

**A Report on Results of Surveys to Measure the Demand for Designating the
Mad River in Clark County Ohio a Recreational River**



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by

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Executive Summary

The detailed report that follows is the result of two surveys. One was sent to the Wittenberg community and the other (virtually identical to the first) was sent to a broader audience of individuals and groups judged likely to have an interest in the possible recreational designation for the Mad River. The surveys were undertaken by Zhang and Wishart in response to a request from the Scenic Mad River Committee to assess the economic impact of designating the Mad River a recreational river as part of Ohio's system of wild, scenic and recreational rivers program.

Zhang and Wishart developed the surveys so that they would generate information that allows the demand for recreational designation to be measured even though there is no formal market for recreational designation (as with other non-market amenities). Specifically, the surveys asked questions to help determine the willingness to pay for recreational designation using a technique called contingent valuation. Other questions generated data to allow use of the travel-cost method to estimate the consumer surplus arising from a person's visit to the Mad River, which is the difference between what an individual is willing to pay per visit and what the individual actually pays. Willingness to pay into a fund that would help support recreational designation for the Mad River was estimated using probit regression analysis, then again using logit regression analysis. The certainty-adjusted value for willingness to pay per person is \$54.15 according to the probit analysis and 41.81 as calculated, certainty adjusted, with logit regression. The average of these two values is our best estimate equal to \$47.98, or just under \$50 per year. The consumer surplus per person per trip per year was estimated using Poisson regression to be \$178 for the broader sample and \$142 for the Wittenberg sample. These estimates are high and are supported by other data generated by the survey that suggest a strong demand for recreational designation. **Therefore, the policy recommendation is to complete the process for designating the Mad River recreational as soon as possible.**

The report discusses the possible designation of the Mad River as recreational in the context of Ohio's wild, scenic, and recreational river program. The history of the scenic river program is outlined along with key aspects of the legislation related to the program, especially regarding the designation of a river as recreational. The fact that the property rights of adjacent landowners will not be restricted is emphasized.

The Little Miami River, which was designated the first state scenic river (and later a national scenic river) some 50 years ago, is presented as a case study for the economic benefits that can arise from designation. Although the Little Miami is a much longer river that passes

through many more populated areas, the benefits that arise from its designation as a scenic river are of the same types that can be expected to arise from designating the Mad River recreational.

The fourth section of the report presents information regarding methodologies to estimate the benefits from recreational designation. Further discussion of methodology specific to the techniques used to estimate willingness to pay via contingent valuation and consumer surplus per person per trip is presented in section five along with other results from the surveys. Econometric methodology is detailed in Appendices C and D.

A portrait of a typical respondent to the surveys emerges from the information gleaned. The average respondent is a middle-aged person (average age of 40 for the Wittenberg sample and 55 for the broader sample) with some college education living in a small household with between two and three adults and one child earning an average income between \$75,000 and \$100,000 per year. Respondents reported that they believe all seven reasons presented for protecting the Mad River are either very important or important indicating that a broad range of reasons for protection is supported. An overwhelming 91 percent of respondents either strongly favor or favor designation of the Mad River as recreational.

When faced with a hypothetical ballot issue that could create and finance a fund to support designation of the Mad River as recreational, 72.2 percent of respondents reported that they would vote yes to contribute \$ X annually to the fund where X took on values randomly assigned between \$0 and \$200. Of those who voted no on the hypothetical ballot regarding funding, over half reported that they could not afford to contribute or they thought designation should be funded by a recreation fee or some other charge. A handful ($n = 26$) of staunch opponents to designation were willing to pay just over \$8 per year into a fund to prevent designation. Respondents who were willing to fund the designation were asked to split their contributions among six categories of benefits they desired to see arise from the recreational designation. Remarkably, expenditures were split quite evenly across all six categories. Moreover, a significant majority of respondents believe that water quality in the Mad River will improve greatly, slightly, or stay the same one year after designation and five years after designation.

The survey questions then shifted to focus on patterns of travel to the Mad River and other rivers and lakes. Many respondents in both sample groups are avid users of rivers and lakes. Respondents reported that they planned for an average of 2.59 trips to the Mad for 2016 and that value would increase to 3.5 trips if the Mad were declared recreational. When asked how many trips had been taken to the Mad and to other Ohio rivers and lakes, the numbers rise for both groups. Wittenberg respondents reported taking on average 5.05 trips to the Mad and 12.25 trips to other rivers and lakes for 2015, while the respective figures for the broader sample are 4.28 and 9.03.

Respondents like to take trips to the Mad and other rivers and they have been doing it for decades. A plot of the frequency of first visits over the years shows a steady increase since 1945 and a significant uptick in the number of first visits from 2000 to present. Visitors to rivers spend significant sums on these trips. The Wittenberg sample spends on average just under \$30 on a trip to the Mad and just over \$60 for a trip to a different waterway. For the broader sample,

spending on a trip to the Mad averages \$108 while spending for a trip to a different location averages \$150. Respondents acknowledge a broad array of outdoor recreational activities from nature watching, kayaking, and canoeing, to picnicking and paddle boarding, that designation of the Mad River as recreational could support.

I. Introduction: The Purpose of the Surveys

Since 2004, designation of a 22-mile portion of the Mad River in Clark County as a state recreational river has been promoted by several groups including the Ohio Department of Natural Resources, Rivers Unlimited, and a local citizens' group called the Scenic Mad River Committee, among others. Their efforts notwithstanding, the recreational river designation has yet to be achieved due to opposition from property owners along the river as well as other interested individuals in Clark County including the Springfield Chamber of Commerce. *The Dayton Daily News* reported on January 2, 2015 that the effort to have the Mad River designated a scenic river was to resume.¹ As part of that effort, David Wishart, a professor of economics at Wittenberg University, was contacted to determine if he had an interest in pursuing an "economic study" of the impact a recreational designation for the Mad River might have on Clark County. During the spring and summer of 2015, Wishart was in contact with members of the Scenic Mad River Committee to lay the groundwork for such a study. At the same time, Wishart enlisted the help of Wendong Zhang, who was then a Ph.D. student in agricultural environmental economics at The Ohio State University. Wishart met Zhang during the spring of 2015 as he participated in the Preparing Future Faculty program that Wittenberg faculty support in conjunction with The Ohio State University. Zhang had presented a lecture in Wishart's environmental economics course outlining the results of a study he had worked on that used a survey approach to gauge the demand for control of agricultural run-off pollution into Lake Erie that has periodically resulted in toxic algae blooms in the lake.

After some discussion during the summer of 2015 of various methodologies that might be employed to estimate the demand for recreational designation between Zhang and Wishart and the Scenic Mad River Committee, it was decided that Zhang and Wishart would independently develop a survey and distribute it as widely as possible in order measure the demand for recreational designation. Zhang and Wishart worked on designing the survey for several weeks in the fall of 2015, applied for and received approval from both the Wittenberg University and Iowa State University Institutional Review Boards to distribute the survey to Wittenberg students, staff, faculty, and retirees, then did a test run of the survey with the Wittenberg community sending the survey as an e-mail attachment to over 2,000 students, staff, faculty, and retirees. This first run of the survey pointed to a few problems that were corrected, after which an edited version of the survey was distributed more broadly by e-mail as an attachment primarily to groups with an interest in aquatic recreation, however, the survey was also forwarded by recipients to individuals during the winter and spring of 2016.

The purpose of this report is to present the results of these surveys. However, the results are best understood in the context of some background information. In the next section, we present some information regarding the state of Ohio's scenic rivers program within which the Mad River in Clark County would function if it is designated a recreational river. Section three

presents an overview of the economic impact associated with designation of the Little Miami River as a wild and scenic river. Contingent valuation and the travel cost method are discussed in section four as methodologies commonly used by economists to estimate the demand for environmental amenities like recreational rivers for which no market exists. The structure of the surveys is described and results from each survey are discussed and analyzed in section five. Section six concludes the report with conclusions regarding the likely economic impact recreational designation will have and the recommendation that designation of the river as recreational should proceed as soon as possible.

II. The Scenic River Program in Ohio and the Mad River

Ohio was the first state to employ the scenic river designation under the Scenic River Act of 1968. The first river in Ohio to be designated a state scenic river was the Miami Valley's own Little Miami River, whose source lies in Clark County.² The generally positive economic impact of the Little Miami River's designation as a scenic river may be indicative of what Clark County could experience if the Mad River is designated a recreational river. The Little Miami River's record as a scenic and wild river is presented in brief below.

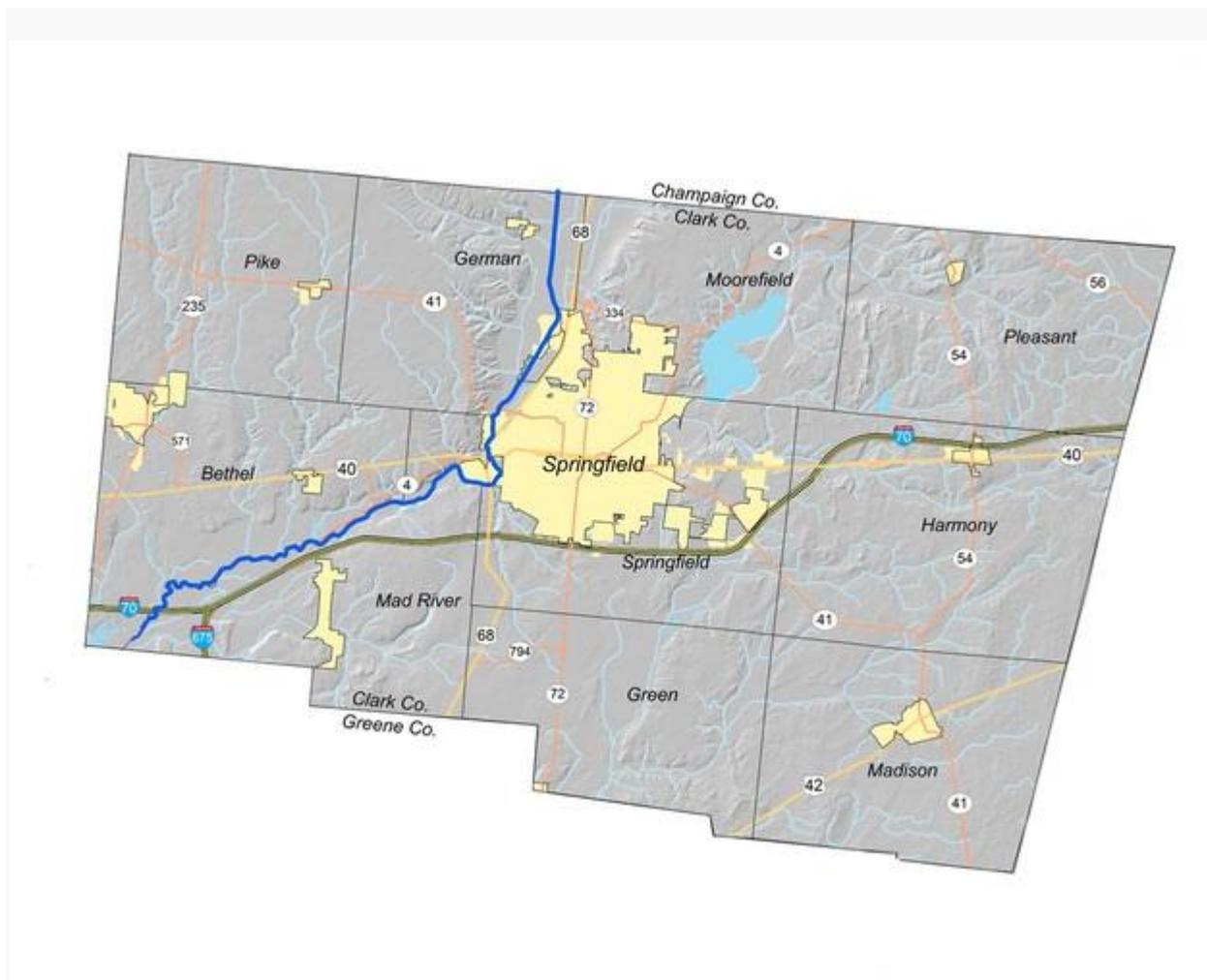
The Ohio scenic river program has developed so that there are three categories into which rivers with the right characteristics may fit – wild, scenic, and/or recreational. Rivers can be designated under more than one category depending on their characteristics. The process for creating wild, scenic, and/or recreational rivers is part of the Ohio Revised Code with the specific text presented at <http://codes.ohio.gov/orc/1547#1547.81> and copied in Appendix A below. The Mad River meets the criteria for designation as a recreational river. These criteria are found at the Scenic Mad River web site <http://www.scenicmadrivern.com/requirements.html>.

Designation of a river as wild, scenic, and/or recreational affords greater protection to streams in Ohio in three ways. First, any **public** project proposed along a designated river must be reviewed by the Ohio Department of Natural Resources (ODNR) for its possible environmental impact. The ODNR can refuse or, request modifications, to approve a **public** project based on the possible negative environmental impact for designated rivers outside municipal corporation limits. Second, after designation, landowners adjacent to the river are assisted and advised regarding techniques for protecting the quality of the stream in ways that do not interfere with the rights of those who own property along the stream. Third, a degree of watershed protection is afforded to the designated river as the Ohio Environmental Protection Agency works in conjunction with the ODNR as well as federal, state, and local governments to monitor stream quality, conduct biological surveys, and reduce nonpoint-source pollution that damages streams.³

The 22-mile stretch of the Mad River being considered for designation as a scenic/recreational river is shown delineated in blue in Map 1 presented below.

