

MEASURING THE VALUE OF REMEDICATION AND RESTORATION IN MUSKEGON LAKE

Dr. Paul Isely

Seidman College of Business
Grand Valley State University

&

Carrie Hause

Elaine Sterrett Isely



FUNDING

- National Oceanic and Atmospheric Administration
 - Great Lakes Commission
 - West Michigan Shoreline Regional Development Commission
- Other Project Partners
 - Muskegon Lake Watershed Partnership
 - Grand Valley State University – Annis Water Resources Institute
 - Muskegon River Watershed Assembly
 - Private Landowners
 - Public Landowners – City of Muskegon, Muskegon County, State of Michigan
- Muskegon Lake Area of Concern
- \$10 million NOAA Coastal and Marine Habitat Restoration and ARRA Program of 2009
- Socioeconomic monitoring





GRAND TRUNK REMEDIATION



PURPOSE

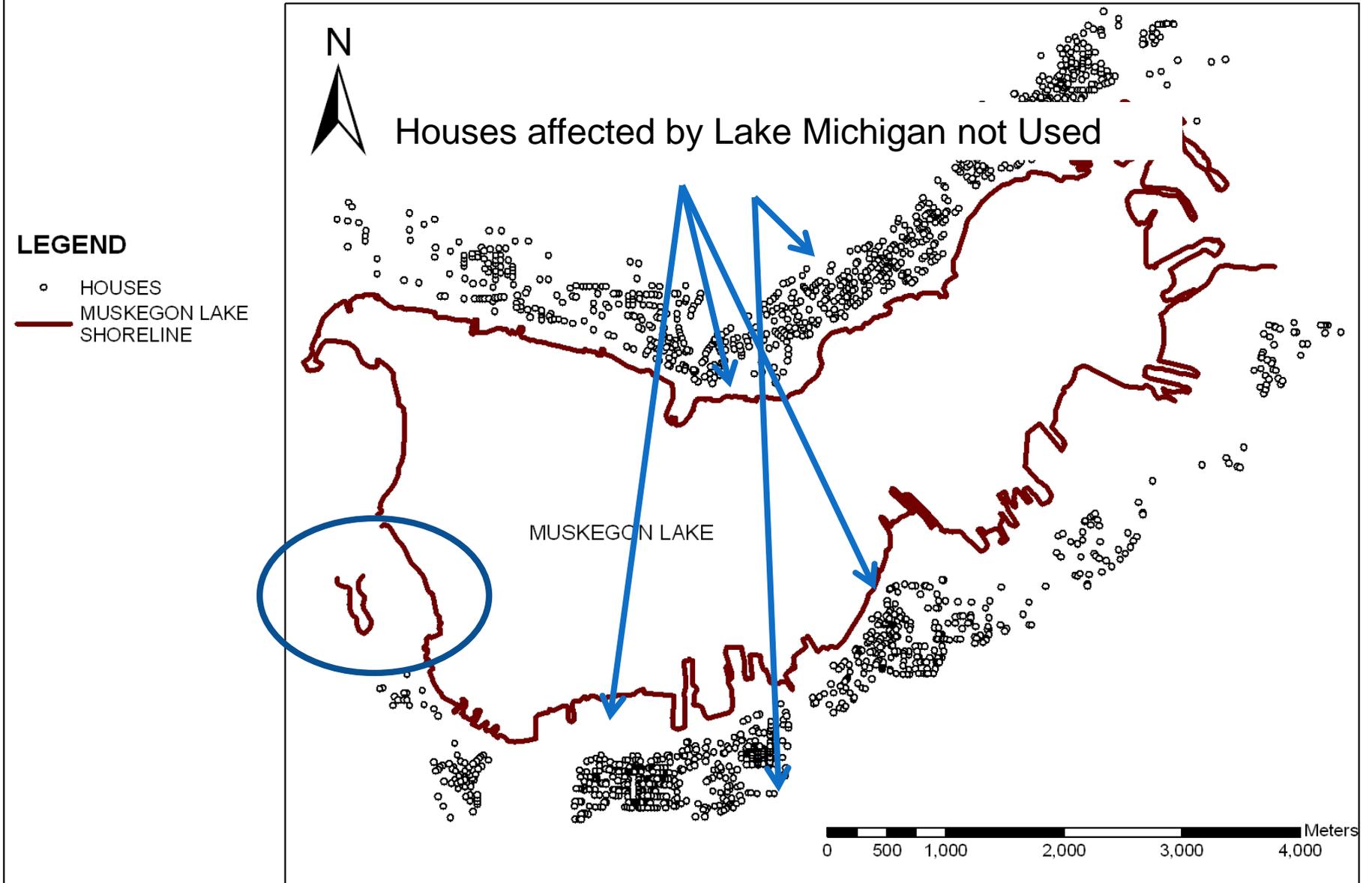
- ◉ Hedonic Analysis of Housing Values
- ◉ Travel Cost Study of Recreation Values
- ◉ Contingent Valuation study of Use and Non-Use Values

