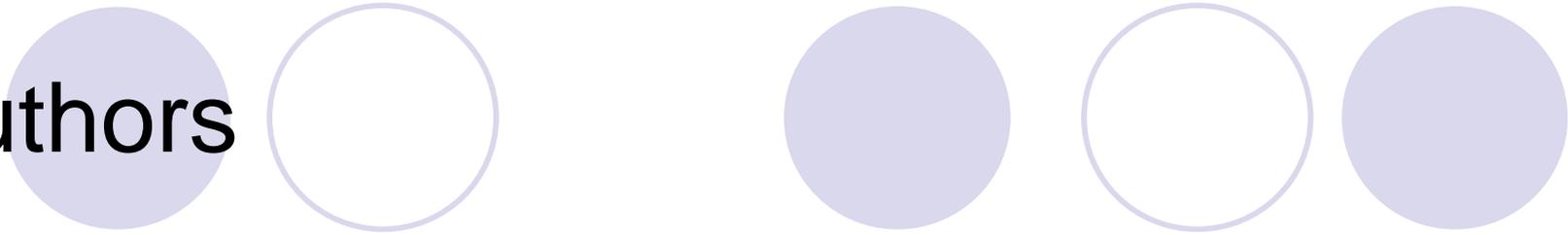


# BENEFITS FROM IMPROVED WATER QUALITY

*The Opequon Watershed in  
West Virginia And Virginia*

# Authors



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# Funding Provided By:

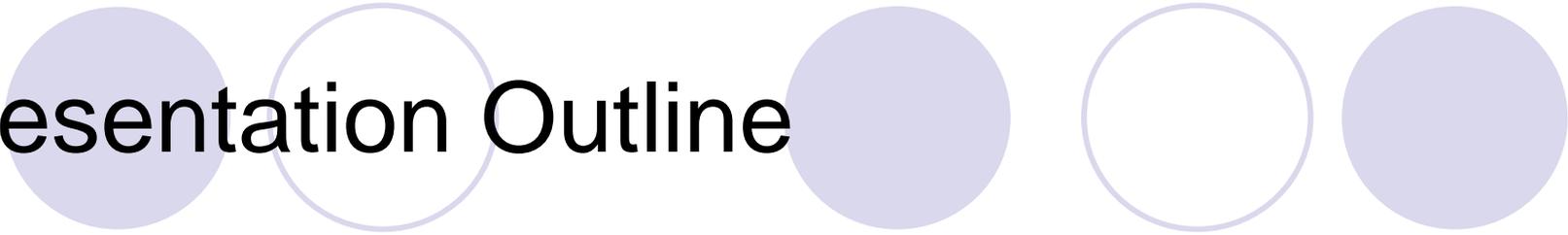
- Mid-Atlantic Regional Water Program through the Cooperative State Research, Education and Extension Service of the U.S. Department Agriculture.



# Acknowledgement of Funding Support

- Tom Basden, Nutrient Management Specialist with the WVU Cooperative Extension Service, who directed funding from the Mid-Atlantic Regional Water Program to pay for the survey.