Map 1

The Mad River in Clark County



Source: <http://www.scenicmadriver.com/requirements.html>

The portion of the river flowing through Clark County is an excellent candidate for the recreational designation because it meets several stringent requirements. These are:

- The total length of the proposed river segment must be at least 20 miles
- The proposed river segment must be 60% free-flowing in a natural channel without head dams, diversions, or other modifications. The river must have connectivity to its natural floodplain along the majority of its length
- The area adjacent to at least 50% of the stream length, considering both banks, must be in native forest or wetland, outward from the river to a depth of 120 feet or greater

- No more than half the proposed river segment may have roads within 300 feet of the river
- No more than 10% of the river's watershed upstream and adjacent to the recreational river segment may be covered with impervious surfaces (roofs, parking lots, roads, etc.) at the time of designation. Some development within 300 ft. of the river is acceptable, but not to the extent that it impairs the health of the stream and floodplain habitat
- The segment must be performing at its highest potential for biological diversity and water quality, given any naturally occurring limitations. Water quality of 100% of the river segment must at least meet Ohio Warm-Water Habitat or Cold-Water Habitat criteria, if not Exceptional Warm-Water Habitat Criteria.⁴

Indeed, the Mad River is unique in Ohio if for no other reason than because it supports populations of brown and rainbow trout – the only river in Ohio cold enough to provide a habitat for these prized sport fish.⁵ By designating the Mad River a recreational river, greater attention will be afforded to the area thus attracting anglers who might travel to Clark County and Springfield for fishing expeditions, spending on food, supplies, and lodging in the community as they visit. Designation of the Mad River as recreational will catch the attention of canoeists, kayakers, and floaters who will also use the river and spend their dollars in the Springfield area. The emerging Buck Creek Corridor and its recreational activities naturally link to the Mad River so that recreational designation could provide a variety of benefits to Springfield and Wittenberg University. Water quality maintenance and improvement in the river are important benefits whose economic value can be estimated using survey techniques, as we will show in the pages that follow. Other potential benefits can be identified and their magnitudes estimated by using survey techniques as well.

Any costs associated with recreational designation of the Mad River are limited. 'Areas of concern' might be a better phrase to use to describe potential problems or costs associated with a recreational designation for the Mad River. The most prominent area of concern is the potential for violation of private property rights for landowners along the river due to the recreational designation. **However, no adjacent landowner will experience any restriction of their property rights because of the recreational designation.** While public projects along the river must go through an approval process if the project is located within 1,000 feet of the river, there is no such restriction for projects undertaken by private property owners. Potential costs that could arise from recreational designation include increased trespassing and littering due to a higher activity level on the river. However, these should be mitigated somewhat by better monitoring of the river that will accompany a recreational designation. In fact, after recreational designation, a 10-member citizens' advisory council would be created to deal with problems that arise regarding river usage.⁶

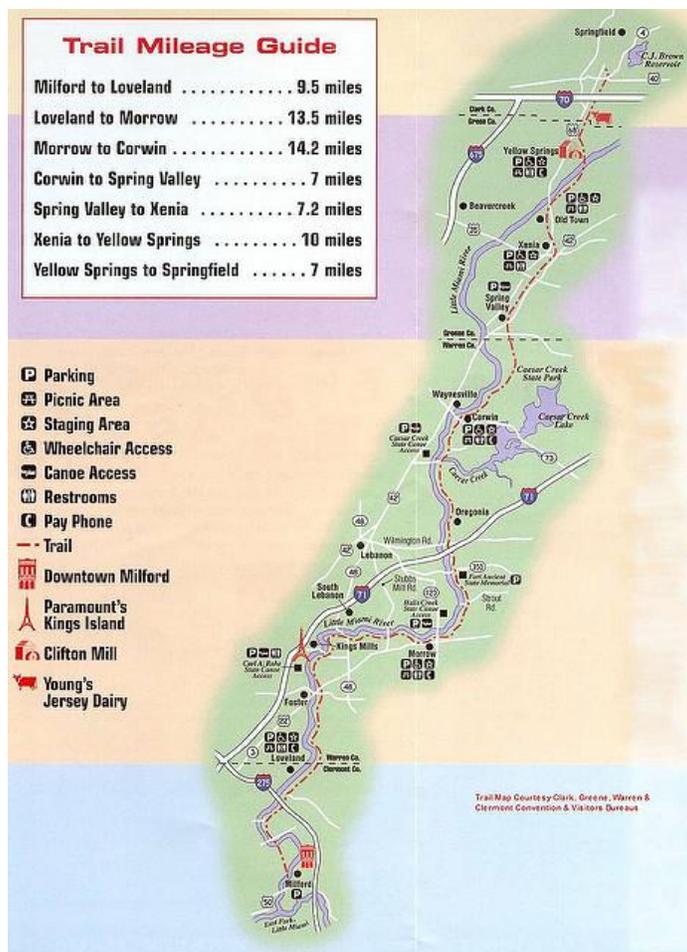
Before we examine the surveys used to estimate the demand for recreational designation of the Mad River, as background, an overview of the economic benefits that have accrued during the Little Miami River's half century as a state and national wild and scenic river forms the next section.

III. The Economic Impact of the Little Miami as a Wild and Scenic River

The economic benefits generated by recreational use of the Little Miami River are significant. The Little Miami holds claim to having been designated the first state scenic river and the first national scenic river. One of the nation's leaders in the study of economic benefits from rivers is Mike Fremont, an Ohioan from the Cincinnati area who helped found the organization Rivers Unlimited. Fremont has created something of a cottage industry with his encouragement of studies to identify the economic benefits arising from Ohio's rivers. The Little Miami can be regarded as a case study in the economic benefits that might be realized from a "mature" scenic river, given its five decades of existence in that status. We caution against extrapolating directly from the Little Miami to the Mad River since the Little Miami is much longer (94 designated miles) and flows past or through a variety of villages, towns, and the eastern reaches of Cincinnati's sprawl. A map of the Little Miami River that also shows the Little Miami Bike Trail that runs alongside the river for much of its length is presented in Map 2 below.

Map 2

The Little Miami River and Related Bike Trails



In a three-page memorandum dated November 6, 2008, Fremont relies on results from studies that have estimated benefits from bike path usage and river restoration in Ohio and elsewhere to compute his own estimates of the annual economic benefits from the Little Miami Bike Trail, as well as canoeing, kayaking, and fishing in the Little Miami River.⁷ For the Little Miami Bike Trail, Fremont suggests that some 300,000 users per year spend an average of \$7 for equipment and \$13 for food, lodging, travel, etc. per trip, totaling \$20 per user, or \$6 million per year in the aggregate. In addition, there are approximately 100,000 rentals of canoes and kayaks on the Little Miami per year valued at \$20 per rental for a total of \$2,000,000 per year. Fremont cites a figure of \$15,000 per year in benefits per fishable mile of river for Ohio streams, so with some 80 miles along the Little Miami where fishing is possible, angling opportunities along the Little Miami generate at least another \$1 million in benefits per year. Totaling these three categories of benefits yields an annual sum of \$9 million per year. Fremont notes that property values are enhanced along a river that is designated scenic by at least ten percent. Assuming there are five houses per mile on both banks along the Little Miami and that the average residential property price is \$100,000, scenic designation adds some \$9.4 million in value to the tax base. Thus, counties and municipalities can expect to benefit significantly from enhanced property tax revenue flows due to scenic designation.

Fremont is using parameter values for different categories of benefits that can be gleaned from studies done by economists who have measured the economic benefits from environmental amenities, like a wild, scenic, and/or recreational river designation, for which no market exists. The goal of our surveys is to generate data that can be used to calculate parameter values for the Mad River in some of the same benefit categories that Fremont has reported for the Little Miami to estimate the potential economic benefits from recreational designation for the Mad River. The next section describes methodologies that are used to calculate the economic benefits from environmental amenities like recreational rivers given the absence of a market.

IV. Methodologies to Estimate the Benefits from Recreational Designation⁸

For goods that are provided in markets, measuring the economic benefits is a simple matter of measuring the demand for the good or service. Demand for a good or service is given by the willingness and ability of consumers to pay at different price levels. Markets do not exist for many environmental amenities. Hence, measuring the economic benefits from environmental amenities, such as the designation of a river as wild, scenic, or recreational, presents a challenge for economists. Ideally, we want to measure the total willingness to pay for the economic value the environmental amenity provides. Total willingness to pay is defined as the sum of three types of value an amenity could provide – use value, option value, and nonuse value. Use value is given by the benefits provided to a user who experiences the amenity directly, like a canoeist or kayaker on a scenic river. Option value reflects the benefits a person enjoys from knowing they will be able to use the amenity in the future. Nonuse value includes bequest value – the benefits enjoyed when the amenity is preserved for the enjoyment of future generations; and existence value – the benefits arising from the knowledge that the amenity exists. For example, I benefit from the knowledge that the Little Miami River will be available to my grandchildren and great-grandchildren and, although I will probably never visit the site, I enjoy benefits from knowing that the Tongass National Forest exists.

One straightforward way to determine the total willingness to pay is to ask potential users of the amenity how much they are willing to pay for a change in its provision. Potential users can be asked to state their maximum willingness to pay for the change. Or, they might be asked yes or no, whether they would pay a particular sum (\$X) for a change in provision of the amenity. Surveys that ask these types of questions are called contingent valuation surveys. With enough respondents, a hypothetical market for the amenity is created. If respondents provide unbiased answers on the survey, a reasonably accurate valuation of the amenity can be generated by using contingent valuation. A well-designed survey can limit the potential for bias. We use several contingent valuation questions in our survey to determine the total willingness to pay for designating the Mad River a recreational river.

Another technique used by economists to measure the benefits arising from an environmental amenity is the travel-cost method. The travel-cost method infers the value of an environmental amenity by estimating the cost to visitors of making their way to the site for a “visitor day.” In the discussion presented above for the Little Miami River, Mike Fremont was essentially using the travel-cost method to impute a value of \$6 million for the Little Miami Bike Trail. We have several questions that allow us to calculate the benefits that could be realized from the Mad River if it is designated a recreational river by using the travel-cost method.

Oftentimes, economists use a technique called the hedonic property value approach to infer the value of an environmental amenity. Properties that are in proximity to environmental amenities typically enjoy an increase in value compared to properties that are at a considerable distance from the amenity. The marginal increase in the property value due to its fortuitous location can be estimated using statistical techniques to better understand the economic value of an environmental amenity. Although a formal hedonic property value study was beyond the scope of our research, it is possible to infer a value for the increase in property values that homeowners along the Mad River might experience by using the benefit transfer method.

Mike Fremont used the benefit transfer method to infer an increase in property values along the Little Miami River of some \$9.4 million. The benefit transfer method employs parameter values for estimates of the economic benefits from an environmental amenity that have been calculated in one location and uses that parameter value to calculate the economic benefits from a similar environmental amenity in another location. Of course, the accuracy of the benefit transfer method depends crucially on the comparability of the environmental amenities between which benefits are being calculated.

We turn now to a discussion of the surveys and their results.

V. The Surveys and Their Results

The surveys were distributed electronically in two slightly different versions first in the late fall of 2015 to Wittenberg University students, faculty, staff, and retirees, then again in January to a broader audience comprised of participants from stakeholder organizations. Differences between the surveys were limited to minor editing for clarity and the removal of reference to dams and diversions of water, which was erroneously included in the first survey but

with no apparent impact on responses. Both versions of the survey are presented in Appendix B of this report. The results are discussed below.

Table 1 presents demographic information for the two survey groups gleaned from questions 24 through 30 of the surveys. The number of respondents, n , the mean response, and the standard deviation are presented. The Wittenberg sample reflects a younger group on average than the broader sample, but with a greater variation in age range probably owing to the retiree respondents. Both groups suggest a high level of education and small household size with three members, typically, two adults and one child. The response on the employment question indicates that both groups have considerable available leisure time since they are, on average, employed part time or students.

Table 1
Demographic Information

Variable	Wittenberg Sample			Broader Sample		
	n	Mean	Std. Dev.	n	Mean	Std. Dev.
Age	138	40	20.44	103	55	14.44
Education	138	some college	NA	104	some college	NA
# of adults	124	2.65	2.74	104	2.01	0.83
# of children	77	0.96	1.2	64	0.97	1.1
Employment	139	Part time/ student		105	Part time/ student	
Household Income	2	NA	NA	97	\$75,000- \$100,000	NA

Table 2, presented below, summarizes the results from question one on the surveys regarding reasons for protecting the Mad River with a recreational designation. Response options included very important, important, somewhat important, not important, and definitely not important with very important designated as number 1 and definitely not important designated as number 5. The number of people responding to these prompts ranged from 176 to 179 for the Wittenberg sample (not everyone responded to every prompt) and from 132 to 134 for the broader sample. The mean response for all the reasons for designating the Mad River recreational was less than two for both samples, except for provision of recreational opportunities, which was 2.06 for the Wittenberg sample, and improving the local economy, which registered at 2.15 for the broader sample. These results suggest that all seven reasons for protecting the Mad River are of considerable importance to the survey respondents.