HEDONICS

DATA

- ◉ County assessor database
 - House characteristics
 - Sales information
- ◉ AWRI shoreline inventory

HOUSES WITHIN 100 TO 800 METERS OF MUSKEGON LAKE



MULTICOLLINEAR

- ⦿ *NATRATIO1*: natural log of the length of the closest natural shoreline segment divided by the distance to the nearest natural shoreline segment in meters
- ⦿ *HARDRATIO1*: natural log of the length of the closest hardened shoreline segment divided by the distance to the nearest hardened shoreline segment in meters

MODEL

Variable	Model 1	Model 2	Model 3
<u>FLOOR AREA</u>	0.00033* (0.00002)	0.00034* (0.00003)	0.00031* (0.00002)
<u>BASEMENT AREA</u>	0.00011* (0.00002)	0.00010* (0.00003)	0.00012* (0.00002)
<u>GARAGE TYPE</u>	0.04592* (0.01169)	0.04811* (0.01453)	0.04005* (0.01826)
<u>BATHROOMS</u>	0.08381* (0.01513)	0.01869 (0.02281)	0.11915* (0.01985)
<u>AGE</u>	-0.00500* (0.00083)	-0.00450* (0.00104)	-0.00667* (0.00145)
<u>AGE²</u>	0.00001* (0.00001)	0.00001 (0.00001)	0.00003* (0.00001)
<u>STONE</u>	0.04484 (0.02765)	0.01373 (0.17818)	0.04247 (0.03006)
<u>INDUSTRIAL</u>	-0.06073 (0.04267)	-0.06946 (0.04576)	0.02577 (0.08332)
<u>BEAR LAKE</u>	0.54173* (0.03133)	- -	0.51618* (0.03384)
<u>SINGLE FAMILY</u>	-0.15193 (0.11684)	- -	-0.14129 (0.12386)
<u>TOWN HOME</u>	0.1003 (0.12714)	0.52117* (0.10301)	-0.07473 (0.14108)
<u>MLDIST</u>	-0.00022* (0.00005)	-0.00039* (0.00009)	-0.00012 (0.00007)
<u>NATRATIO1</u>	0.02643* (0.00758)	0.03658* (0.01520)	0.01850* (0.00908)
<u>HARDRATIO1</u>	-0.04185* (0.00890)	-0.11909* (0.02682)	-0.03304* (0.01006)
<u>NATRATIO2</u>	-0.00227 (0.00725)	0.00007 (0.01299)	0.00121 (0.00908)
<u>HARDRATIO2</u>	-0.02242* (0.00571)	-0.01743* (0.00783)	-0.03874* (0.00909)
<u>CONSTANT</u>	10.41358* (0.17789)	10.70045* (0.10841)	10.39001* (0.20193)
N	949	427	522
R ² or pseudo R ²	0.83	0.76	0.82

robust standard errors below coefficients;