# Presentation Outline



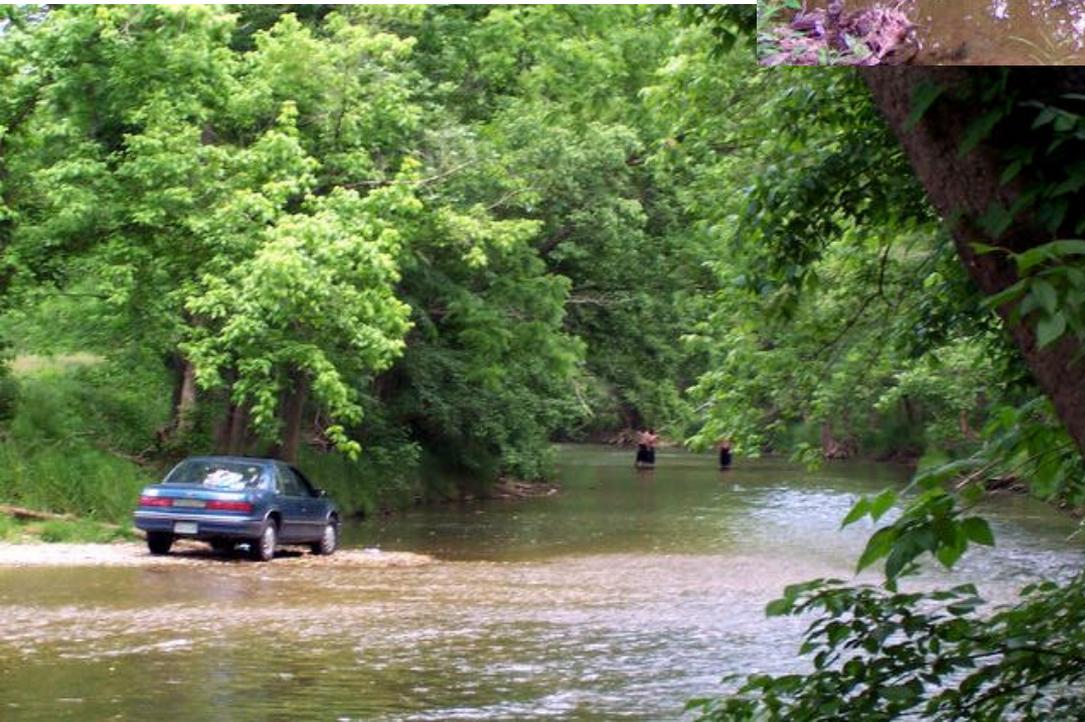
- Problem Introduction: Why assess benefits on this watershed?
- Objectives – Contribute to TMDL IP and assess benefits
- Methods – Contingent valuation survey
- Survey Results – Determine aggregate monetary benefits from water quality improvements on the watershed
- Summary

# Opequon Creek Watershed

- Straddles the border between Virginia and West Virginia
- Part of the Chesapeake Bay Watershed
- Mostly agricultural but rapidly becoming urban
- Creek - used primarily by locals for recreation – more in West Virginia than in Virginia



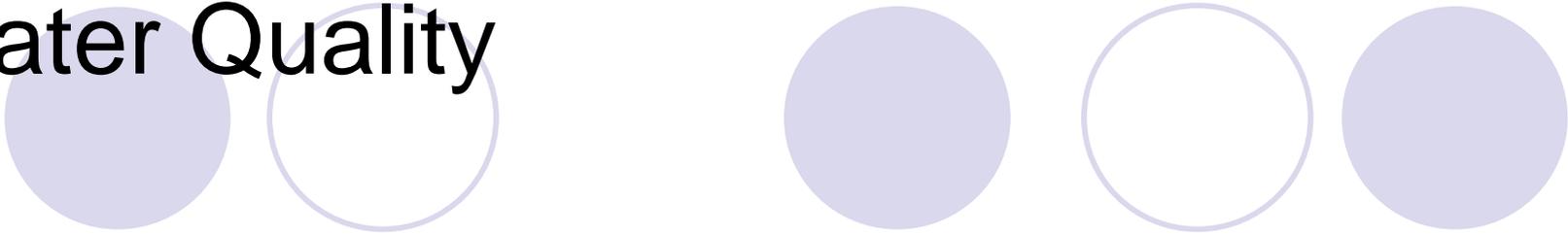
# Opequon Creek: *Virginia*



# Opequon Creek: *West Virginia*



# Water Quality



- Designated use: recreation and support of aquatic life (both in Virginia and West Virginia)
- Violations of bacteria standards and benthic / biologic impairment
- Opequon is on 303d lists in both states
- Pollution contributors: sewage treatment plants, livestock, development, agricultural and urban runoff



# Total Maximum Daily Load (TMDL)

- Virginia

- Benthic impairment – linked to sediment
- TMDLs for bacteria and sediment were developed in 2004
- TMDL Implementation Plan (IP) due in March 2006
- Next phase – implementation of TMDL IP