Table 2 – Results for Question 1 on the Surveys

Response options: Very Important, 1; Important, 2; Somewhat Important, 3; Not Important, 4; Definitely Not Important, 5

Reasons for Protecting Rivers

a. Protecting the quality of water, air and scenery

Wittenberg – mean = 1.23

Broader – mean = 1.1

b. Protecting fish and wildlife habitat

Wittenberg – mean = 1.28

Broader – mean = 1.16

c. Providing you with river recreation (fishing, hunting, camping, boating, sightseeing)

Wittenberg – mean = 2.06

Broader – mean = 1.58

d. Improving the local economy through increased tourism

Wittenberg – mean = 1.99

Broader – mean = 2.15

e. Knowing that in the future you have the option of visiting the river

Wittenberg – mean = 1.78

Broader – mean = 1.43

f. Just knowing the Mad River exists and is protected

Wittenberg – mean = 1.77

Broader – mean = 1.44

g. Knowing that future generations will have the Mad River

Wittenberg – mean = 1.49

Broader – mean = 1.19

Question 2 on the survey directly asks whether, with the knowledge that designation of the Mad River as recreational will not affect the property rights of adjacent land owners, the respondent favors or opposes the recreational designation. Table 3 below summarizes the responses to this question. Somewhat more than two thirds of the Wittenberg sample strongly favored designation while just under 60 percent of the broader sample responded strongly favor. Slightly less than a quarter of the Wittenberg sample favored designation while about one third of the broader sample were in favor. Roughly five percent of both samples were indifferent to designation. Some four percent of both samples were opposed or strongly opposed to designation. The sentiment in favor of the recreational designation as a cumulative frequency (strongly favor plus favor) registered about 91 percent of respondents.

Table 3

Should the Mad River be Designated a Recreational River?

Response	Wittenberg Sample			Broader Sample		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
Strongly Favor	91	67.91	67.91	104	58.1	58.1
Favor	31	23.13	91.04	60	33.52	91.62
Indifferent	6	4.48	95.56	10	5.59	97.21
Oppose	3	2.24	97.76	3	1.68	98.88
Strongly Oppose	3	2.24	100	2	1.12	100

The next section of the survey asked questions designed to generate an estimate for the survey respondents' willingness to pay for the recreational designation using the contingent valuation approach described above.⁹ Briefly, the respondent is faced with a hypothetical situation in which they are asked if they would vote yes on a "special" ballot issue that, if passed, would require them to make an annual contribution equal to \$X (where X is a number between zero and 200) to achieve improved water quality in the Mad River with recreational designation. For both samples combined, 72.2 percent, or 223 out of 309 total respondents (samples combined), voted yes. Respondents were then asked to report how certain they were about their vote. Responses ranged across seven levels of certainty from 'not sure at all' to 'certain.' The mean level of certainty recorded was 5.71 out of 7. Asked next if their vote would affect decision making regarding the recreational designation, responses ranged from 1 (no effect at all) to 5 (extremely) with a mean of 3.27. Based on the values of X presented to the respondents, the mean willingness to pay for the Wittenberg sample is \$28.64 and the value for the broader sample is \$54.23. With the samples merged ($n = 233$), the mean willingness to pay is \$39.74. Respondents answered one more open-ended willingness-to-pay question where they could insert

the amount they were willing to pay annually for recreational designation that put willingness to pay on average at \$39.16 with a combined $n = 225$.

The information provided in answers to these questions related to willingness to pay can be used to generate several unique estimates of individual willingness to pay for the recreational designation using the probit regression technique.¹⁰ The first estimate is generated by a model where the certainty vote regarding willingness to pay is as reported by respondents. The estimated mean willingness to pay from this model is \$117.59 annually for 236 respondents both samples combined (136 from Wittenberg and 100 from the broader sample). Other estimates of willingness to pay are based on more restrictive assumptions. For example, in a second probit regression model, unless a respondent's certainty level was reported at the two highest levels (6 or 7), the response was recorded as a 'no vote' indicating they would not support the ballot initiative with an \$X contribution annually. In this case, the willingness to pay dropped to \$54.15 annually. We also estimated a model using logit regression that only included respondents reporting a 6 or 7 for their certainty level. This model generated a willingness to pay equal to \$41.81. Taking the average of these two estimates gives \$47.98 as our best estimate of the annual willingness to pay into a fund to protect water quality in the Mad River. Details regarding the statistical methods used in this contingent valuation exercise are presented in Appendix C.

The next question was intended to shed light on why respondents voted yes regarding their willingness to make annual contributions so the Mad River could be designated recreational. Table 4 below summarizes the responses to this question. The question asked respondents to allocate percentages of their annual contribution to support various categories of benefits from recreational designation. For example, one might desire that ten percent of their contribution be devoted to maintaining their current recreation experience with the Mad River.

Table 4
Percentages of Annual Contributions Devoted to Different Categories of Benefits
for Those Who Voted Yes on the Ballot

Category:	% Witt	% Broader
My current <i>recreation</i> experience	10.56	13.38
Protect the <i>option</i> of enjoying water-based recreational activities that I do not now partake in	11.11	9.83
Preserve natural habitats and a high-quality environment for <i>future generations</i>	21.63	21.81
Good water quality and a sound environment are essential for <i>human health</i>	19.64	17.42
<i>Existence</i> of natural habitats and good quality streams, rivers, and reservoirs benefits mankind in many intangible ways other than simply recreation	18.92	21.04
Plants, fish and wildlife have a <i>right</i> to inhabit this planet, and it is our <i>duty</i> to protect that right, even if it involves sacrifices	18.29	16.93
Total	100%	100%

Since there are six categories of benefits to which a respondent may allocate a share of their contribution, if all six were equally valued, the contribution would be 16.67 percent to each one. Interestingly, both the Wittenberg and the broader samples show that the benefits from both current use and the option of current use of the Mad River as a designated recreational river are valued at a somewhat lower rate than the preservation of the habitat for future generations (bequest value), maintenance of good water and environmental quality, preserving the existence of natural habitats and aquatic resources (existence value), and the maintenance of plant and wildlife due to a sense of stewardship. The categories ‘my use’ and ‘option’ to partake in recreational activities not currently pursued received less than the 16.67 percent share that would obtain if each category were valued equally, while all the other categories received contributions greater than the 16.67 percent share.

Survey participants were asked to predict the water quality in the Mad River due to recreational designation one year from now and five years from now. The responses are summarized in Table 5 below for both samples. The actual number of responses in each column is reported with the percentage of the total listed in parentheses alongside the actual number.

Table 5

**Predictions of Mad River Water Quality Changes Due to Designation –
One Year from Now and Five Years from Now**

	Far better (1)	Slightly better (2)	About the same (3)	Slightly worse (4)	Far worse (5)	
Wittenberg 1 year from now (n=136)	3 (2%)	42 (31%)	69 (51%)	22 (16%)	0	Mean = 2.81
Wittenberg 5 years from now (n=133)	37 (28%)	58 (44%)	9 (7%)	13 (10%)	16 (12%)	Mean = 2.35
Broader Sample 1 year from now (n=102)	1 (1%)	46 (45%)	44 (43%)	9 (9%)	2 (2%)	Mean = 2.66
Broader Sample 5 years from now (n=100)	37 (37%)	31 (31%)	10 (10%)	17 (17%)	5 (5%)	Me an = 2.22

Values ranging from 1 for far better to 5 for far worse were used to calculate the means for each sample for both one-year and five-year predictions. Water quality does not improve nor, typically, does it deteriorate overnight, so it is unsurprising that the one-year time horizon generated lower average scores than did the five-year time horizon. It is notable that the overwhelming majority from both samples predicted that water quality would stay the same or improve, either slightly or greatly. Both samples perceive that there is a connection between recreational designation and improvement in water quality over a variable time horizon.

Not all respondents voted yes on the hypothetical ballot issue. For the Wittenberg sample, 59 individuals voted no and there were 40 individuals who voted no among the respondents to the broader sample. Reasons for the decision to vote no were explored with a question that listed several possibilities. Table 6 below reports the distribution of responses across these possible reasons to vote no. The number responding for each specific reason is listed with the percentage of the total responses in parentheses alongside.

Table 6
Reasons for a No Vote on the Hypothetical Ballot to Fund

Reason	Wittenberg Sample	Broader Sample
I will not receive any benefits, so there is no reason to pay	3 (5%)	1 (3%)
I object to paying into a trust fund but would pay in another way such as a recreation fee	11 (19%)	11 (28%)
I cannot afford to pay for river protection	24 (41%)	9 (23%)
I have a right to the river and it is unfair to expect me to pay to protect it	5 (8%)	3 (8%)
Other (please specify)	16 (27%)	16 (40%)

A sizeable number of respondents in both samples (11 or 19% for the Wittenberg sample and 11 or 28% for the broader sample) reported they were willing to pay in some other way, such as a recreation fee. Several reported that they cannot afford to pay – 24 for the Wittenberg sample and 9 for the broader sample. An array of responses reported in the ‘Other’ category is listed in Appendix E below.

When individuals who respond to surveys in opposition to a proposal, it is reasonable to believe that they may be willing to spend to prevent the action. Survey respondents who voted no on the hypothetical ballot were asked how much they would be willing to spend annually to avoid designation of the Mad River as a recreational river. The amounts reported ranged from \$0 to \$100 with a mean of \$8.67 for the annual expenditure respondents were willing to make.

As discussed above, contingent valuation is one way to estimate the demand for an amenity like designation of a river as recreational. Another approach, the travel-cost method, is to estimate the value of the resources individuals are willing to devote to traveling to the river or other amenity. A series of questions was presented in the survey to estimate the value of recreational designation for the Mad River using the travel-cost method. Respondents were first asked how many trips they would make to the Mad River in 2016 if it was designated a recreational river. Among 239 respondents, the average number of trips was 3.5 for 2016. Respondents were also asked how many times they would visit the river if it was not designated a recreational river, which had a mean of 2.59 for 230 respondents. These averages suggest that designation as recreational could increase the number of trips to the Mad River by almost one per year for participants in both samples.

Respondents then answered questions about property ownership in Clark County. Only one respondent owned property along the Mad River from the broader sample. The Wittenberg sample had 37 percent of respondents who owned property in Clark County but not along the Mad River. For the broader sample, all but one of the property owners was not along the Mad River and 15% were property owners elsewhere in Clark County. Table 7 below summarizes the data on property ownership in Clark County for respondents.

Table 7

Property Ownership in Clark County

Do you own property in Clark County?	Wittenberg Sample	Broader Sample
Own property in Clark County along Mad River	0	1
In Clark County, not along the Mad River	52 (37%)	16 (15%)
Do not own property in Clark County	90 (63%)	93 (85%)

Questions regarding trips to the Mad River and trips to other rivers in the past year were posed. Data for responses to questions about trips to the Mad River and other rivers are shown below in Table 8. These responses suggest that our survey reached many who use the Mad River and other rivers as a form of recreation. The Wittenberg sample shows that 76 of the respondents had visited the Mad River in the last year – almost 55 percent. Similarly, the broader sample has 57 percent of respondents having visited the Mad River in the last year. The respondents were frequent visitors to other rivers with 36 percent of the Wittenberg sample report having gone to another river in the last year while a remarkable 78 percent of the broader sample had gone to another river in the previous year. The seven most-visited ‘other rivers’ were the Ohio River, the Little Miami, the Great Miami, Buck Creek, the Muskingum, the Cuyahoga, and the Stillwater.

Table 8

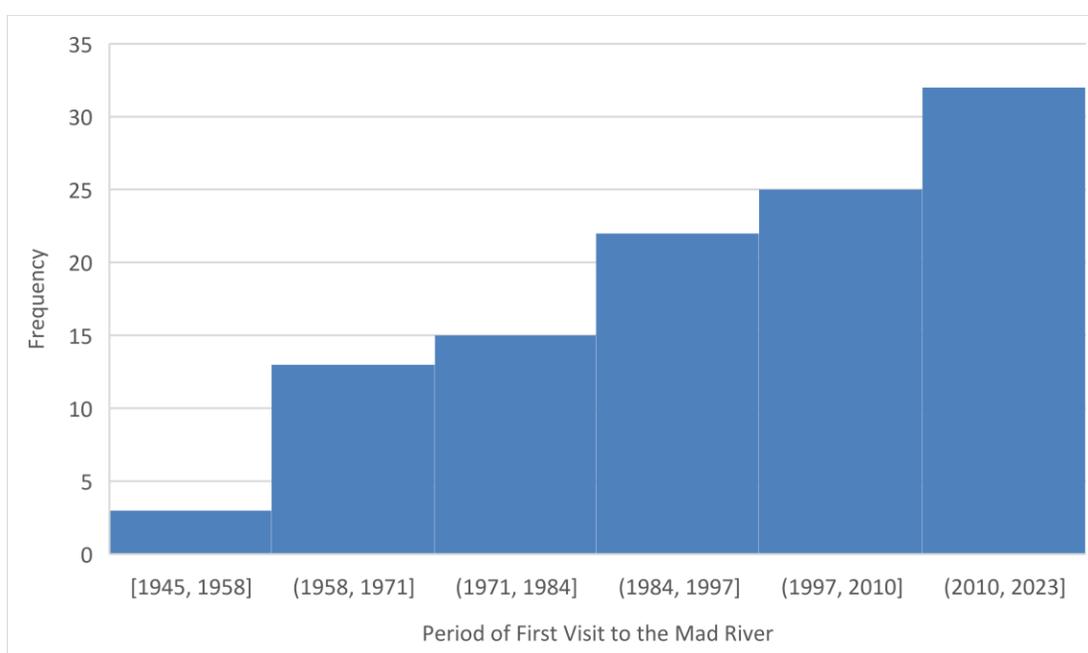
Trips to the Mad and other Rivers

Visits to Mad River	Wittenberg Sample	Broader Sample	Visits to Other Rivers	Wittenberg Sample	Broader Sample
Yes	76	63	Yes	49	87
No	63	48	No	91	24

Two more questions were posed to gain a more detailed view of the respondents use of rivers. Those who had visited the Mad River were asked the year of their first visit. Finally, respondents were asked to report the number of visits to the Mad River, to other Ohio rivers and lakes, and to lakes and rivers in other states during the previous year. The frequency distribution of 13-year periods for the first visit to the Mad River beginning in 1945 is shown in Figure 1 below. The frequency of first visits has risen more or less continuously through the present. The increase in frequency of first visits rises from three during the 1945-1958 period to 33 in the latest period from 2010 to present, according to respondents. These data may reflect an increasing intensity of interest in recreation on the Mad River.