*p<.05

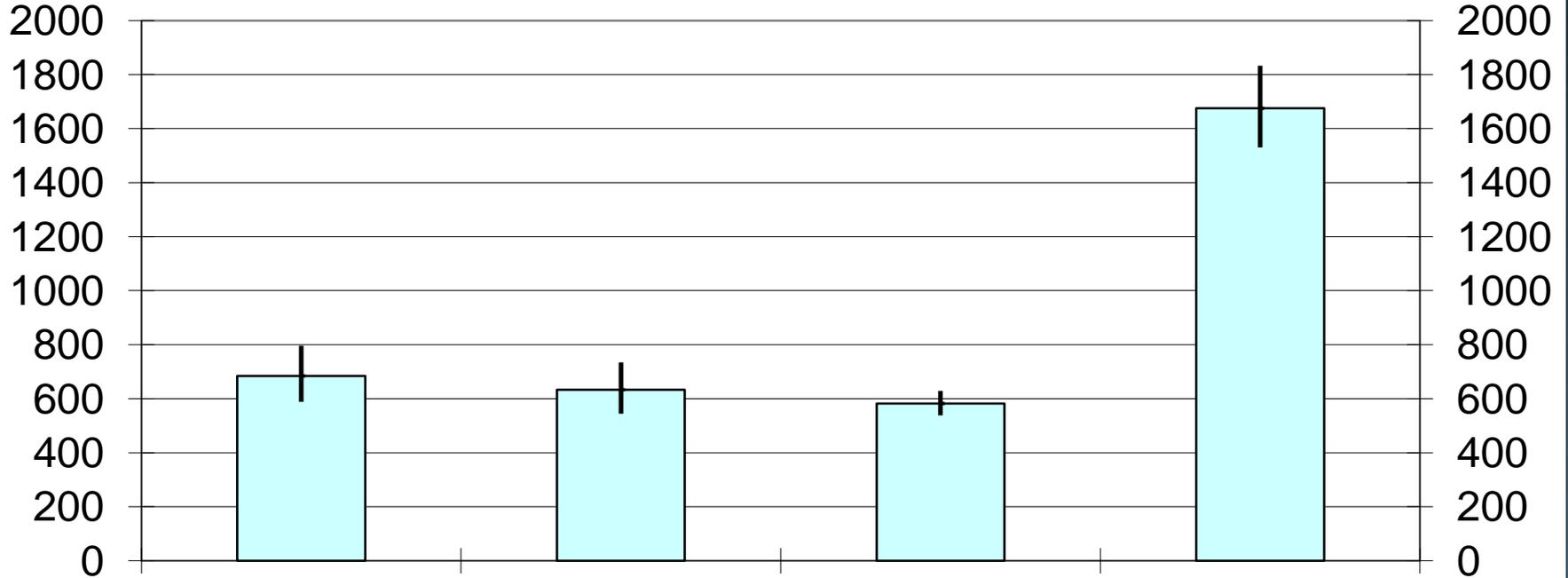
MODEL

Variable	Spatial Regression Model 1 Total Sample	Spatial Regression Model 2 Muskegon	Spatial Regression Model 3 North Muskegon
<u>MLDIST</u>	-0.00022* (0.00005)	-0.00039* (0.00009)	-0.00012 (0.00007)
<u>NATRATIO1</u>	0.02643* (0.00758)	0.03658* (0.01520)	0.01850* (0.00908)
<u>HARDRATIO1</u>	-0.04185* (0.00890)	-0.11909* (0.02682)	-0.03304* (0.01006)
<u>NATRATIO2</u>	-0.00227 (0.00725)	0.00007 (0.01299)	0.00121 (0.00908)
<u>HARDRATIO2</u>	-0.02242* (0.00571)	-0.01743* (0.00783)	-0.03874* (0.00909)

WHAT DOES THE
MODEL MEAN?