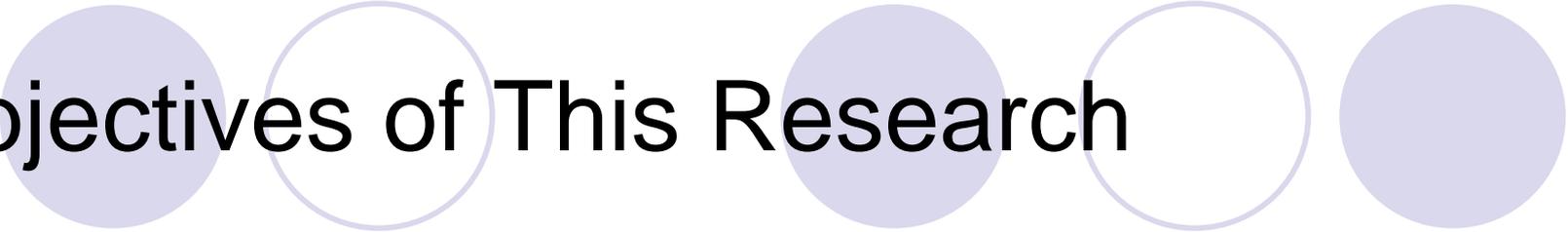
- West Virginia

- TMDL due by June 2006
- Biologic impairment – cause not yet identified

# TMDL IP in Virginia



- Required by state law
- Resource team leading the development
  - Virginia Tech Faculty (leader),
  - VA DCR, VA DEQ, UVA, WVU
- Steering committee – main decisions
- Ag and Urban working groups
- Public participation and benefit estimation – essential components



# Objectives of This Research

- Obtain general public feedback to incorporation into the TMDL IP in VA
- Determine the monetary benefits from water quality improvements linked to TMDLs in both states

# Methods

- Mail survey development involved public meetings and pre-tests during the summer of 2005.
- Questions included
  - Use, attitudes, knowledge, and improvement desires
  - Contingent valuation
  - Socio-demographics
- Surveys sent to random samples of households in the watershed
  - 2500 – West Virginia
  - 2300 – Virginia
  - 200 - Virginia riparian landowners

# Methods



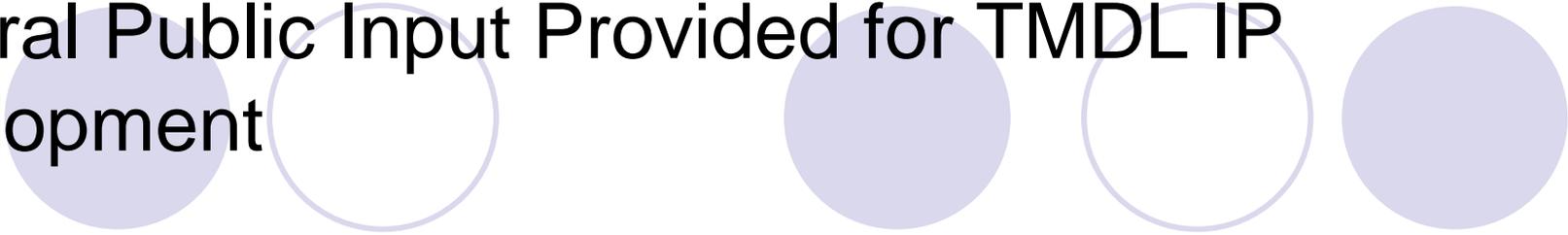
- Implementation procedure
  - First mailing – August/September 2005
  - Reminder post-card – October 2005
  - No additional contacts due to time and budget constraints
  
- Response rates:
  - 13% – West Virginia
  - 10% – Virginia
  - 36% – Virginia riparian landowners

# Results

- Watershed and Survey Socio-Demographic characteristics

	WEST VIRGINIA		VIRGINIA	
	Watershed	Survey	Watershed	Survey
Gender: % male	50%	69%	49%	60%
Education level: % with at least college degree	15%	40%	22%	53%
Median age (years)	36	52	36	51
% of households with income >\$50,000	35%	51%	39%	53%

# General Public Input Provided for TMDL IP Development



- Familiarity and use of Opequon
- Perception of environmental problems
- Awareness about TMDL process (VA)
- Expected improvement projects
- Trust in various institutions to solve water quality problems
- Willingness of riparian landowners to participate (VA)

# Familiarity and Use of Opequon Creek

- About 80% of respondents were familiar with the Opequon (both states)
- Majority of respondents had used the creek
  - 52%(VA) and 64%(WV)
- Most popular outdoor activities on the Opequon:
  - Wildlife viewing in Virginia
  - Fishing and wildlife viewing in West Virginia

