An Economic Valuation of Improved Water Quality in Opequon Creek Watershed

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Introduction

The Opequon watershed is located in northern Virginia (VA) and the eastern panhandle of West Virginia (WV), and is approximately 221,000 acres in size. Opequon Creek flows north from its start in southern Frederick County, VA and continues through WV before emptying into the Potomac River.

Currently, the main creeks in the watershed (Opequon and Abrams) do not meet VA and WV state water quality standards for recreational uses (*e.g.* swimming, fishing and boating) and for aquatic life (*e.g.* viable benthic populations). In VA, Opequon and Abrams Creeks are listed as impaired by the VA Department of Environmental Quality because of high bacteria levels and benthic impairment (linked to excessive dirt or sediment). In WV, Opequon Creek is listed as impaired by the WV Department of Environmental Protection because of high bacteria levels and biologic impairment (tentatively linked to excessive dirt or sediment).

Because of these impairments, a Total Maximum Daily Load (TMDL) plan has been developed and is in the process of being implemented on the VA portion of Opequon watershed. In WV, a TMDL plan is expected to be completed by the end of 2006 . These TMDLs specify the maximum amount of pollutants that creeks in the watershed can receive and still meet water quality standards.

An anticipated outcome of TMDL implementation will be cleaner waters in the Opequon watershed as pollution levels become reduced to meet water quality standards. As a result of reducing bacteria and sediment pollutants, watershed residents will benefit from improved safety of water recreation, conservation of natural resources, improved aquatic habitat, reductions in the amount of flood damage, greater economic opportunities, and enhanced real estate values for land located near creeks in the watershed.

While all of the preceding benefits could not be quantified, the expected monetary benefits from improved aquatic life (game fish population) and the safety of swimming and wading were measured as part of this study. Specific objectives included determination of: (1) expected monetary value of these benefits due to improved water quality within Opequon watershed, and (2) important factors influencing watershed residents' willingness-to-pay (WTP) for improved water quality. A secondary purpose was to facilitate public participation in the TMDL process within Opequon watershed.

Research Methods

A contingent valuation (CV) approach was used. CV involves a survey of people that are impacted by some environmental change (like creek water quality improvement). At least one question in such a survey asks each participant: what would you be willing to pay for an environmental improvement if it was made available? In this study, watershed clean-up plans were presented to survey participants in both the VA and WV portions of the Opequon watershed. In VA, water quality improvements were described in terms of increased safety in swimming and wading. In WV, water quality improvements were described in terms of improved sport (game) fish populations as well as increased safety of swimming and wading. Survey participants were asked to state their maximum WTP for these clean-up plans.

The survey development process included focus group interviews, field trips, and pre-tests. The survey itself was conducted in fall 2005, when 5,000 surveys were mailed to random samples of households in the watershed. Surveys were designed for three separate sub-samples of households: (1) WV general public (WVGP) residents; (2) VA general public (VAGP) residents; and (3) VA riparian landowners (VARL). The survey included questions about: (a) use and knowledge of creeks in the watershed; (b) opinions on environmental quality; (c) both in-state and out-of-state clean-up plans; and (d) demographic information (age, income, education, etc.).

Statistical models were used to determine important factors that explain WTP for watershed clean-up. These models were compared across the three sub-samples (WVGP, VAGP, and VARL) to determine if similar factors influenced each sub-sample's WTP.

Results

Of the 4,961 deliverable surveys, a total of 625 surveys were returned for a 13% response rate (Table 1). Response rates for the sub-samples ranged from a low of 10% for VAGP to a high of 36% for VARL. To determine if this sample represented the watershed population, personal information from the survey was compared with statistics from the 2000 Census. On average, the survey sample was older, more educated, had a higher percentage of males, and had a higher household income compared to the watershed population.

Table 1. Survey Response Rates

Sub-sample	*Initial mailing*	*Total returned*	*Response rate (%)*
West Virginia (WVGP)	2,500	332	13
Virginia (VAGP)	2,300	230	10
Virginia riparian landowners (VARL)	200	63	36
Total	5,000	625	13

In both VA and WV, the vast majority of respondents were familiar with at least one portion of Opequon Creek. In addition, over half of all respondents had used Opequon Creek for recreation and most thought that there were environmental problems associated with this creek. About one-half of all respondents were very concerned about the ability of fish and other aquatic life to survive in Opequon Creek. Only a limited number (14%) of VAGP respondents were aware of the TMDL compared to almost 1/3 of riparian landowners. In both states, trash was cited as the number one environmental problem within Opequon watershed. Regular trash clean-ups were the most commonly preferred environmental improvement in Opequon watershed.

Approximately 69% of WVGP respondents were supporters of an in-state clean-up plan. VAGP respondents expressed slightly greater support (70%) while VARL respondents expressed slightly lower support (67%). The remaining respondents either opposed or chose to remain neutral about in-state clean-up. Approximately two-thirds of both VA and WV general public respondents, but only 54% of VARL respondents, had a positive WTP for the out-of-state clean-up plan.

When comparing sub-samples statistically, all three were found to represent different populations when valuing in-state clean-up. However, both VAGP and WVGP were found to have the same factors influencing WTP for out-of-state clean-up.