Change In Value with Error Bars for a Representative Average House in Nims

Dollars



100 Meter
Longer Natural
Shoreline

100 Meter
Closer Natural
Shoreline

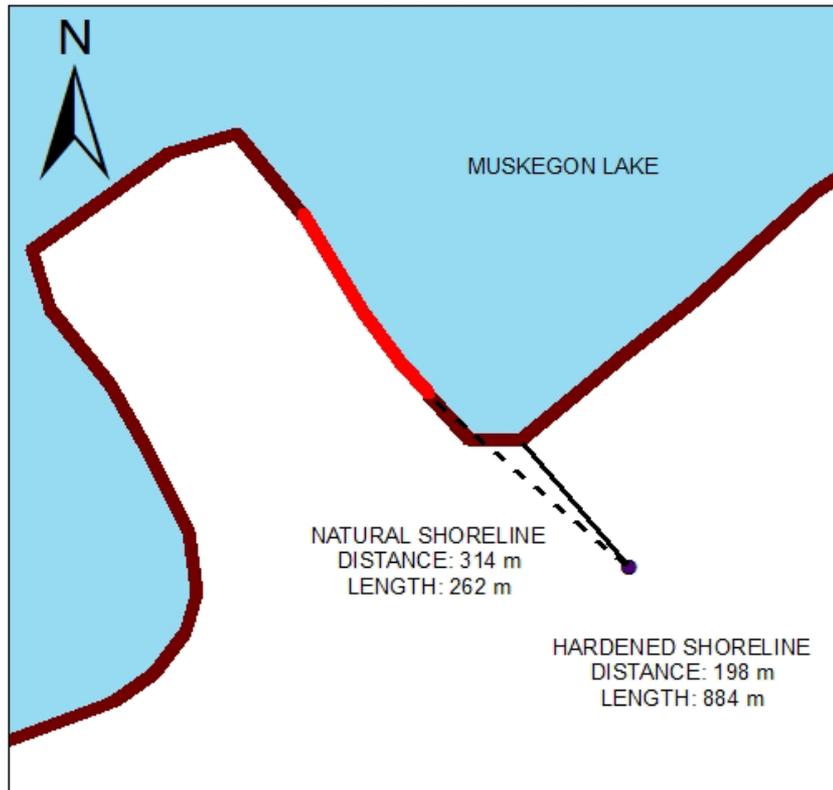
100 Meter
Shorter
Hardened
Shoreline

100 Meter More
Distant
Hardened
Shoreline

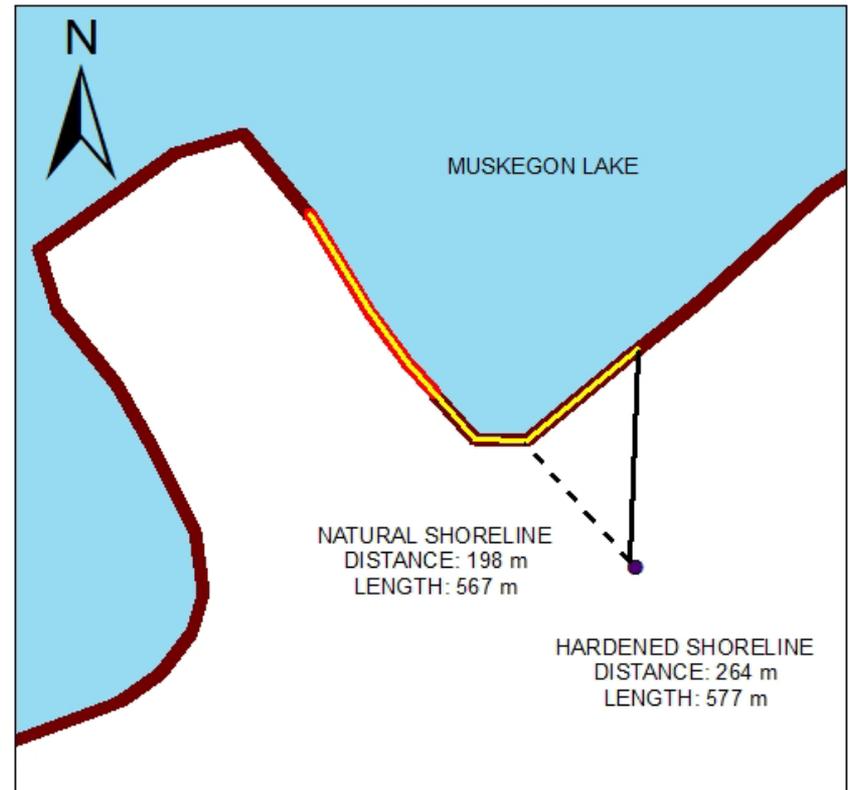
PREDICTED EFFECT OF REMEDICATION

EXAMPLES OF CHANGES IN DISTANCE TO SHORELINE AND LENGTH OF SHORELINE