# Perceptions of Environmental Problems

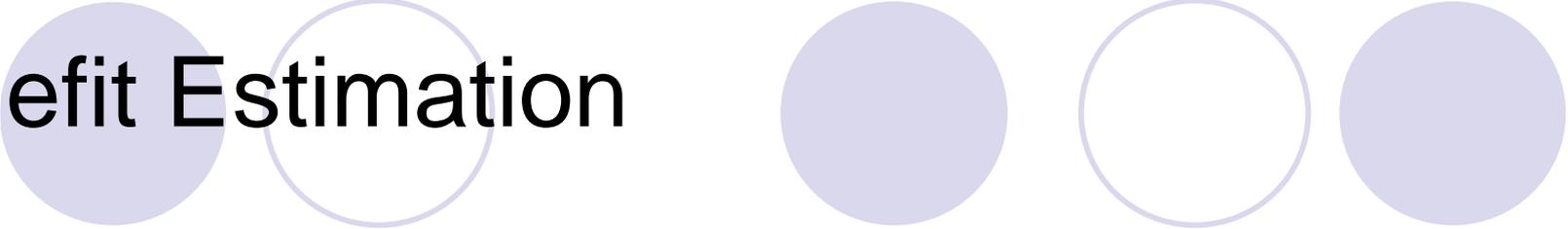
- Overall, respondents perceived that the quality of their local environment has gotten worse in the past few years
  - 68% (VA) and 75% (WV)
- Most respondents thought there are environmental problems associated with the creek
  - 64% (VA) and 70% (WV)
- Main environmental problems in the Opequon
  - #1 - Trash (more than 80% of respondents, both states)
  - #2 – WV - Sewage (58%); VA - Dirt and Sediment (53%)
- Many respondents were very concerned about the ability of fish and other aquatic life to survive in the creek
  - 45%(VA) and 57%(WV)

- Only 18% of respondents were aware about TMDL (VA)
- Most trusted groups / institutions to solve water quality problems
  - WV: university scientists, watershed organizations, state agencies
  - VA: watershed organizations, university scientists, local Soil and Water Conservation District
- Commonly suggested improvements:
  - Regular trash clean-ups, protection of forests along the creek

# VA Riparian Landowners

- Concerns about Opequon creek
  - Stream pollution (85%)
  - Trash (66%)
- Willingness to implement streamside improvement projects
  - At their own expense - tree planting beside the stream (26%)
  - With government cost share - stream bank restoration (34%)
  - The most common response was “none of the above”.

# Benefit Estimation



- Required by Virginia law, but rarely conducted in a formal manner
- Benefit estimation provides a link between water quality changes and uses of the creek
- To assess monetary benefits: Contingent Valuation used to estimate willingness to pay

# Monetary Benefit Estimation

- Contingent Valuation question asked respondents to state their support for a clean-up plan to provide:
  - Safety for swimming and wading in VA
  - Safety for swimming and wading and sport fish population in WV
- Those supporting this plan were asked the maximum amount that they were willing to pay.

# Monetary Benefit Estimation (con't)

- In-state and out-of state improvements were assessed.
- Five years of increased local taxes for in-state improvement
- One-time donation for out-of-state improvement

# Monetary Benefit Estimation (cont.)

- Models were developed to explain WTP for in-state improvements – grouped Tobit estimation procedure
- VA and WV samples were found to be statistically different in the variables that explained WTP
  - VA variables: use, concern, quality of life, TMDL knowledge, age, education, length of time lived in watershed, and income
  - WV variables: use, quality of life, age, length of time lived in watershed, and income

# Monetary Benefit Estimation (cont.)

- Model coefficient estimates were used to estimate median WTP of the non-respondent portion of our sample using median socio-demographics from census data at the zip code level and sample means for non-socio-demographic variables
- Monetary benefits were aggregated to the watershed population using WTP estimates from respondents and non-respondents

# In-State Water Quality Improvement

	RESPONDENTS			NON-RESPONDENTS
	Support Clean-up plan	Median WTP annually for 5 years	Oppose or neutral	Median WTP
West Virginia	<b>69%</b>	<b>\$44</b>	<b>31%</b>	<b>\$26</b>
Virginia	<b>71%</b>	<b>\$64</b>	<b>29%</b>	<b>\$25</b>
Virginia Riparian landowners	<b>67%</b>	<b>\$75</b>	<b>33%</b>	--

# Monetary Values from Contingent Valuation Research on Water Quality

- Expressed as annual WTP values
- Range from a low of \$50 on small watersheds in Iowa (Hurley, Otto, and Holtkamp (1999) to a high of \$250 for the South Platte River in Colorado (Loomis et al. 2000)
- Our findings are at the low end of this range.