Figure 1

Period of First Visit to the Mad River



During the previous calendar year, 113 respondents or more, reported relatively frequent trips to the Mad River, Ohio lakes and other Ohio rivers, and to lakes and rivers in other states. Data for responses to this question are reported in Table 9 below. The average number of trips to other Ohio rivers exceeds the number of trips to the Mad River and to lakes and rivers in other states by a wide margin in both samples. An average of 12.24 trips were taken by Wittenberg respondents to other Ohio rivers while on average 9.03 trips were taken to other Ohio rivers by the broader sample compared to an average of 5.05 trips to the Mad River for Wittenberg respondents and a 4.28 average number of trips to the Mad River for the broader sample. These data suggest that the respondents are not averse to traveling to enjoy aquatic recreational opportunities.

Table 9
Visits to the Mad River, other Ohio Lakes and Rivers,
and Lakes and Rivers in other States

Trips to:	Number of Responses (WittenbergSample)	Mean	Minimum Value	Maximum Value
Mad River	43	5.05	0	52
Other Ohio Rivers	45	12.24	0	100
Ohio Lakes	45	4.58	0	45
Lakes and Rivers in other States	45	4.6	0	50
	(Broader Sample)			
Mad River	70	4.28	0	20
Other Ohio Rivers	77	9.03	0	100
Ohio Lakes	74	5.58	0	40
Lakes and Rivers in other States	72	7.07	0	80

Respondents were then asked about their patterns of spending for trips to the Mad River in Clark County and trips outside Clark County to enjoy a lake or river. Seven categories of expenditure were listed including beverages, gas, restaurants, groceries, bait, gear, and other. Data for patterns of spending are presented below in Table 10. These data show similar relative

Table 10
Patterns of Spending for Trips in Clark County and outside Clark County

Spending in Clark County	Wittenberg Sample		Broader Sample		Spending Outside Clark County	Wittenberg Sample		Broader Sample	
	<i>n</i>	Mean (\$s)	<i>n</i>	Mean (\$s)		<i>n</i>	Mean (\$s)	<i>n</i>	Mean (\$s)
Beverages	25	4.00	44	5.32	Beverages	27	8.19	41	15.90
Gas	28	9.04	47	12.32	Gas	28	20.18	46	28.59
Restaurant	24	6.75	44	11.45	Restaurant	28	29.29	44	29.05
Grocery	26	4.04	41	5.10	Grocery	29	9.72	37	11.21
Bait	25	0.20	41	3.44	Bait	25	1.32	40	3.60
Gear	25	2.20	41	5.68	Gear	26	5.96	37	35.35
Other	11	2.73	12	17.92	Other	12	32.92	13	26.92
Total		\$28.96		\$61.23	Total		\$107.58		\$150.62

levels of spending in different categories for each sample and between trips inside and outside of Clark County. Restaurant meals and gasoline are the top two spending items for all respondents (except for other) with respondents from the broader sample spending considerably more than respondents for the Wittenberg sample. The Wittenberg sample included many students who typically do not have funds for expensive recreational activities. The most interesting feature of these data is the large margin of spending outside of Clark County versus inside Clark County. Spending for the Wittenberg sample increased by some 3.7 times outside of Clark County compared to inside, while those responding in the broader sample increased spending by nearly 2.5 times. Perhaps some trips outside of Clark County for aquatic recreation will be moved to Clark County with designation of the Mad River as a recreational river. Also, designation as recreational might attract bigger spenders from more distant places who, like the respondents in this case, tend to spend more as the distance to the aquatic amenity increases.

The next question asked respondents whether the trip to the Mad River, or to another river in Ohio was worth more to them than what was actually spent. The margin by which the value to a person from consumption spending exceeds the actual amount spent is known to economists as consumer surplus. For both samples combined, among 121 respondents to the question, 113 reported that the value to them was greater than the amount spent while 8 reported the value to them was not worth the amount spent.

Respondents were then asked about how many miles the respondent would have had to travel one way to visit their next most preferred river. Among 109 respondents in both samples, the average distance was 38.64 miles.

The average number of people in groups going to rivers was 3.88 among 113 respondents from both samples. Respondents also reported the types of activities that they or members of their households participated in when visiting a river in the last 12 months. The types of activities and the frequency of participation is reported in Table 11 below.

Table 11

Activities and Frequency of Participation

Activity	Frequency
Nature/Wildlife watching	95
Canoeing or Kayaking	73
Trail Use	71
Relaxing and/or picnicking	65
Fly, Lure, or Bait Fishing	44
Swimming and/or beach use	32
Camping	31
Stand-up Paddle Boarding	11
Jet Skiing, water skiing, or tubing	8
Other	7

Finally, respondents were asked about the length of their residency in Clark County and in Ohio. Among Wittenberg sample respondents, 43 reported an average of 14.92 years in Clark County and 44 reported an average of 32.51 years in Ohio. Among the broader sample respondents, 65 reported an average of 5.63 years in Clark County and 78 respondents reported an average of 39.63 years in Ohio.

Travel cost models were estimated for the Wittenberg sample and the broader sample combined as well as for the Wittenberg sample alone. Details for the estimation technique used, which is called Poisson regression that assumes the number of visits per person per year follows a truncated Poisson distribution, are presented in Appendix E below.¹¹ Simply put, this method uses the natural logarithm of the number of trips to the Mad River per person per year as the dependent variable which is explained by variables that, in this case, include the cost of traveling to the Mad River, the cost of traveling to an alternative river, the respondent's income, age, gender, educational level, the importance of recreational activities as a reason to designate the Mad River recreational drawn from responses to question 1, part C (see Table 2 above), and whether or not the respondent lives in Clark County. Once estimates for the coefficients on the explanatory variables are estimated, these can be used to compute the consumer surplus from recreational designation, that is, the difference between what respondents are willing and able to pay for a trip to the Mad River and what they actually pay. Data for 90 respondents was used to estimate the consumer surplus for both samples combined. Several observations for individuals from the broader sample were excluded from the estimate since they lived quite far away from Clark County and dramatically skewed the results. An estimate for the Wittenberg sample was computed based on responses from 34 individuals. The consumer surplus for both samples combined was estimated to be \$178 per visit and the consumer surplus for the Wittenberg sample was \$142 per visit. These values are higher than we expected, which diminishes our confidence in the estimate somewhat. For further discussion of the estimation technique and the results, refer to Appendix D below.

VI. Conclusions and Recommendations

Both the probit regression results for the contingent valuation estimate of willingness to pay to have the Mad River designated a recreational river and the Poisson regression results used to estimate the consumer surplus per trip to the Mad River reflect a strong demand for the recreational designation. Consider that 236 respondents are estimated to have an annual willingness to pay for the recreational designation equal to just under \$50 per year. The total willingness to pay is then equal to 236 times \$50 equal to \$11,800 per year. Although this estimate is a significant sum, imagine how large the true value must be if all those in the region who value the Mad River as a recreational river could have been included. Moreover, the travel-cost estimates of consumer surplus equal to \$178 per person per trip for both samples combined and the \$154 per person per trip for the Wittenberg sample alone are quite high (assuming no bias on the part of respondents) suggesting that visitors to the Mad River are thoroughly enjoying themselves. Their willingnesses to pay are much higher than the actual cost of a trip. Our results suggest that the Mad River is highly valued by survey respondents and is a recreation bargain when the value of a trip to the river is compared to its cost.

In addition to a strong demand for designating the Mad River recreational, the results from the surveys lead us to other conclusions. For example, Table 4 shows data for how respondents would distribute their monetary support for recreational designation across various categories of non-pecuniary benefits to be achieved via designation. There is support in the double digit percentages for all the categories listed. The data regarding expectations for water quality in the Mad River are presented in Table 5. These show optimism that designation will be followed by water quality improvement. Together, these tables reflect the recognition by respondents that amenity benefits are valuable and these benefits can be enhanced with recreational designation.

Another important conclusion is that some respondents are opposed to paying into a trust supporting the recreational designation. For the samples combined, 99 respondents who voted no on the willingness to pay into a trust question reported their reasons for the no vote. Twenty-two of these were willing to pay in principle through a recreation fee. Another 33 respondents reported that they could not afford to pay anything. Among those who were willing to pay in order not to have the river designated recreational, the average willingness to pay was just \$8.67.

We conclude that usage rates for the Mad River are currently high and will increase somewhat as a result of recreational designation based on data presented in Tables 8 and 9 and Figure 2. In Table 8, 275 individuals from the combined samples report that they had visited the Mad River and/or other rivers in the last year. The responses suggest that the number of trips per person per year to the Mad could increase by about one from 2.59 to 3.5. Moreover, Figure 2 suggests that a surge in first visits to the Mad seems to be currently underway. Table 9 shows that many respondents to both surveys are using the Mad River and are even more frequent visitors to other lakes and rivers. Enthusiasm for aquatic recreational activities is significant and may be increasing.

Patterns of spending associated with trips to the Mad River and other rivers and lakes lead us to conclude that these journeys are not cheap with the possible exception of trips taken by Wittenberg respondents that registered an average of only \$28.96 per trip, less than half the \$61.23 per trip average spending reported by the broader sample. The average spending on a trip to a river or lake outside of Clark County was over \$100 for both samples. People who visit rivers and lakes spend considerable sums in the process.

The positive conclusions drawn thus far seem unsurprising given the range of activities that a scenic/recreational river can support as reported in Table 11. A wide variety of recreational activities is reflected in the choices reported. People enjoy aquatic-related recreation.

We duly note the objections to the proposed recreational designation for the Mad River. Some landowners along the portion of the Mad being considered for designation are understandably nervous that their property rights as riparian owners could be abridged. Violation of the property rights of adjacent landowners cannot happen as a result of state action according to the language of the legislation. Riparian landowners do have a significant concern regarding an increase in use of the river that might result in spillover effects that harm adjacent owners. Noise, littering, trespassing and other activities that create nuisances for adjacent

owners are real costs and need to be considered. These costs cannot be ruled out entirely – they may increase for some adjacent landowners after a recreational designation for the Mad River. Therefore, avenues for recourse and compensation must exist. The creation of a 10-member citizens' council after recreational designation to monitor the way the river is used is one such avenue. Adjacent landowners with concerns regarding nuisances arising from river users can appeal to the council by presenting information for it to consider. They also may apply for membership on the council. Those living along the river can reasonably expect more careful monitoring from the Ohio Department of Natural Resources after designation. Hopefully, nuisance issues will be diminished for adjacent landowners after the recreational designation given the creation of the citizens' council and increased monitoring of river users. In any case, the civil courts are an avenue of recourse for anyone who is a victim of trespass and other nuisances.

Significant benefits have been identified in this study and are likely to arise from designation of the Mad River as recreational. The costs of designation are low and mechanisms exist to minimize any nuisance costs that adjacent landowners might experience. Our recommendation is that the remaining steps necessary to designate the Mad River a recreational river be taken as soon as possible. Clark County and Springfield are virtually certain to enjoy net benefits.

Appendix A – Text of the Ohio Code Regarding the Creation of Wild, Scenic, and Recreational Rivers

1547.81 Creating wild, scenic, or recreational river areas.

The director of natural resources or the director's representative may create, supervise, operate, protect, and maintain wild, scenic, and recreational river areas. In creating wild, scenic, and recreational river areas, the director shall classify each such area as either a wild river area, a scenic river area, or a recreational river area. The director or the director's representative may prepare and maintain a plan for the establishment, development, use, and administration of those areas as a part of the comprehensive state plans for water management and outdoor recreation. The director or the director's representative may cooperate with federal agencies administering any federal program concerning wild, scenic, or recreational river areas.

The director may propose for establishment as a wild, scenic, or recreational river area a part or parts of any watercourse in this state, with adjacent lands, that in the director's judgment possesses water conservation, scenic, fish, wildlife, historic, or outdoor recreation values that should be preserved. The area shall include lands adjacent to the watercourse in sufficient width to preserve, protect, and develop the natural character of the watercourse, but shall not include any lands more than one thousand feet from the normal waterlines of the watercourse unless an additional width is necessary to preserve water conservation, scenic, fish, wildlife, historic, or outdoor recreation values.

The director shall publish the intention to declare an area a wild, scenic, or recreational river area at least once in a newspaper of general circulation in each county, any part of which is within the area, and shall send written notice of the intention to the legislative authority of each county, township, and municipal corporation and to each conservancy district established under Chapter 6101. of the Revised Code, any part of which is within the area, and to the director of transportation, the director of development, the director of administrative services, and the director of environmental protection. The notices shall include a copy of a map and description of the area.