BEFORE REMEDIATION

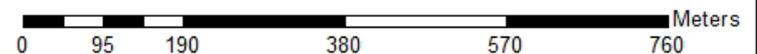


AFTER REMEDIATION

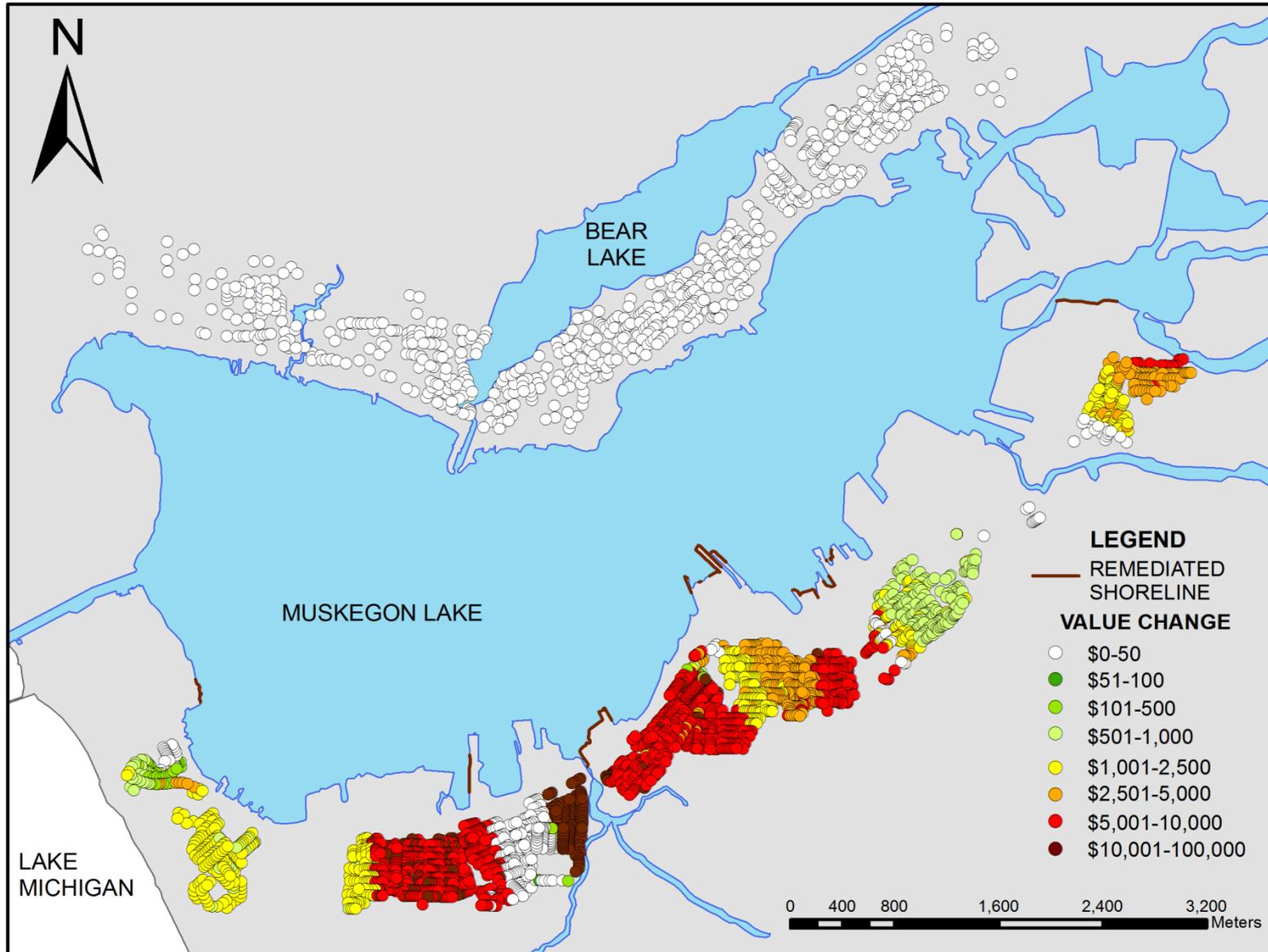


LEGEND

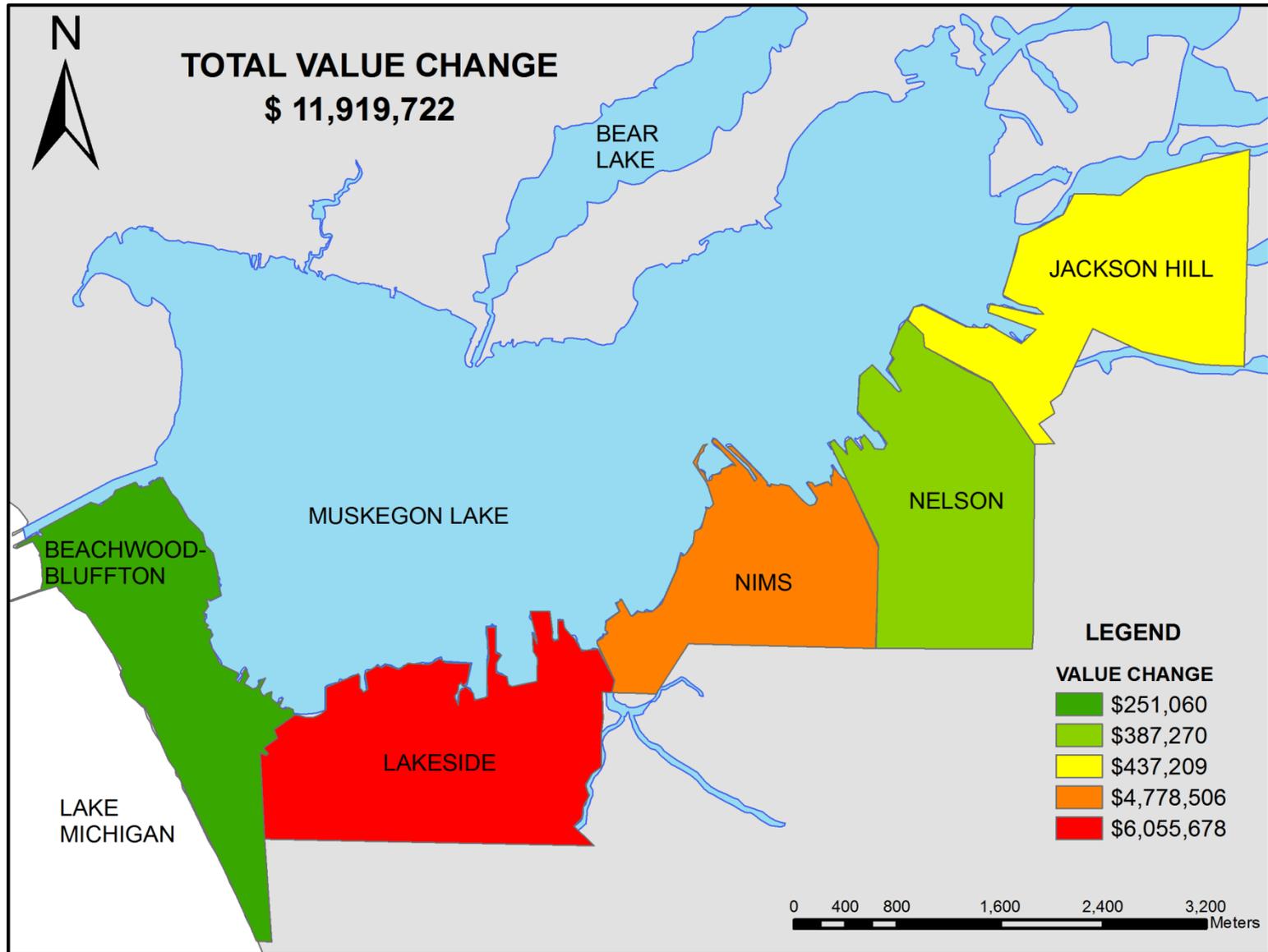
- HOUSES
- MUSKEGON LAKE
- HARDENED SHORELINE
- NATURAL SHORELINE
- REMEDIATED SHORELINE
- LINE TO NEAREST HARDENED SHORELINE
- - - LINE TO NEAREST NATURAL SHORELINE



PREDICTED HOUSING VALUE CHANGE (USING MODEL 3)



PREDICTED HOUSING VALUE CHANGE (USING MODEL 3)