# Out-of-State Water Quality Improvement

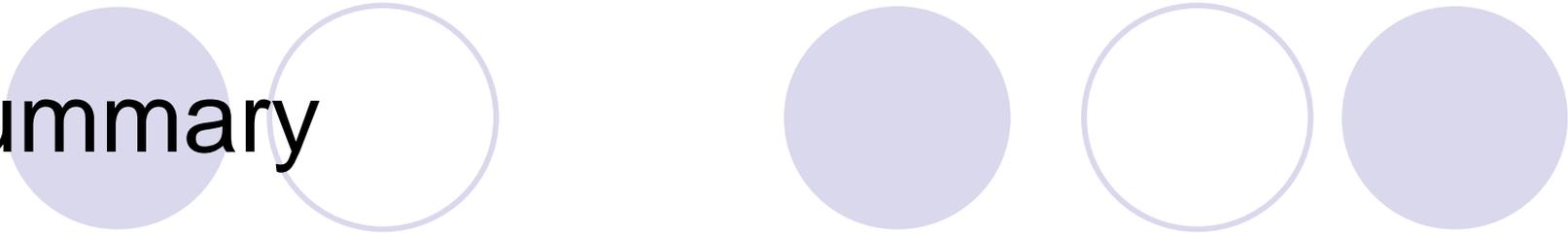
	One-time donation (Median Value)
West Virginia households for improvement in Virginia	\$20.0
Virginia households for improvement in West Virginia	\$20.0
Virginia Riparian Landowners for improvement in West Virginia	\$7.5

# Aggregate Monetary Benefits

- A range of preliminary estimates of water quality improvement values have been computed.
- These values represent the present value benefit from providing safety for swimming and wading in VA and WV plus habitat for sport fish populations in WV.
- These are total not annual monetary values.
- Ranges depend on discount rates used (4% to 29%).

# Aggregate Monetary Benefits

- Monetary value in VA:  
Range from \$1.7 to \$2.3 million
- Monetary value in WV:  
Range from \$2.1 to \$2.8 million
- Over the entire watershed:  
Range from \$3.8 to \$5.1 million



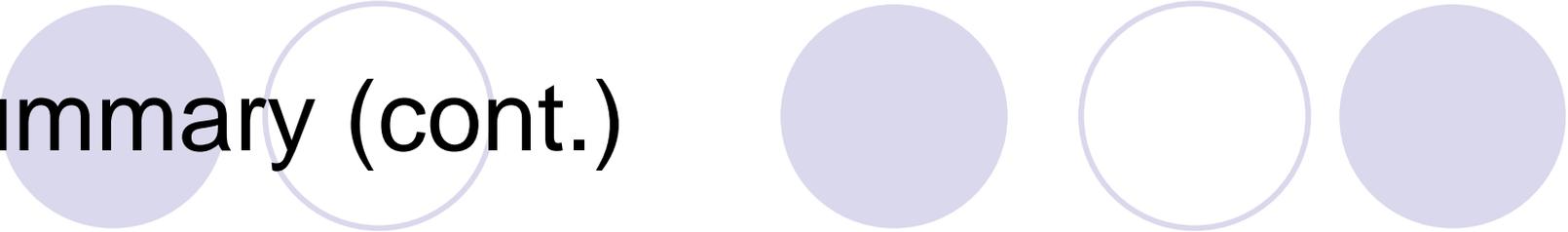
# Summary

- WV respondents had greater familiarity and use of the Opequon than in VA.
- The main environmental problem perceived by survey respondents was trash.
- Most trusted groups to solve water quality problems were watershed organizations and university scientists.
- VA riparian landowners – at most about 1/3 were willing to implement BMPs (with or without government help).

## Summary (cont.)

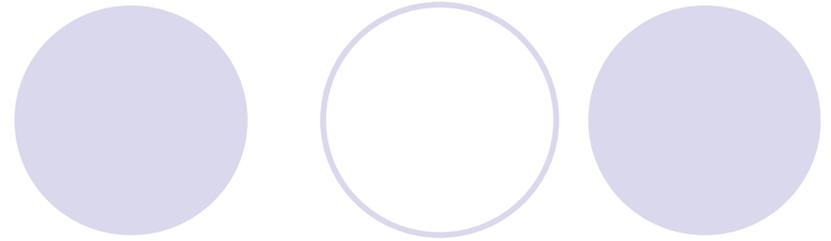
- VA respondents were willing to pay more than WV respondents for in-state water quality improvement of Opequon Creek
- Our WTP estimates were at the low end of those found in the research literature
- Both Virginians and West Virginians were willing to pay for out-of-state water quality improvements.