For in-state clean-up, positive influences on WTP were found for recreational use of creeks, a respondent's age and household income. In VA, awareness of the TMDL, education, and concern about aquatic life also had positive influences on WTP. On the other hand, a respondent's opinion of local environmental quality, and being a life-long resident had negative influences on WTP in VA and WV, respectively. For out-of-state

Opequon Creek in West Virginia.

clean-up, a respondent's concern about aquatic life, familiarity with the other state's portion of Opequon watershed, support of in-state improvements, age and annual income were found to positively influence WTP.

Average WTP values were calculated for survey respondents (Table 2). For in-state clean-up, WV respondents had the lowest WTP while VA riparian landowners had the highest WTP. Sub-sample WTP values were statistically different from one another. For out-of state clean-up, since the factors affecting WTP were similar for the VAGP and WVGP sub-samples, respondents in both states were pooled into one average. The average among the general public was higher than riparian landowners. WTP for in-state clean-up was greater than that for out-of-state.

Projecting survey respondent WTP values to the watershed population[1], total economic benefits within the entire Opequon watershed were estimated to range from $3.8 to $5.2 million (Table 3). The range of values is based on different assumptions about how respondents view future payments for in-state clean-up. Total measured benefits for clean-up of the WV portion of the Opequon watershed were found to range between $1.7 and $2.4 million while the total measured benefits for clean up of the VA portion of the Opequon watershed were found to range between $2.1 and $2.8 million.

Table 2. Average WTP for Watershed Clean-Up Among the Three Sub-Samples[a].

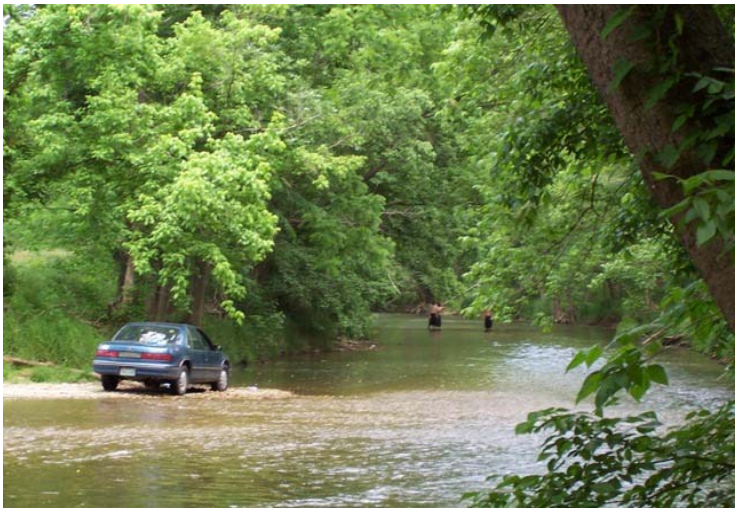
Sub-sample	*Average WTP for In-State Clean-Up (Annually per household)*
West Virginia (WVGP) (N=246)	$32
Virginia (VAGP) (N=172)	$48
Virginia riparian landowners (VARL) (N=49)	$62
	Average WTP for In-State Clean-Up (One time donation per household)
West Virginia and Virginia (N=454)	$18
Virginia riparian landowners (N=30)	$8

[a] Averages were computed only for survey respondents with positive and zero WTP.

Table 3. Total WTP Aggregated Over the Entire Watershed Population

State	*In-state ($ million)*	*Out-of-state ($ million)*	*Total ($ million)*
West Virginia	1.5 – 2.2	0.29	1.7 – 2.4
Virginia	1.7 – 2.5	0.18	2.1 – 2.8
Total	3.2 – 4.6	0.50	3.8 – 5.2

[1] **To account for differences between our sample and the watershed population, average WTP values were adjusted downward based on a younger, less educated and lower income population as compared to our sample.**



Recreation occurring on Opequon Creek in Virginia.

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Additional Information

You can find more information about this research on-line at http://www.caf.wvu.edu/resm/faculty/borisova/OpequonProject.htm or http://eidr.wvu.edu/etd/documentdata.eTD?documentid=4666 The Opequon and Abrams TMDL is available at: http://www.tmdl.net/forum/. More information about the specific clean-up of Opequon watershed is available from Jim Lawrence at (540) 667-0761 or JIML@crosslink.net; and Alana Hartman at (304) 882-7266 or ahartman@wvdep.org

Although several individuals contributed to, and reviewed, this study, the authors alone are responsible for the contents.

Conclusions

- Total economic benefits within the Opequon watershed were estimated to range from $3.8 to $5.2 million. These benefits measure improved swimming safety and aquatic life in creeks. These estimates do not include conservation of natural resources, reductions in the amount of flood damage, greater economic opportunities, and enhanced real estate values.

- A part of the higher in-state WTP in Virginia can be attributed to the TMDL process. Although awareness of the TMDL was low, this awareness did have a positive influence on WTP for in-state watershed clean-up.

- Trash was cited as the number-one problem by respondents in the watershed and trash clean-ups were the number-one requested environmental improvement. Although trash was not considered as part of the TMDL, it is viewed as an important environmental issue to residents of Opequon Creek watershed.

- One limitation of this study was a low response rate. Although average WTP from the sample was adjusted downward to account for differences between our sample and the watershed population, the relatively low survey response rate may still prevent accurate estimation of WTP for non-respondents. Survey results do, however, provide an indication of the general public's perceptions about the Opequon Creek watershed, and do show the existence of a positive WTP to improve water quality.

Fishing, a popular activity in Opequon watershed.