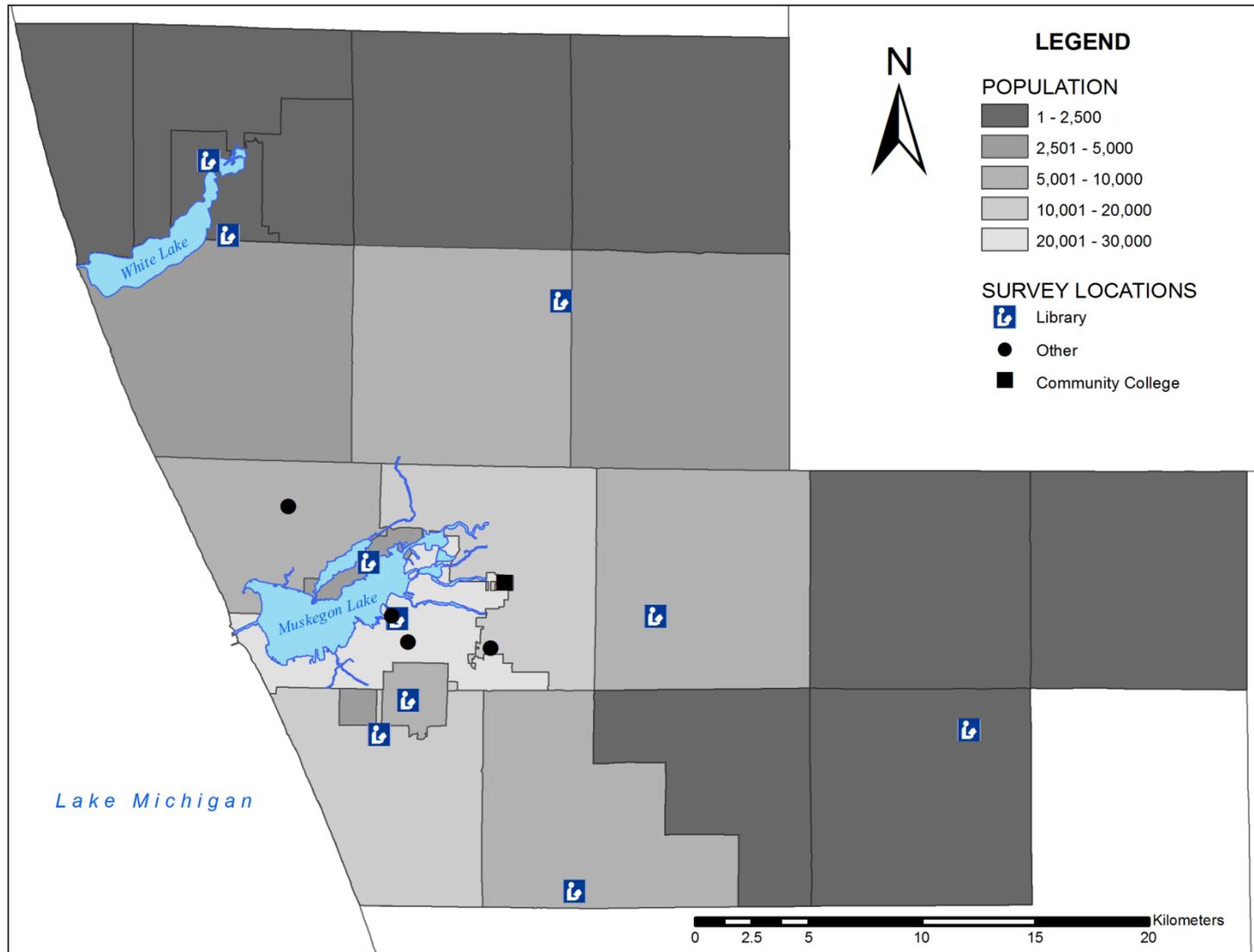


CONTINGENT VALUATION

VALUE OF LAKE RECREATION

- Mailed survey as part of a CV study
 - A little more than 15% response rate
 - Sample not representative
- Follow-up in person survey
 - 212 surveys
 - 64.6% response rate

SURVEY LOCATIONS AND ADULT POPULATION



THE QUESTION

To restore just 1 acre of wetland habitat in Muskegon Lake, 1 in every 300 households in Michigan would need to contribute \$A to this fund. If more households contribute, more habitat can be restored.

Given your household income and expenses, would you be willing to make a one time, tax-deductible donation of \$A?
_____YES _____NO

THE RESULTS

- ◉ 72% of respondents visit Muskegon Lake with an average of 35 trips per year
- ◉ 50% of respondents would make more visits to Muskegon Lake following the restoration
- ◉ 34% of respondents were willing to pay \$ X for further restoration of Muskegon Lake
- ◉ Of the respondents who were not willing to donate money, 45% indicated they would be willing donate a lesser amount

THE RESULTS – PRELIMINARY

◉ Logistic Regression

- Results dependent on functional form
- Small variations in model – big changes in value