## Summary (cont.)



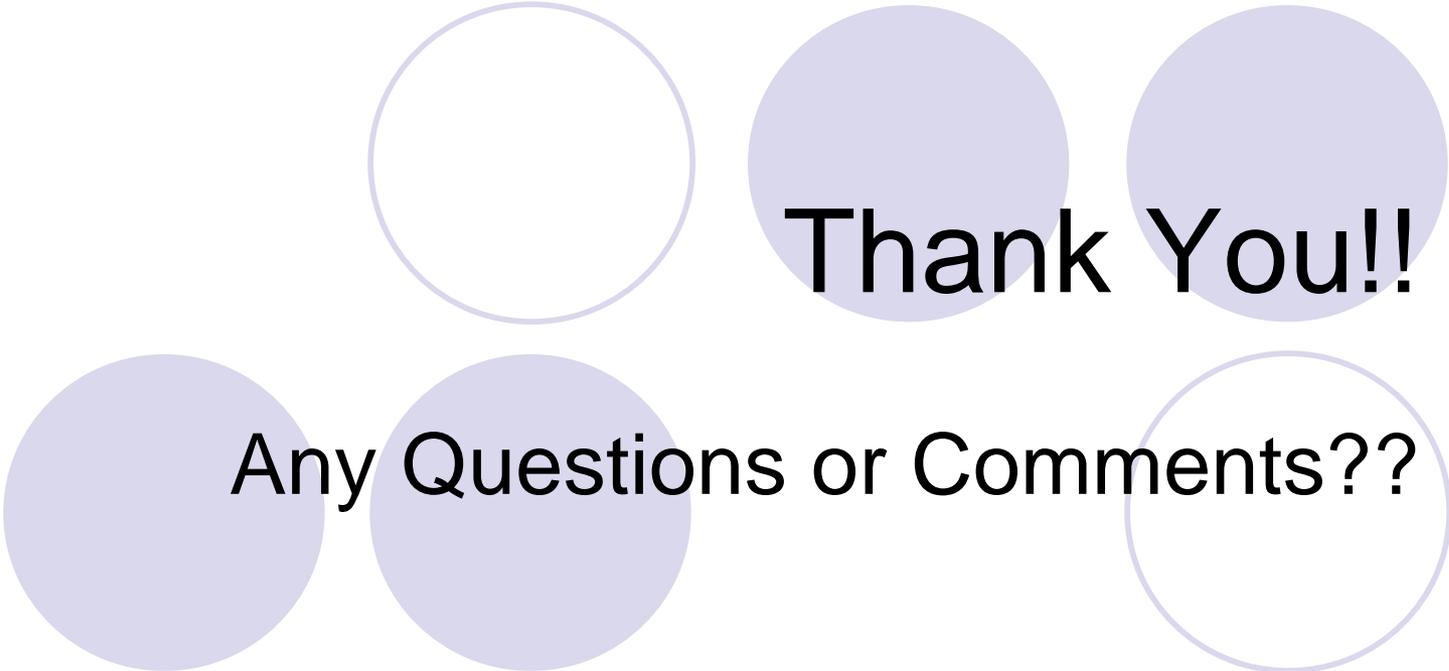
- The total monetary benefits aggregated over the entire watershed were between \$4 and \$5 million for water quality improvements in Opequon Creek.

# Summary (cont.)



## ● Limitations

- Only watershed populations were included in this benefit estimation.
- Survey response rates were lower than expected although reasonable estimates could be made for non-respondents.
- Cost estimates are still being developed for TMDL implementation.
- Will the clean-up plan described in this research be achieved through TMDL IP implementation?

The slide features five decorative circles arranged in two rows. The top row contains three circles: one white with a light purple outline on the left, and two solid light purple circles on the right. The bottom row contains three circles: two solid light purple circles on the left, and one white with a light purple outline on the right. The text "Thank You!!" is centered over the two solid purple circles in the top row.

**Thank You!!**

**Any Questions or Comments??**