After thirty days from the last date of publication or dispatch of written notice as required in this section, the director shall enter a declaration in the director's journal that the area is a wild river area, scenic river area, or recreational river area. When so entered, the area is a wild, scenic, or recreational river area, as applicable. The director, after thirty days' notice as prescribed in this section and upon the approval of the recreation and resources commission created in section [1501.04](#) of the Revised Code, may terminate the status of an area as a wild river area, scenic river area, or recreational river area by an entry in the director's journal.

Declaration by the director that an area is a wild, scenic, or recreational river area does not authorize the director or any governmental agency or political subdivision to restrict the use of land by the owner thereof or any person acting under the landowner's authority or to enter upon the land and does not expand or abridge the regulatory authority of any governmental agency or political subdivision over the area.

The director may enter into a lease or other agreement with a political subdivision to administer all or part of a wild, scenic, or recreational river area and may acquire real property or any estate, right, or interest therein in order to provide for the protection and public recreational use of a wild, scenic, or recreational river area.

The chief of the division of watercraft or the chief's representative may participate in watershed-wide planning with federal, state, and local agencies in order to protect the values of wild, scenic, and recreational river areas.

Renumbered from § [1517.14](#) and amended by 128th General Assembly File No.9, HB 1, §101.01, eff. 7/17/2009.

Effective Date: 03-18-1999

Appendix B – Texts of the Surveys

The Survey Sent to the Wittenberg Community

SCENIC/RECREATIONAL MAD RIVER SURVEY



The State of Ohio is considering designation of a 22-mile stretch of the Mad River in Clark County, OH as a recreational river in the Ohio Scenic Rivers Program. It is important for policy makers to know the preferences of the local community regarding protecting rivers and recreation opportunities in and along the Mad River so as to assess the value that the community places on a recreational designation for the river. These survey results will be included in a larger study of the economic impact of designating the Mad River as recreational that is being undertaken by Wendong Zhang, Assistant Professor of Economics, Iowa State University and David Wishart, Professor of Economics, Wittenberg University.

You, or a member of your household, are being asked to complete this survey related to the possible designation of the Mad River as recreational. Your participation in this study is completely voluntary. You are free to leave questions unanswered as you work through the survey. However, to ensure that the results of our study accurately reflect the preferences of local residents, it is essential that each questionnaire be completed and returned promptly. It should not require more than 20 to 30 minutes to complete. Any adult (18 years or older) in your household may answer the questions. By completing the survey, you will help Ohio policy makers base their decisions on the best available information.

You are assured complete confidentiality. Your name will never be associated with the answers you give. The responses on your completed survey are automatically transferred to a data base on completion. It is impossible for us to distinguish individual responses. After we have collected as many responses as possible, **the e-mail addresses for everyone who completed the survey will be entered in a drawing for ten \$50 Amazon gift accounts.** We deeply appreciate the time you take to complete the survey.

The results from this survey will play an important role in determining whether or not to proceed with the designation of the Mad River as recreational. The information you provide will have a direct impact on this policy decision. We can send you a summary of the results of the survey and the broader study. Simply e-mail us that you would like to see a copy of the results of the study and we will provide them. Please write or phone us with any questions you might have.

Sincerely,

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I. YOUR PREFERENCES

1. Once a river is designated as a state scenic, wild, or recreational river, dams to hinder the flow and diversions that remove large amounts of water are prohibited. Moreover, rivers that are designated as scenic, wild, or recreational tend to be healthier with higher water quality and greater diversity of plants and animals instream and along the banks, have easier accessibility for recreational users with designated access points from public lands along the river, and result in economic benefits for adjacent communities due to increased tourism. There are many reasons for protecting the Mad River. Seven possible reasons for protecting the Mad River are listed below. Please circle the choices that best describe how important each reason is to you.

Reasons for Protecting Rivers	Very Important	Important	Somewhat Important	Not Important	Definitely Not Important
a. Protecting the quality of water, air and scenery	1	2	3	4	5
b. Protecting fish and wildlife habitat	1	2	3	4	5
c. Providing you with river recreation (fishing, hunting, camping, boating, sightseeing)	1	2	3	4	5
d. Improving the local economy through increased tourism	1	2	3	4	5
e. Knowing that in the future you have the option of visiting the river	1	2	3	4	5
f. Just knowing the Mad River exists and is protected	1	2	3	4	5
g. Knowing that future generations will have the Mad River	1	2	3	4	5

2. Designating the Mad River as a recreational river will protect it from dams and diversions. However, the property rights of landowners along the river will not be impacted, according to state law. Do you favor or oppose designating the Mad River a recreational river? Circle the choice below that best describes your preference.

Strongly Favor	Favor	Indifferent	Oppose	Strongly Oppose
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II. THE ECONOMIC VALUE OF THE MAD RIVER AS A RECREATIONAL RIVER

In the next question, we will be asking how you would vote on a special ballot to determine how much you value the designation of the 22-mile stretch of the Mad River in Clark County as a recreational river. Specifically, you will be asked how much you would be willing to contribute annually to funds that provide for improved water quality, easier access to the river, and the promotion of tourism to the Mad River, respectively. While there is no such ballot initiative, nor will there be one in the future that charges Clark County residents for designating the Mad River as recreational, we would like you to respond as if you were actually voting on

8. If you answered YES in the referendum question, could you allocate your contribution to these following different categories in terms of percentage:

<i>Category</i>	<i>Percentage</i>
My current <i>recreation</i> experience	
Protect the <i>option</i> of enjoying water-based recreational activities that I do not now partake in	
Preserve natural habitats and a quality environment for <i>future generations</i>	
Good water quality and a sound environment are essential for <i>human health</i>	
<i>Existence</i> of natural habitats and good quality streams, rivers, and reservoirs benefits mankind in many intangible ways other than simply recreation	
Plants, fish and wildlife have a <i>right</i> to inhabit this planet, and it is our <i>duty</i> to protect that right, even if it involves sacrifices	
Total	100%

9. If you are not willing to contribute to one or more of the funds described above, please identify one of the five choices listed below that most closely describes your reason.

- a. You do not receive any benefits from the protection of these rivers and, therefore, see no reason to pay.
- b. You object to paying into a trust fund, but would not oppose some other way of paying for river protection, such as a recreation fee.
- c. You cannot afford to pay for river protection.
- d. You have a right to the river and it is unfair to expect you to pay to protect it.
- e. Other (please specify) _____

10. If you are not willing to contribute to these trust funds, what is the maximum amount of money you would pay annually to avoid river protection? Please write zero if you are not willing to pay at all.

\$ _____

11. During 2016, how many trips do you expect to make to visit the Mad River if it is designated a recreational river?

_____ trips in January 2016 – December 2016

III. QUESTIONS ABOUT YOUR TRIPS TO THE MAD RIVER IN CLARK COUNTY AND OTHER RIVERS

12. What is your home zip code _____ (Wittenberg students use 45501)

13. Do you own property in Clark County?

_____ Yes and along Mad River _____ Yes and not along Mad River _____ No

14. Have you visited the Mad River in Clark County in the last year?

_____ Yes _____ N

15. Have you visited any other Ohio rivers in the past 12 months?

_____ Yes (Please name the two most visited rivers _____:_____)

_____ No (If you have not visited the Mad River or other rivers in Ohio in the past 12 months, please go to question 23 below.)

16. When did you first visit the Mad River in Clark County? (Calendar year) _____

17. Approximately how many trips did you take to visit a river in the last 12 months?

The Mad River in Clark County: _____ trips

Other Ohio Rivers Combined: _____ trips in Ohio

18. For your typical trip to the Mad River in Clark County or another Ohio river, what dollar amounts do you typically spend in each of the following categories?

Expenses in dollars	In Clark County, OH	Outside Clark County, OH
Beverages		
Gas		
Restaurant		
Groceries		
Bait/Tackle		
Gear		
Other (Please specify below)		

19. Was the trip typically worth more to you than what was actually spent?

_____ Yes _____ No

20. If you were unable to visit this river, how many miles would you have to travel to visit your next most preferred river, one way? _____ miles

21. How many people, including yourself, were in the party on this trip? _____ persons

22. How many years have you been living in Ohio: _____ years

How many years have you been living in Clark County: _____ years

23. Please indicate all the activities you or a member of your household participated in when visiting this river in the past 12 months. Please check all that apply

_____ Boating with motor _____ Canoeing, kayaking or sailing _____ Camping
 _____ Fly, Lure, or Bait Fishing _____ Jet skiing, water skiing, or tubing _____ Trail use
 _____ Relaxing, and or picnicking _____ Nature/wildlife watching
 _____ Swimming and/or beach use _____ Other

IV. DEMOGRAPHIC INFORMATION

Your responses to the following questions will help us to understand better how household characteristics affect an individual's use of the Mad River and attitudes regarding changes in the river. It will also help us to determine how representative our sample is of Clark County. All of your answers are strictly confidential. The information will only be used for comparison purposes. We will never identify individuals or households who have responded. Please be as complete in your answers as possible. Thank you.

24. What is your gender? Male Female

25. In what year were you born? _____ Year

26. What is the highest level of education you have completed?

Some High School or less High School graduate or GED
 Some College or trade/vocational school College Graduate
 Graduate School – Master's Degree Graduate School – Doctorate Degree

27. Including yourself, how many people live in your household?

Number of Adults Number of Children (Under 18)

28. Which best describes your employment status?

Full time Part time Student Unemployed Retired

29. Which of the following categories best describes your total household income before taxes in year 2014?

Less than \$10,000 per year \$10,000 to \$15,000 per year \$15,000 to \$20,000 per year
 \$20,000 to \$25,000 per year \$25,000 to \$30,000 per year \$30,000 to \$35,000 per year
 \$35,000 to \$40,000 per year \$40,000 to \$50,000 per year \$50,000 to \$60,000 per year
 \$60,000 to \$75,000 per year \$75,000 to \$100,000 per year \$100,000 to \$125,000 per year
 \$125,000 to \$150,000 per year More than \$150,000 per year

30. Do you belong to:

- a. an outdoor sporting organization Yes No
b. an environmental organization Yes No
c. an agricultural organization Yes No

Finally, we would appreciate a little more information on your reaction to this survey.

31. How well informed are you about the general state of water quality in Ohio's rivers?

1 (not well informed at all) 2 3 4 5 (very knowledgeable)

32. In this survey, we have asked you about your usage of Ohio's rivers especially Mad River and your views about the possible designation of Mad River in Clark County as Ohio's recreational scenic river. Do you believe that you are likely to have other opportunities to express your views about the designation and other water quality programs?

1 (not likely at all) 2 3 4 5 (very likely)

The Survey Sent to a Broader Audience – Revised Version

SCENIC/RECREATIONAL MAD RIVER SURVEY



The State of Ohio is considering designation of a 22-mile stretch of the Mad River in Clark County, OH as a Recreational River in the Ohio Scenic Rivers Program. The Ohio Scenic Rivers Program provides for rivers to be designated as Wild, Scenic, or Recreational, depending on their characteristics. To read the legal provisions for the Ohio Scenic Rivers Program you may go to <http://watercraft.ohiodnr.gov/laws/scenic-rivers-laws>. It is important for policy makers to know the preferences of the local community regarding protecting rivers and recreation opportunities in and along the Mad River so as to assess the value that the community places on designating the river as a Recreational River. Results from this survey will be incorporated into a larger study of the potential economic impact of designating the Mad River as Recreational that is being undertaken by Wendong Zhang, Assistant Professor of Economics, Iowa State University and David Wishart, Professor of Economics, Wittenberg University.

You, or a member of your household, are being asked to complete this survey related to the possible designation of the Mad River as Recreational. Your participation in this study is completely voluntary. You are free to leave questions unanswered as you work through the survey. However, to ensure that the results of our study accurately reflect the preferences of Ohio residents, it is essential that each questionnaire be completed and returned promptly. It should not require more than 20 to 30 minutes to complete. Any adult (18 years or older) in your household may answer the questions. By completing the survey, you will help the State of Ohio and local leaders base the designation decision on the best available information.

You are assured complete confidentiality. Your name will never be associated with the answers you give. The responses on your completed survey are automatically transferred to a data base on completion. It is impossible for us to distinguish individual responses. After we have collected as many responses as possible, **the e-mail addresses for everyone who completed the survey will be entered in a drawing for ten \$50 Amazon gift accounts.** We deeply appreciate the time you take to complete the survey. The results from this survey will play an important role in determining whether or not to proceed with the designation of the Mad River as Recreational. The information you provide will have a direct impact on this policy decision. We can send you a summary of the results of the survey and the broader study. Simply e-mail us that you would like to see a copy of the results of the study and we will provide them. Please write or phone us with any questions you might have.

Sincerely,

Wendong Zhang, Assistant Professor
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 Ames, Iowa
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I. YOUR PREFERENCES

1. Rivers that are designated as Scenic, Wild, or Recreational tend to be healthier with higher water quality and greater diversity of plants and animals instream and along the banks, have easier accessibility for recreational users with designated access points from public lands along the river, and result in economic benefits for adjacent communities due to increased tourism. There are many reasons for protecting the Mad River. Seven possible reasons for protecting the Mad River are listed below. Please circle the choices that best describe how important each reason is to you.

Reasons for Protecting Rivers	Very Important	Important	Somewhat Important	Not Important	Definitely Not Important
a. Protecting the quality of water, air and scenery	1	2	3	4	5
b. Protecting fish and wildlife habitat	1	2	3	4	5
c. Providing you with river recreation (fishing, hunting, camping, boating, sightseeing)	1	2	3	4	5
d. Improving the local economy through increased tourism	1	2	3	4	5
e. Knowing that in the future you have the option of visiting the river	1	2	3	4	5
f. Just knowing the Mad River exists and is protected	1	2	3	4	5
g. Knowing that future generations will have the Mad River	1	2	3	4	5

2. The property rights of landowners along the river will not be impacted, according to state law. Do you favor or oppose designating the Mad River a Recreational river? Circle the choice below that best describes your preference.