◉ Lower-Bound Willingness to Pay Estimate

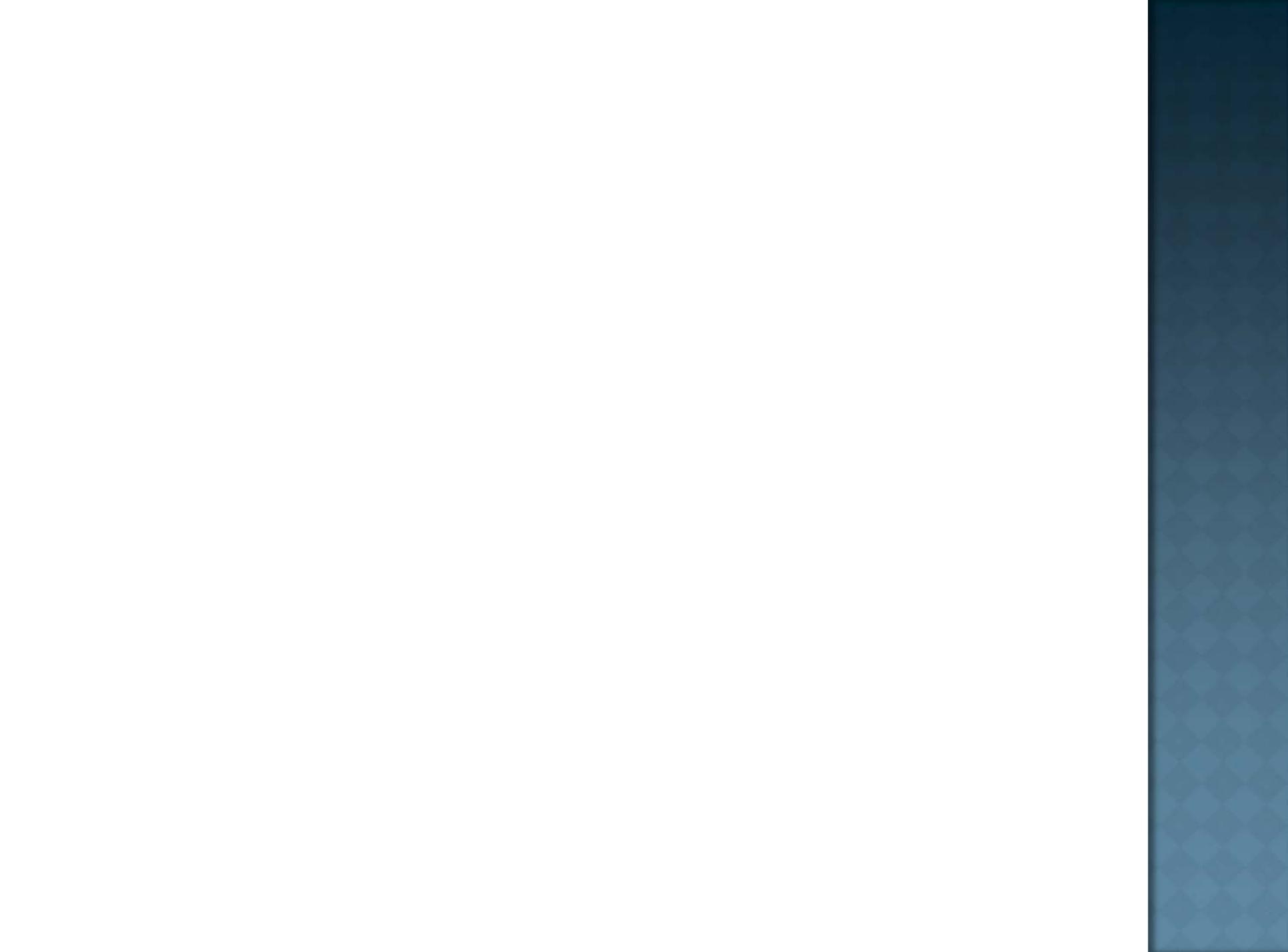
- Haab & McConnell (2002)
- Not dependent on functional form

THE RESULTS – PRELIMINARY

- ◉ Willingness to Pay is estimated at **\$48.41** per household
 - Set surveys with “low certainty – less than 8” to zero
 - Population sample important

- ◉ Aggregate Willingness to Pay **\$3,113,299**
 - Houses within 10 miles (2,775 houses)
 - No houses within 800 meters

