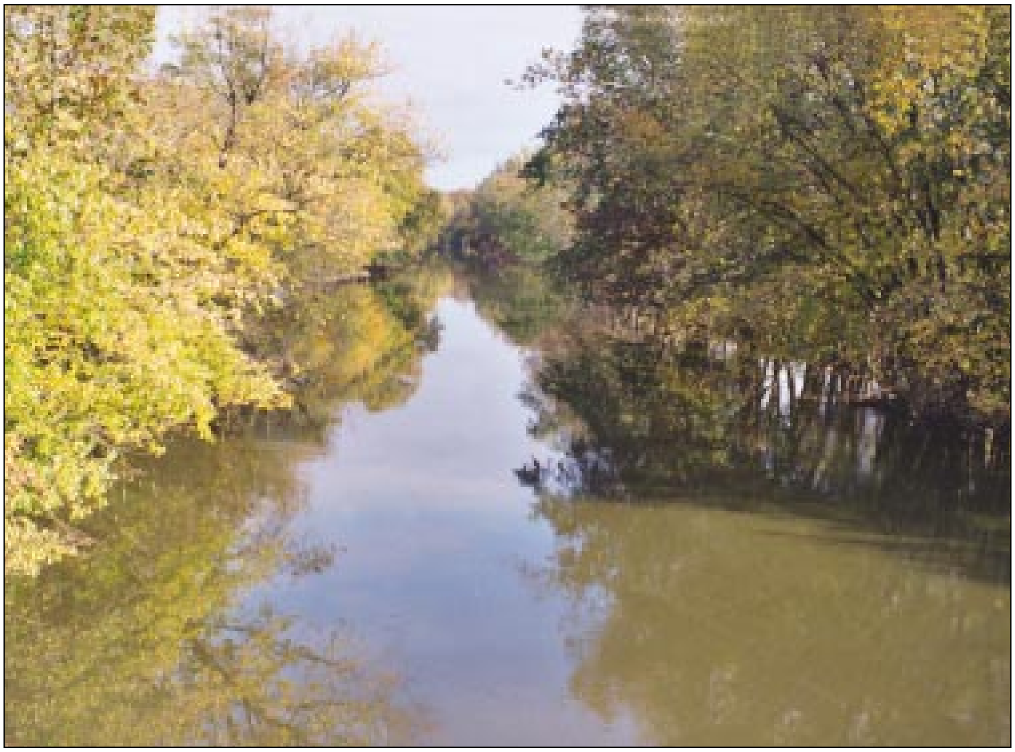


Photo by Marilyn Wall

Photo by Marilyn Wall

Appendix 1:

Gathering Baseline Data on the Use of the Great Miami River Stretch of Interest: Butler and Hamilton Counties Focus Group

Purpose: *It has been documented that the Great Miami River is underutilized due to lack of access points. Assessing the benefits of increasing access to the river requires knowledge about whether river users will increase their use if more access points become available. This focus group (survey) is intended to shed light on this important question. Provided answers will help decision makers allocate funds efficiently to river-related recreational activities.*

All responses will be confidential. No individual responses will be reported, only the average. No name is necessary.

Targeted People: *Canoe club's president and/or members, people living by the river, township trustees, Miami Conservancy District, mayors of river villages, ODNR Division of Wildlife, Watercraft and Natural Areas and Preserves, Friends of the Great Miami, and others knowledgeable about the use of the river. These resource persons would be asked two sets of questions. The first set is about themselves and the second set is about how they think other people use the river.*

Questions about the resource persons' use of the river, if at all:

1. For which of the recreational purposes do you use the river the most? Choose all applicable:

a) Walking/jogging
b) Fishing
c) Boating (motorized and/or non-motorized)
d) Tubing
e) Swimming
f) Kayaking
g) Hunting (lots of ducks)
h) Canoeing
i) Biking on roads paralleling (some bikers ride their bikes across town and need to park)
j) Sight seeing: 1) Bird watching 2) Wild life viewing
k) Other________________________________

2. a) In which months did you use the river last year?________________________
b) How many trips did you take in these months?________________________

3. How much money do you and your party members spend on average on a trip (including, if any, charges for motel/hotel or camp) ?

4. Where do you purchase your trip supplies?
_____ close to your trip destination
_____ before you reach your trip destination?

5. What kind of trip supplies do you usually purchase? (Mark all applicable)

____Beverages _____Restaurant Food
_____Gas _____Lodging
_____Gear _____Groceries
_____Bait/Tackle _____Other (Please describe_________________)

6. Do you take trips to other segments of the river or to other river corridors?

__Yes __No

If yes, how many did you take last year ?__________

7. Which of the following best describes your household income?

a) Less than 10,000 b) 10,000 – 20,000
c) 20,000 – 30,000 d) 30,000 – 40,000
e) 40,000 – 50,000 f) 50,000 – 60,000
g) 60,000 – 70,000 h) 70,000 and above

8. If you are using the river currently, would you respond to an increase in the access to the river such as boat ramps, road access, and parking? If so, by how much would you increase your use in a month you usually take trips?

9. Is there any change in the river or river corridor that would prevent you from increasing your use of the river? If yes, please describe: __________________
____
____

10. Suppose you were asked to make a monetary donation as your one time contribution to installing new access points, how much would you be willing to donate? $______________

11. Where would you suggest placing the access points? Identify Townships and specific sites within townships; specify any reason for your location choice.

Townships:_____________________ Specific Site:_____________________

Reasons: ____

12. What if any infrastructure such as road, parking lots etc would be required in conjunction with building the access point(s) at the location(s) you indicated in the previous question?

13. What is your gender?

a) Male
b) Female

14. What is your home county and postal zip code? Please choose the one applicable and specify the zip code

a) Butler _________Zip code

b) Hamilton __________Zip code

c) Other, please specify: ________________County ____________Zip code

Questions About Other River Users:

Choose all applicable:

a) Walking/jogging

b) Fishing

c) Boating (motorized and/or non-motorized)

d) Tubing

e) Swimming

f) Kayaking

g) Hunting (lots of ducks)

h) Canoeing

i) Biking on roads paralleling (some bikers ride their bikes across town and need to park)

j) Sight seeing: 1) Bird watching 2) Wild life viewing

k) Other_________________________________

2. What would be your best guess about the number of river users at the Butler and Hamilton county stretch?
   - On a typical sunny week day ____________________________________
   - On a typical week-end day_____________________________________

3. Do you think people would increase their use of the river if more access points were available? __Yes __No
   If yes, by how much? ________________

4. What would be the best way to collect data on the use of the river?
   Examples include:
   a) Regular mail survey
   b) Focus group
   c) Other_____________________

5. If we were to administer a mail survey, do you think we can get a list of the river users and their addresses? If so, how and where?

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