Strongly Favor	Favor	Indifferent	Oppose	Oppose	Strongly Oppose
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II. THE ECONOMIC VALUE OF THE MAD RIVER AS A RECREATIONAL RIVER

In the next question, we will be asking how you would vote on a special ballot to determine how much you value the designation of the 22-mile stretch of the Mad River in Clark County as a Recreational river. Specifically, you will be asked how much you would be willing to contribute annually to funds that provide for improved water quality, easier access to the river, and the promotion of tourism to the Mad River, respectively. While there is no such ballot initiative, nor will there be one in the future that charges Clark County residents for designating the Mad River as Recreational, we would like you to respond as if you were actually voting on the initiative and as if this were the only alternative available for improving water quality in the river, access

8. If you answered YES in the referendum question, could you allocate your contribution to these following different categories in terms of percentage?

<i>Category</i>	<i>Percentage</i>
My current <i>recreation</i> experience	
Protect the <i>option</i> of enjoying water-based recreational activities that I do not now partake in	
Preserve natural habitats and a high-quality environment for <i>future generations</i>	
Good water quality and a sound environment are essential for <i>human health</i>	
<i>Existence</i> of natural habitats and good quality streams, rivers, and reservoirs benefits mankind in many intangible ways other than simply recreation	
Plants, fish and wildlife have a <i>right</i> to inhabit this planet, and it is our <i>duty</i> to protect that right, even if it involves sacrifices	
Total	100%

9. If you are not willing to contribute to one or more of the funds described above, please identify one of the five choices listed below that most closely describes your reason.

- a. You do not receive any benefits from the protection of the Mad River and, therefore, see no reason to pay.
- b. You object to paying into a trust fund, but would not oppose some other way of paying for river protection, such as a recreation fee.
- c. You cannot afford to pay for river protection.
- d. You have a right to the river and it is unfair to expect you to pay to protect it.
- e. Other (please specify) _____

10. If you are not willing to contribute to these trust funds, what is the maximum amount of money you would pay annually to avoid river protection? Please write zero if you are not willing to pay at all.

\$ _____

11. During 2016, how many trips do you expect to make to visit the Mad River if it is designated a Recreational river?

_____ trips in January 2016 – December 2016

III. QUESTIONS ABOUT YOUR TRIPS TO THE MAD RIVER IN CLARK COUNTY AND OTHER RIVERS

12. What is your home zip code _____

13. Do you own property in Clark County?

_____ Yes, along Mad River _____ Yes, but not along Mad River _____ No

14. Have you visited the Mad River in Clark County in the last year?

_____ Yes _____ No

15. Have you visited any other Ohio rivers in the past 12 months?

_____ Yes (Please name the two most visited rivers)

_____ No (If you have not visited the Mad River or other rivers in Ohio in the past 12 months, please go to question 23 below.)

16. When did you first visit the Mad River in Clark County? (Calendar year, best guess)

17. Approximately how many trips did you take to visit a river in the last 12 months?

The Mad River in Clark County: _____ trips

Other Ohio Rivers Combined: _____ trips in Ohio

18. For your typical trip to the Mad River in Clark County or another Ohio river, what dollar amounts do you typically spend in each of the following categories?

Expenses in dollars	In Clark County, OH	Outside Clark County, OH
Beverages		
Gas		
Restaurant		
Groceries		
Bait/Tackle		
Gear		
Other (Please specify below)		

19. Was the trip typically worth more to you than what was actually spent?

_____ Yes _____ No

20. If you were unable to visit this river, how many miles would you have to travel to visit your next most preferred river, one way? _____ miles

21. How many people, including yourself, were in the party on the trip described above? _____ persons

22. How many years have you been living in Ohio? _____ years

How many years have you been living in Clark County? _____ years

23. Please indicate all the activities you or a member of your household participated in when visiting this river in the past 12 months. Please check all that apply

- | | | |
|--|--|------------------------------------|
| <input type="checkbox"/> Boating with motor | <input type="checkbox"/> Canoeing, kayaking | <input type="checkbox"/> Camping |
| <input type="checkbox"/> Fly, Lure, or Bait Fishing | <input type="checkbox"/> Jet skiing, water skiing, or tubing | <input type="checkbox"/> Trail use |
| <input type="checkbox"/> Relaxing, and or picnicking | <input type="checkbox"/> Nature/wildlife watching | <input type="checkbox"/> Other |
| <input type="checkbox"/> Swimming and/or beach use | <input type="checkbox"/> Stand-up Paddle-boarding | |

IV. DEMOGRAPHIC INFORMATION

Your responses to the following questions will help us to understand better how household characteristics affect an individual's use of the Mad River and attitudes regarding changes in the river. It will also help us to determine how representative our sample is of Clark County. All of your answers are strictly confidential. The information will only be used for comparison purposes. We will never identify individuals or households who have responded. Please be as complete in your answers as possible. Thank you.

24. What is your gender? Male Female

25. In what year were you born? _____ Year

26. What is the highest level of education you have completed?

- | | |
|--|---|
| <input type="checkbox"/> Some High School or less | <input type="checkbox"/> High School graduate or GED |
| <input type="checkbox"/> Some College or trade/vocational school | <input type="checkbox"/> College Graduate |
| <input type="checkbox"/> Graduate School – Master's Degree | <input type="checkbox"/> Graduate School – Doctorate Degree |

27. Including yourself, how many people live in your household?

- | | |
|---|--|
| <input type="checkbox"/> Number of Adults | <input type="checkbox"/> Number of Children (Under 18) |
|---|--|

28. Which best describes your employment status?

- Full time Part time Student Unemployed Retired

29. Which of the following categories best describes your total household income before taxes in year 2014?

- | | |
|--|--|
| <input type="checkbox"/> Less than \$10,000 per year | <input type="checkbox"/> \$10,000 to \$15,000 per year |
| <input type="checkbox"/> \$15,000 to \$20,000 per year | <input type="checkbox"/> \$20,000 to \$25,000 per year |
| <input type="checkbox"/> \$25,000 to \$30,000 per year | <input type="checkbox"/> \$30,000 to \$35,000 per year |
| <input type="checkbox"/> \$35,000 to \$40,000 per year | <input type="checkbox"/> \$40,000 to \$50,000 per year |
| <input type="checkbox"/> \$50,000 to \$60,000 per year | <input type="checkbox"/> \$60,000 to \$75,000 per year |
| <input type="checkbox"/> \$75,000 to \$100,000 per year | <input type="checkbox"/> \$100,000 to \$125,000 per year |
| <input type="checkbox"/> \$125,000 to \$150,000 per year | <input type="checkbox"/> More than \$150,000 per year |

30. Do you belong to:

- | | | |
|--------------------------------------|------------------------------|-----------------------------|
| a. An outdoor sporting organization? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b. A conservation organization? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| c. An agricultural organization? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Finally, we would appreciate a little more information on your reaction to this survey.

31. How well informed are you about the general state of water quality in Ohio's rivers?

1 (not well informed at all) 2 3 4 5 (very knowledgeable)

32. In this survey, we have asked you about your usage of Ohio's rivers especially Mad River and your views about the possible designation of Mad River in Clark County as one of Ohio's Recreational rivers. Do you believe that you are likely to have other opportunities to express your views about the designation and other water quality programs?

1 (not likely at all) 2 3 4 5 (very likely)

Please write down any comments you have regarding the survey

Appendix C – An Overview of the Statistical Analysis to Estimate Willingness to Pay Using Contingent Valuation¹²

A description of the contingent evaluation approach to measuring the willingness to pay for a change in the provision of an environmental amenity, such as designating a river recreational, is presented above in the body of this report. Potential users of the amenity might simply be asked to state their maximum willingness to pay for the change. However, since the payment is purely hypothetical, respondents may be inclined to inflate their willingnesses to pay, leading to an overstatement of the true value of the amenity. Economists call this phenomenon hypothetical bias. Another type of bias, strategic bias, can also lead to misleading results whereby respondents insert survey responses that attempt to shift the results toward the respondent's preferred outcome.

Although it is impossible to eliminate these types of bias completely from surveys like the one undertaken in this study, it is possible to control for biases through the construction of questions that are likely to elicit responses that are consistent with the respondent's true preferences. For example, more recently, economists have begun to use questions that are dichotomous in format (yes/no) rather than open ended as in a simple query regarding how much a person is willing to pay for a change in the provision of an amenity. Question 3 in the survey that we employed asked the question "In order to improve the quality of water in the Mad River in Clark County Ohio through its designation as a state scenic/recreational river, would you be willing to make an **annual** contribution of **\$X** to a trust fund for that purpose?" where X is a value ranging from \$1 to \$200 with specific values equal to \$1, \$2, \$5, \$10, \$20, \$50, \$100, \$150, and \$200. The question is introduced with an admonition for the respondent to answer in a way that is consistent with their actual preferences. Respondents are asked to imagine that they are actually writing a check for the fund to support improved water quality in the river designated recreational when they respond to the yes/no question. Question 4 in the survey asks respondents how certain they are about the response in Question 3. The responses to this "certainty" question can be used statistically to correct for possible inflation of willingnesses to pay that are reported. Question 5 is known as a "consequentiality" question that can be used to further correct responses to Question 3 that may be biased. Question 5 asks "How likely do you think it is that survey results such as these will affect decisions like designation of the Mad River as a Recreational River in the Ohio Scenic Rivers Program?" with response options ranging from 1 (no effect at all) to 7 (extremely). Several other demographic and socioeconomic variables can be included in the analysis to control for factors that might also affect the respondents' willingnesses to pay, including income, age, educational level, water quality preferences, employment, property ownership along the river, prior visits to the river, membership in an environmental organization, and the number of adults in the household.

Consider the economic meaning of a person's response to the binary-yes/no question "In order to improve the quality of water in the Mad River in Clark County Ohio through its designation as a state scenic/recreational river, would you be willing to make an **annual** contribution of **\$X** to a trust fund for that purpose?" If a person answers yes, then they must perceive themselves to be slightly better off with less money of at least the amount \$X and the change in the provision of the amenity than they would be with the \$X in hand and no change in the amenity. The person's willingness to pay for the change in provision of the amenity is then equal to at least \$X. Either probit or logit regression analysis can be used to estimate the relationship between a group of independent variables and a dependent variable that is expressed in binary terms like a yes/no question. The estimated regression equation can then be used to predict a yes or no vote based on specific values for the independent variables. With some algebraic manipulation, the total willingness to pay for a change in provision of an amenity can be calculated from the regression results.

The choice of either probit or logit analysis depends on assumptions regarding the distribution of the error term for the regression equation. Put simply, the estimated equation allows one to make best estimates of the probability of a yes vote based on values for the independent variables. However, the actual value of the probability will differ from the estimated value. This difference is the error. If a researcher believes that the error term has a standard normal distribution, then probit is the appropriate regression technique to use. If the error is believed to exhibit a standard logistic distribution, then logit is the appropriate technique. In practice, the results from both approaches are usually very similar.

The first equation we estimated using probit has the following form:

Probability (yes) = $f(-\$X$, age, age squared, education, gender, employment, membership in an environmental group, residence in Clark County, retirement status, natural log of income, and recreation opportunities), which can be read as:

the probability of a yes vote is a function of the opposite of the random payment (as the random payment goes up the probability of a yes vote goes down), age, the age squared, education, gender, employment, membership in an environmental group, residence in Clark County, retirement status, natural log of income, and recreation as a very important reason for protecting rivers.

Formally, we have:

$$E(y_j) = \Phi(\alpha_0 + \beta_1 BID_j + \alpha_1 AGE_j + \alpha_2 AGE_j^2 + \alpha_3 EDU_j + \alpha_4 GDR_j + \alpha_5 EMP_j + \alpha_6 ENVIRO_j + \alpha_7 CLK_j + \alpha_8 RTRD_j + \alpha_9 LOGINC_j + \alpha_{10} RCRN_j + \varepsilon_j)$$

for all respondents j equal to 1 through n where $E(y)$ is the expected value of a yes vote between zero and one, Φ is the probit function (the inverse normal cumulative density function), BID is the value of X that is voted on, AGE is the age of the survey respondent, AGE^2 is the survey respondent's age squared, EDU is the educational level, GDR is gender (1 if female, 0 if male), EMP is the employment status of the respondent, $ENVIRO$ is membership in an environmental group (1 if a member, 0 if not), CLK is residence in Clark County (1 if a resident, 0 if not), $RTRD$ is retirement status (1 if retired, 0 if not), $LOGINC$ is the natural log of the respondent's income level, and $RCRN$ is the response to reasons for protecting rivers on the question regarding provision of recreational opportunities (1 if very important and 0 otherwise). The constant term (or intercept) is given by α , the value of $E(y)$ when the values for the 11 independent variables are all equal to zero. The error term, ε_j , is assumed to be distributed normally with a mean equal to 0 and a constant standard deviation.