TRAVEL COST



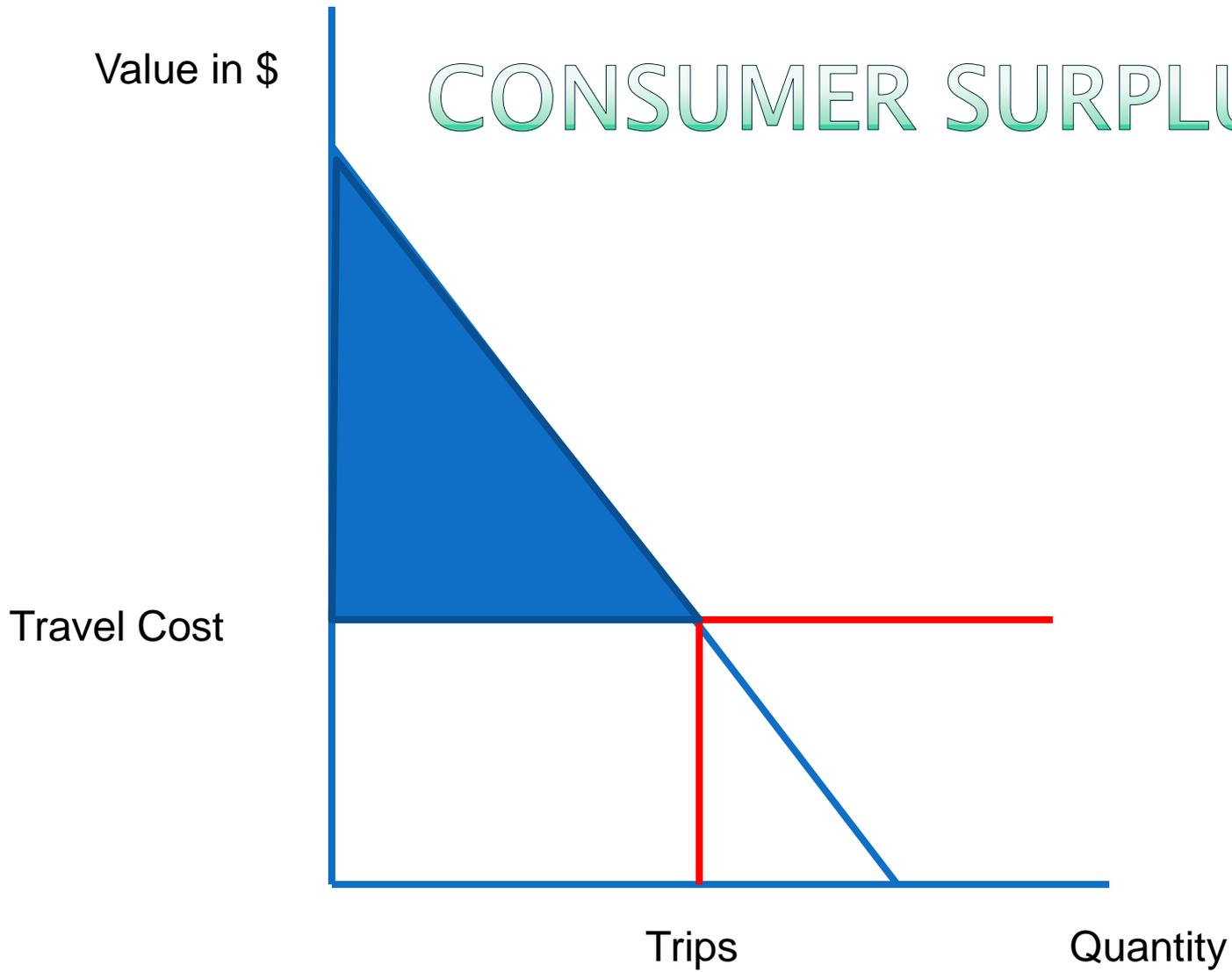
TRAVEL COST

- ◉ Stated costs plus time cost
- ◉ Calculated costs using mileage and normal expenses plus $1/3$ time cost
- ◉ These were averaged together for the model estimations

$$E[TRIPS_k | X_k] = \Lambda_k = EXP(X_k B)$$

- ◉ $TRIPS_k$
- ◉ $TRAVEL COST_k$
- ◉ $TRAVEL COST WH_k$
- ◉ $TRAVEL COST$
- ◉ $FISHING_k$
- ◉ $BOATING_k$
- ◉ $FIRST TIME_k$
- ◉ $MALE_k$
- ◉ $ACCESS 1_k$
- ◉ $ACCESS 2_k$

CONSUMER SURPLUS



VALUE OF A TRIP 2009 – 2010

- ◉ Coefficient on *TRAVEL COST* is -0.026
- ◉ Value of a single trip is $1 / (-\beta_{TRAVEL\ COST})$
- ◉ Value of a single trip to Muskegon Lake is \$37.79

THE RESULTS – PRELIMINARY

- ◉ CV survey – 50% of respondents would make at least 1 more trip
- ◉ Applied to the population results in *64,835 additional visits* from Muskegon County
- ◉ Applying \$37.79 per trip results in \$2,450,114.65 increase in recreational value
- ◉ More work on non–Muskegon visitors and demand shift

OVERALL

OVERALL – PRELIMINARY

- Housing value prediction \$11.9 million
- Contingent value prediction \$3.1 million
- Travel cost prediction \$2.5 million
- Housing can be added to either contingent value or travel cost predictions results in \$14.3 – \$15 million

OVERALL – PRELIMINARY

- Annualized ROI greater than 5 year treasury yields
- Conservative
 - No health benefits
 - No effects counted outside Muskegon
 - No multiplier effect
 - No short run jobs effect
 - Accounted for decreasing returns

QUESTIONS

iselyp@gvsu.edu