The coefficients to be estimated are β_1 , the change in $E(y)$ associated with a \$1 increase in the value of X ; α_1 , the change in $E(y)$ associated with a one-year increase in age; α_2 , the change in $E(y)$ associated with a one unit increase in AGE squared; α_3 , the change in $E(y)$ associated with a one unit increase in educational level; α_4 , the change in $E(y)$ associated with female respondents as opposed to male; α_5 , the change in $E(y)$ associated with a change in employment status; α_6 , the change in $E(y)$ associated with belonging to an environmental group; α_7 , the change in $E(y)$ associated with being a resident of Clark County; α_8 , the change in $E(y)$ associated with being retired; α_9 , the change in $E(y)$ associated with a one unit increase in the natural logarithm of income; and α_{10} , the change in $E(y)$ associated with the response 'very important' to the availability of recreational activities as a reason to protect rivers.

We estimated the equation initially with no adjustments to the survey responses. Recall from the discussion in the text that contingent valuation estimates of willingness to pay are potentially susceptible to bias that may tend to inflate them. Indeed, when the average annual willingness to pay was calculated from estimates obtained using all respondents from both surveys ($N = 236$), the value was a rather large \$117.59. We then adjusted the BID values based on the responses given to Question 4 in the surveys that asked how certain respondents were to their responses to the previous question where they were asked if they would pay $\$X$ annually to the hypothetical fund with values for X ranging from \$1 to \$200. Only those respondents who recorded a 6 or a 7 (certain) were used in the estimate. Any respondent who reported a value of 5 or less on the certainty question was recorded as a zero bid. This second estimate showed an average annual willingness to pay equal to \$54.15

Regression results from the certainty-adjusted estimate are reported below in Table 12. The results show that 236 respondents for both Wittenberg and the broader sample answered the questions necessary to estimate this equation. The term LR Chi^2 (11 degrees of freedom) refers to a hypothesis test using the Chi^2 statistic where the null hypothesis is that all coefficients on the 11 explanatory variables are equal to zero and the alternative hypothesis is that they are different from zero. The Chi^2 value equal to 69 suggests that the coefficients are not all zero. The fact that $Prob > Chi^2 = 0$ allows us to reject the null hypothesis with zero probability that we are rejecting the null hypothesis and the null is true. In other words, the probability of a type one error is zero. The Pseudo $R^2 = 0.2121$ is difficult to interpret with Probit regression. In standard ordinary least squares regression analysis, the R^2 reflects the

fraction (or percentage) of variation in the dependent variable that is explained by the independent variables. Adding more independent variables tends to increase the Pseudo R^2 .

Table 12 below presents the variable list, the estimated coefficient for each variable along with other statistics to be discussed. In an ordinary least squares regression equation, the estimated coefficients reflect the change in the dependent variable for a one unit change in the independent variable, holding all other variables constant at zero. The coefficient is simply the marginal effect of a one unit change in the variable chosen holding the values of other variables constant. However, this straightforward interpretation does not apply in the case of probit regression because the estimates are based around the standard normal probability distribution. Economically meaningful interpretations of the coefficients require conversion of coefficients to marginal effects. Specifically, the coefficients' interpretations in probit regression depend on the starting point for a one unit increase in the value of an independent variable and the values assumed for all the other independent variables. However, the signs on the coefficients are useful for interpreting the results because a positive sign indicates that an increase in that variable leads to an increase in the probability of a yes vote and a negative sign indicates that an increase in the variable leads to a decrease in the probability of a yes vote. Therefore, as AGE^2 , EDU , GDR (value of 1 if female), $ENVIRO$, $RTRD$, and $RCRN$ increase, the probability of a yes vote increases. However, as AGE , EMP , CLK (value of 1 if a Clark County resident), and $LOGINC$ increase, the probability of a yes vote decreases. Recall that the values for BID were coded as negative values. The logic is that as the monetary value presented to the respondent increases, the respondent is less likely to vote yes. Essentially, coding the values for BID as negative assumes that as the price for designating the Mad River a recreational river increases, the probability that a respondent will favor the recreational designation decreases.

For the most part, the signs of the coefficients are what one would expect. For example, the coefficient on BID is positive because that values were coded as negative and as the value presented to a respondent in the referendum increases in absolute value, respondents are less likely to vote yes. As AGE^2 increases, the probability of a yes vote increases, perhaps because those who are more advanced in age enjoy river outings more than others and probably have the means and the time to do so compared to students and those early in their careers. As the level of education increases, the probability of a yes vote increases perhaps because more educated individuals tend to prefer access to a recreational river at a rate greater than those with less education. Gender identification as female increases the probability of a yes vote due possibly to the fact that women are more supportive of environmental causes than are men. It makes sense that an individual who was the member of an environmental organization will be more likely to vote yes. Likewise, a retired person with additional leisure time would tend to vote yes, at a higher rate than a student or an individual who is employed. As a person's age increases the probability of a yes vote decreases, perhaps because of the large number of individuals in the samples who are still students or in their peak earning years, so they do not wish to trade-off income for recreational experiences at such a high rate. Being a Clark County resident decreases the probability of a no vote relative to respondents who do not reside in Clark County. As the natural log of income increases the probability of a yes vote decreases, perhaps because as percentage changes in income increase, the opportunity cost of taking advantage of a recreational outing increases or, percentage increases in income open up other recreational opportunities that are preferred to visiting the Mad River.

The column labeled z , the z statistic, is calculated by dividing the coefficient by its standard error. Each estimated coefficient reflects the mean effect of a change in that variable, therefore, roughly two-thirds of the possible values for the estimated coefficient lie within one standard error higher or lower than the value of the coefficient. The z value is used to test the null hypothesis that the value of the coefficient is zero versus the alternative hypothesis that the coefficient differs from zero. The $p > z$ is the cumulative probability left in the tail of the distribution above the z value if it is positive or below the z value if it is negative. This probability can be evaluated against a level of significance for the hypothesis test in order to determine if the coefficient is statistically significant. The level of significance is the probability of a Type 1 error, which is to reject the null hypothesis when the null is true. Typically, a coefficient is interpreted as being statistically significantly at the 10%, 5% and/or 1% significance levels when the p value is less than 0.1, 0.05, and 0.01, respectively. Therefore, BID is significant at any level since the $p > z$ is zero. The only other variable for which we reject the null hypothesis is GDR at a 10 percent level of significance since the $p > z$ is 0.065.

Finally, the mean willingness to pay is calculated to be \$54.15. This calculation is given by the following equation:

$$WTP_j = \sum_{k=1}^{10} \alpha_k \bar{x}_{jk} + \alpha_0 / B_1$$

Where WTP_j is the willingness to pay for respondent j , which is equal to the sum of the estimated coefficients for all the independent variables $k = 1$ through 10 (note that the coefficient for BID is excluded) each multiplied by the sample mean, \bar{x} , for the k th independent variable, plus the constant term, α_0 , divided by B_1 , the coefficient for BID .

Table 12

Probit Regression Results for the Combined Surveys Certainty Adjusted

<i>n</i> = 236						
LR χ^2			(11 degrees of freedom) = 69.03		<i>Prob</i> > χ^2 = 0	
Pseudo R^2 = 0.2121						
Variable List	Coeff. List	Std. Err.	Z	<i>P</i> > <i>z</i>	95% Confidence Interval	
<i>BID</i>	0.012	0.002	5.64	0	0.008	0.017
<i>AGE</i>	-0.047	0.050	-0.93	0.354	-0.145	0.052
<i>AGE</i> ²	0.0007	0.0005	1.35	0.177	-0.0003	0.002
<i>EDU</i>	0.094	0.075	1.26	0.209	-0.053	0.240
<i>GDR</i>	0.382	0.207	1.85	0.065	-0.023	0.788
<i>EMP</i>	-0.147	0.197	-0.75	0.456	-0.534	0.24
<i>ENVIRO</i>	0.032	0.258	0.13	0.899	-0.472	0.537
<i>CLK</i>	-0.002	0.240	-0.01	0.995	-0.472	0.469
<i>RTRD</i>	0.202	0.804	0.25	0.801	-1.374	1.78
<i>LOGINC</i>	-0.203	0.23	-0.9	0.368	-0.645	0.239
<i>RCRN</i>	0.238	0.207	1.15	0.25	-0.168	0.644
<i>CONSTANT</i>	2.982	3.002	0.99	0.321	-2.902	8.865

We were surprised that so many of the variables in the probit regression were insignificant so we ran another specification of the model using logit regression. Recall that logit regression is an alternative method to model the determinants of the probability that an event will occur when the outcome is binary, like the yes or no response to the question on the survey regarding the willingness to finance at different levels a program to maintain water quality in the Mad River in the hypothetical referendum.

The logit regression we estimated has the following form:

Logit Probability (yes) = $f(-\$X$, age, education, employment, membership in an environmental group, whether or not the respondent had visited the Mad River in the previous year, the number of adults in the household, whether or not the respondent had visited that Mad River in the previous year, and property ownership along the Mad River), which can be read as:

the natural logarithm of the probability of a yes vote is a function of the opposite of the random payment (as the random payment goes up the probability of a yes vote goes down), age, education, employment, membership in an environmental group, whether or not the respondent visited the Mad River in the previous year, the number of adults in the household, the natural log of the respondent's income, and whether or not the

respondent owns property along the Mad River.

Formally, we have:

$$\begin{aligned} \text{logit}E(y_j) = & \alpha_0 + \beta_1 \text{BID}_j + \alpha_1 \text{AGE}_j + \alpha_2 \text{EDU}_j + \alpha_3 \text{EMP}_j + \alpha_4 \text{ENVIRO}_j \\ & + \alpha_5 \text{VISIT}_j + \alpha_6 \text{ADULT}_j + \alpha_7 \text{LOGINC}_j + \alpha_8 \text{OWN}_j + \varepsilon_j \end{aligned}$$

for all respondents j equal to 1 through n where $\text{logit}E(y)$ is the natural logarithm of the expected value of a yes vote between zero and one (often called the log odds), BID is the value of X that is voted on, AGE is the age of the survey respondent, EDU is the educational level, GDR is gender (1 if female, 0 if male), EMP is the employment status of the respondent, ENVIRO is membership in an environmental group (1 if a member, 0 if not), VISIT is whether the respondent visited the Mad River in the previous year (1 if visited, 0 if not), ADULT is the number of adults living in the respondent's household, LOGINC is the natural log of the respondent's income level, and OWN is ownership of property along the Mad River (1 if property is owned, 0 if not). The constant term (or intercept) is given by α , the value of the log odds of $E(y)$ when the values for the 9 independent variables are all equal to zero. The error term, ε_j , is assumed to follow the standard logistic distribution with a mean equal to 0 and a constant standard deviation.

The coefficients to be estimated are β_1 , the change in the log odds of a yes vote associated with a \$1 increase in the value of X ; α_1 , the change in the log odds associated with a one-year increase in age; α_2 , the change in the log odds associated with a one unit increase in educational level; α_3 , the change in the log odds associated with a change in employment status; α_4 , the change in the log odds associated with belonging to an environmental group; α_5 , the change in log odds associated with a visit in the past year to the Mad River; α_6 , the change in log odds associated with another adult in the household; α_7 , the change in the log odds associated with a one unit increase in the natural logarithm of income; and α_8 , the change in the log odds associated with ownership of property along the Mad River.

Table 13 below shows the results from estimating this equation in certainty adjusted form was done for the logit regression described above. Specifically, only those respondents who reported a 6 or 7 on the certainty question were included while values 5 and lower were recorded as no votes.

The results show that 214 respondents for both Wittenberg and the broader sample answered the questions necessary to estimate this logit regression equation. The statistics presented in Table 13 have the same interpretations as we described for the probit analysis. The Chi^2 value equal to 64.19 (9 degrees of freedom) suggests that the coefficients are not all zero. As with probit regression, the Pseudo R^2 is difficult to interpret and increases with the addition of more variables. Its value, 0.218, is very close to the value computed in the probit regression.

The variable list and estimated coefficients to be interpreted are shown in the two left columns of Table 13. A straightforward interpretation of the coefficients for variables estimated using logit regression is that for a one unit increase in the variable, holding all other variables constant, the log odds of a yes vote change by the value of the coefficient. A more useful interpretation is gleaned by exponentiating the estimated coefficient. Exponentiating the coefficient transforms the coefficient from its natural log to the actual number reflecting the change in the dependent variable, which in this case is a percentage equal to the rate at which the probability of a yes vote changes by the amount of the exponentiated coefficient – a rate ratio. Consider the variable BID . Exponentiating the estimated coefficient we have $\exp 0.012 = 1.012$, so a \$1 increase in BID is associated with a -1.012 percent decline (recall that the value for X was recorded as negative) in the probability of a yes vote. The z value for BID equal to 5.22 strongly suggests the value presented to respondents in the mock referendum is significant with zero probability that the value presented has no effect on the probability of a yes vote.

The next variable on the list is AGE , with an exponentiated coefficient equal to $\exp 0.035 = 1.036$ suggesting that a one year increase in age increases the probability of a yes vote by 1.036 percent. AGE is also significant with zero probability of rejecting falsely that AGE has an affect on the probability of a yes vote. The other significant coefficient is VISIT , which asks whether or not the respondent has visited the Mad River in the previous year. Exponentiating the coefficient (0.83) gives the value 2.29 so at least one visit to the Mad in the prior

year increases the probability of a yes vote by 2.29 percent. With the $P > z = .013$ the variable is significant at the five percent level. None of the remaining variables are significant. Interpreting coefficients for these variables is the same as described above, except we have no confidence that their true values are different from zero. The certainty adjusted calculation of the mean willingness to pay is the same as presented for probit regression (adjusting for the number of independent variables with an α as a coefficient, eight in this case) according to the formula presented below:

$$WTP_j = \sum_{k=1}^8 \alpha_k \bar{x}_{jk} + \alpha_0 / B_1$$

The value of the certainty adjusted mean willingness to pay in this case is \$41.81 compared to the \$54.15 that was computed for the probit analysis. The average of these estimates is \$47.98, about \$50 per year. We offer this as a best estimate of the mean willingness to pay.

Table 13

Logit Regression Results for the Combined Surveys Certainty Adjusted

<i>n</i> = 214							
LR χ^2 (9 degrees of freedom) = 64.19 <i>Prob</i> > χ^2 = 0							
Pseudo R^2 = 0.218							
Variable List	Coeff. List	Std. Err.	<i>z</i>	<i>P</i> > <i>z</i>	95% Confidence Interval		Mean
<i>BID</i>	0.012	0.004	5.22	0	0.012	0.027	-39.744
<i>AGE</i>	0.035	0.012	2.98	0.003	0.013	0.058	45.415
<i>EDU</i>	0.038	0.012	0.3	0.765	-0.208	0.283	3.292
<i>EMP</i>	0.028	0.119	0.23	0.816	-0.205	0.261	2.41
<i>ENVIRO</i>	0.225	0.409	0.55	0.582	-0.578	1.027	0.191
<i>VISIT</i>	0.83	0.335	2.48	0.013	0.172	1.487	0.375
<i>ADULT</i>	-0.067	0.127	-0.53	0.598	-0.316	0.182	2.355
<i>LOGINC</i>	-1.7E-05	1.2E-05	-1.43	0.153	-4E-05	6.47E-06	54287.9
<i>OWN</i>	-0.095	0.422	-0.22	0.822	-0.923	0.733	0.507
<i>CONSTANT</i>	-0.180	0.954	0.99	0.85	-2.051	1.690	

Appendix D – An Overview of the Statistical Analysis Used to Estimate Willingness to Pay by the Travel Cost Method¹³

Data was collected in the surveys regarding the number of trips to the Mad River along with the cost per trip of going to the river and to alternative rivers. Data for the number of trips to the river is called “count data” that is best modeled using a Poisson distribution. The Poisson distribution is skewed to the right, reflecting that most individuals take only a few trips to a recreational site like the Mad River during the course of a year. In a Poisson regression equation, the dependent variable is estimated as the natural logarithm of its value which reflects the percentage change in the dependent variable or, in this case, the percentage change in the number of trips to the Mad associated with one unit changes in each dependent variable. Other variables that we believe may influence the number of trips to the Mad a person takes are also included in the regression. The equation we developed estimates percentage changes in the number of trips as follows:

Percentage change in number of trips = f (cost of travelling to the Mad, cost of travelling to an alternative river, income, age, gender, education, importance of recreation as a reason for protecting rivers, and residence in Clark County), which can be read as:

the percentage change in the number of trips to the Mad River is a function of the cost of travelling to the Mad, the cost of travelling to an alternative river, income, gender, education, the importance of recreation as a reason for protecting rivers, and residence in Clark County.

Formally, we have:

$$\log y_i = \alpha + \beta_1 CMAD_i + \beta_2 CALT_i + \beta_3 INC_i + \beta_4 AGE_i + \beta_5 GDR_i + \beta_6 EDU_i + \beta_7 RCRN_i + \beta_8 CLK_i$$

for all observations $i = 1$ through n where $\log y_i$ is the natural logarithm of the number of visits reported, $CMAD$ is the dollar cost of travelling to the Mad River for individual i , $CALT$ is the dollar cost of travelling to an alternative river for individual i , INC is income, AGE is the respondent's age, GDR is gender (1 if female, 0 if male), EDU is the educational level, $RCRN$ is the response to reasons for protecting rivers on the question regarding provision of recreational opportunities (1 if very important and 0 otherwise), and CLK is whether or not the respondent lives in Clark County (1 if a resident, 0 if not). The constant term (or intercept) is given by α , the value of the natural logarithm of y when the values for the 10 independent variables are all equal to zero.

Table 14

**Poisson Regression Results Used to Estimate Willingness to Pay
by the Travel Cost Method**

LR χ^2 (8 degrees of freedom) = 293.5 $Prob > \chi^2 = 0$							
Pseudo $R^2 = 0.3183$							
Variable List	Coeff. List	Std. Err.	z	$P > z$	95% Confidence Interval		$exp(coeff)$
<i>CMAD</i>	-0.007	0.002	-3.59	0	-0.011	-0.003	0.993
<i>CALT</i>	-0.002	0.0007	-3.31	0.001	-0.004	-0.0009	0.998
<i>INC</i>	0.00001	1.47E-06	6.82	0	7.13E-06	1.29E-05	1.00
<i>AGE</i>	0.019	0.004	4.73	0	0.011	0.027	1.019
<i>GDR</i>	-0.363	0.127	-2.88	0.004	-0.612	-0.116	0.695
<i>EDU</i>	0.107	0.04	2.7	0.007	0.029	0.185	1.11
<i>RCRN</i>	1.193	0.140	8.49	0	0.918	1.468	3.297
<i>CLK</i>	-0.125	0.18	-0.69	0.488	-0.477	0.228	0.883
<i>CONSTANT</i>	-1.610	0.341	-4.72	0	-2.279	-0.942	0.2

The regression equation was estimated with 90 observations that combined responses from both samples. Results are presented in Table 13 above. The term LR χ^2 (11 degrees of freedom) refers to a hypothesis test using the χ^2 statistic where the null hypothesis is that all coefficients on the 11 explanatory variables are equal to zero and the alternative hypothesis is that they are different from zero. The χ^2 value equal to 293.5 suggests that the coefficients are not all zero. The fact that $Prob > \chi^2 = 0$ allows us to reject the null hypothesis with zero probability that we are rejecting the null hypothesis and the null is true. In other words, the probability of a type one error is zero. The Pseudo $R^2 = 0.2121$ is an attempt to estimate the fraction of variation in the dependent variable that is explained by the independent variables, as is the case with the R^2 statistic that is computed for ordinary least squares regression equations. Adding more independent variable tends to increase the Pseudo R^2 .

The coefficient for the cost of travelling to the Mad River is negative, as expected, since an increase in the cost of travel would tend to decrease the number of trips to the Mad. One way to interpret the coefficients that are estimated is as rate ratios. The dependent variable, number of trips to the Mad River, measures trips per year. However, the equation was estimated using the log of the number of trips per year. In order to interpret the coefficient as a rate ratio, it must be exponentiated so that it is consistent with the dependent variable that measures trips per year. The last column in Table 13 shows the exponentiated values for the estimated coefficients. The exponentiated coefficient for the cost of travelling to the Mad is 0.99 suggesting that a one dollar cost increase in the cost of travelling to the Mad is associated with a 0.99 decrease in trips to the Mad. This is a big effect and we are not confident in the result. The other exponentiated coefficients are similarly large beyond our expectation.

As was the case for the probit regression analysis described in Appendix C, the column labeled z , the z statistic, is calculated by dividing the coefficient by its standard error. Each estimated coefficient reflects the mean effect of a change in that variable, therefore, roughly two-thirds of the possible values for the estimated coefficient lie within one standard error higher or lower than the value of the coefficient. The z value is used to test the null hypothesis that the value of the coefficient is zero versus the alternative hypothesis that the coefficient differs from zero. The $P > z$ is the cumulative probability left in the tail of the distribution above the z value if it is positive or below the z value if it is negative. This probability can be evaluated against a level of significance for the hypothesis test in order to determine if the coefficient is statistically significant. The level of significance is the probability of a Type 1 error, which is to reject the null hypothesis when the null is true. In this case all of the

coefficients estimated are significant at the one percent level or lower except for the residency in Clark County coefficient which is insignificant. This result is surprising as well.

Data for the number of trips to the Mad River for respondents and the estimated coefficients for the independent variables in the Poisson regression equation can be used to estimate the consumer surplus that an individual enjoys from trips to the Mad River during a calendar year. Consumer surplus is the difference between what an individual would be willing to pay and what they actually pay for a trip to the Mad River. The median number of trips per person to the Mad River is used rather than the average number of trips per person since the distribution is skewed. An estimate of the consumer surplus per person is given by the formula

$$CS/q = \left| \frac{q}{2\beta} \right|,$$

which can be read as the consumer surplus per person per annum per trip is equal to the absolute value of the median number of trips divided by two times the sum of the estimated coefficients. For the samples combined, with very long distance travelers removed from the sample, the consumer surplus per trip is estimated to be \$178. For the 34 individuals who answered enough questions to be included from the Wittenberg sample (closer to the Mad River) the consumer surplus is estimated at \$142 per trip. These values are higher than we anticipated.

Appendix E – List of Reasons for a No Vote on the Hypothetical Ballot on Funding Designation of the Mad River Recreational

The Wittenberg Sample

Other (Please Specify)
i am willing.
More inclined to <u>Buck Creek</u> for its white water features. Would anything like the artificial waves be possible--ones in Snyder Park and behind the Museum?
Other competition for discretionary "contributions" to causes.
I do not wish to pay for activities that I would not utilize.
I am willing to pay since I realize the river is important to preserve habitat & <u>wildlife</u> , for recreation and for future generations.
<input type="checkbox"/> <u>#GoWitt</u>
I am willing
I am willing to contribute to the funds as a whole.
But I AM willing.
I would contribute to the funds for the Mad River.
Funds should be contributed by the jurisdictions along the Mad River and who benefit from the boost in economic development through increase in tourism and quality of life.
Benefit Principle. I likely won't use the river and see no need to fund others' use of it.
To ask those who would not use the recreational aspects of the river to provide financial support to enable a small number who would seems unrealistic. Perhaps creating a corps of volunteers, applying for grants or soliciting donations for a recognition project in conjunction with the goal could be options. Frankly, I think we need to be more concerned about the quality of life in Springfield (i.e., preventing the exodus of retail stores/mall) before creating water recreational experiences for a few.
<u>leaving</u> the state, can't support every river and would prefer to support one that I am close to.

The Broader Sample

I am losing faith in my <u>gouvernement</u> to protect our natural resources for future generations. I believe
I am willing.
I am not opposed.
I'm already paying significant state taxes.
I think \$50 annual is too high for a typical sportsman, although not excessive if there were demonstrable plans for the considerate use of the funds. If that \$50 improved parking security, ensured access and was a necessary cost to use the resources then I'm in favor.
200 is too much. I maybe consider half that amount.
How will the monies collected be spent in Clark County?
I said I would pay, but I also think recreation fees are somewhat useful, to control the use of the resource, and not over-use it. Also, I do <u>not understand</u> question 10!
I would pay
I can't predict my future income.
I would be willing to contribute, but I doubt I will get any value as I live closer to many other rivers.
0
The river is just fine not sure it needs any protection
Our taxes go to protecting the river, too.
<u>this</u> should be funded by local municipal or state taxes, so that everybody contributes as everybody will benefit in some way. I am totally willing to see some of my tax dollars go toward this.
It will not affect the quality of the river

Endnotes

¹ See <http://www.daytondailynews.com/news/news/campaign-to-designate-river-will-resume-supporters/njfRX/>. Accessed July 1, 2015.

² A brief history of Ohio's scenic river program can be found at <http://watercraft.ohiodnr.gov/scenicrivers>. Accessed July 1, 2015.

³ These three mechanisms for protecting scenic rivers are found at <http://watercraft.ohiodnr.gov/scenicrivers#Act>. Accessed July 1, 2015.

⁴ These requirements are listed at <http://www.scenicmadriver.com/requirements.html>. Accessed July 1, 2015.

⁵ For information related to various fish species found along different parts of the river, visit <http://mvff.tripod.com/madriver.html>. Accessed July 1, 2015.

⁶ Questions regarding property rights concerns are addressed at <http://www.scenicmadriver.com/factual-information.html>. For the full text of laws related to the Ohio state scenic rivers program, visit the site <http://watercraft.ohiodnr.gov/laws/scenic-rivers-laws>.

⁷ Memorandum from Mike Fremont, Rivers Unlimited, Dated November 6, 2008. A copy is available upon request from the authors.

⁸ The discussion in this section relies heavily on information presented by Tietenberg and Lewis in the fourth chapter ("Valuing the Environment: Methods") of their text, *Environmental and Natural Resource Economics*, 10th edition, Pearson Education, Boston, 2015, pp. 73-104

⁹ The following discussion borrows from Haab and McConnell, 2002, Ch. 4, "The Distribution of the Willingness to Pay," pp. 84-113.

¹⁰ Ibid.

¹¹ The following discussion borrows from Haab and McConnell, 2002, Ch. 6, "Modeling the Demand for Recreation," pp. 137-150; Hellerstein, 1991, "Using Count Data Models in Travel Cost Analysis with Aggregate Data," pp. 860-866; and Blackwell, 2007, "The Value of a Recreational Beach Visit: An Application to Mooloolaba Beach and Comparisons with other Outdoor Recreation Sites," pp. 77-98.

¹² The following discussion borrows from Haab and McConnell, 2002, Ch. 4, "The Distribution of the Willingness to Pay," pp. 84-113.

¹³ The following discussion borrows from Haab and McConnell, 2002, Ch. 6, "Modeling the Demand for Recreation," pp. 137-150; Hellerstein, 1991, "Using Count Data Models in Travel Cost Analysis with Aggregate Data," pp. 860-866; and Blackwell, 2007, "The Value of a

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Hellerstein, Daniel. "Using Count Data Models in Travel Cost Analysis with Aggregate Data." *American Journal of Agricultural Economics* 73, No. 3 (August 1991): 860-866.

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