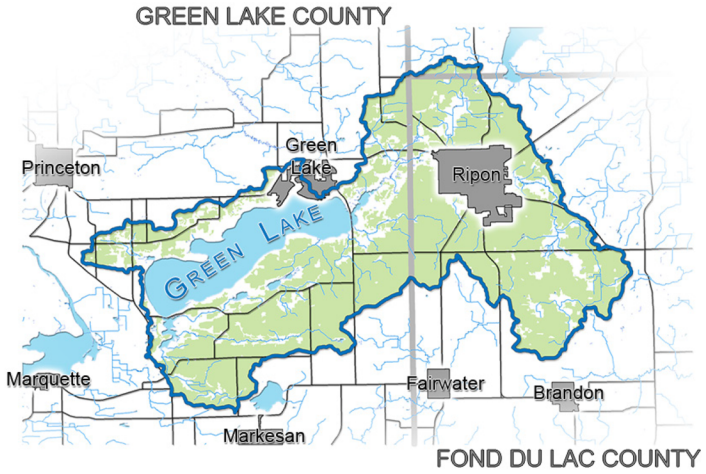
PURDUE UNIVERSITY | Center for Community & Environmental Design

Green Lake Watershed
Social Science Assessment

Community Survey Report



We're asking for your help! This survey, which we expect should take about 20 minutes to complete, is a crucial step to help develop new management efforts to protect Green Lake. As part of this research project assessing lake stakeholder opinions, we're asking that you share your experience, opinions, and thoughts on the future of your lake and watershed, along with some demographic information to help us understand more about the people who respond. The survey is being conducted as a partnership between Purdue University and the Green Lake Association that is working hard to protect the health of your lake. The summarized survey results will inform scientific publications and the multi-organization team working around Green Lake's shorelines, urban and agricultural areas to improve lake water quality. To contribute to this effort by completing the survey please follow the instructions below.

Here are a few important notes about this study:

- Remember all results will be kept confidential, we're just looking for your important perspective about how to better manage Big Green Lake and the surrounding watershed.
- All responses will be treated as anonymous and records used to contact respondents containing identifying information will be destroyed before the research team reviews the data.
- Please skip any questions that make you feel uncomfortable or that you don't know how to answer.

While your participation is voluntary your input can help bring local voices into these important efforts to benefit Green Lake! If you have any questions or comments about this project you may contact the survey team using the information provided below.

Thank you for your time and we're looking forward to hearing from you!

Aaron Thompson, Ph.D.
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Green Lake Social Science Assessment

Community Attitudes & Lake Management

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Acknowledgments

This work was made possible by support from the Wisconsin Department of Natural Resources and conducted in partnership between the Center for Community & Environmental Design at Purdue University and the Green Lake Association. Additional support was also provided by local conservation staff representing federal, state, and local agencies.

I would like to thank many individuals who were involved in the development of the Green Lake Community Survey. First and foremost this project was initiated and funded by the Green Lake Association and without the support of Stephanie Prellwitz and her team it would not be possible to do this type of community driven research. Additionally, thank you to undergraduate research assistants who provided administrative support throughout the data collection process. Finally, the purpose of this research effort is to help stakeholders in the Green Lake watershed share their voice and opinions to inform the watershed protection and restoration efforts – this work is not possible without those individuals who took the time to complete the survey and a big thank you is well deserved for the community members who contributed their time to share their views!

Suggested Citation

Thompson, Aaron (2021). Green Lake Association Community Survey Report: Community Attitudes and Lake Management. Retrieved from Purdue University.

For additional information, requests for permission to use materials contained within, or if you have questions about the work contained in this report contact:

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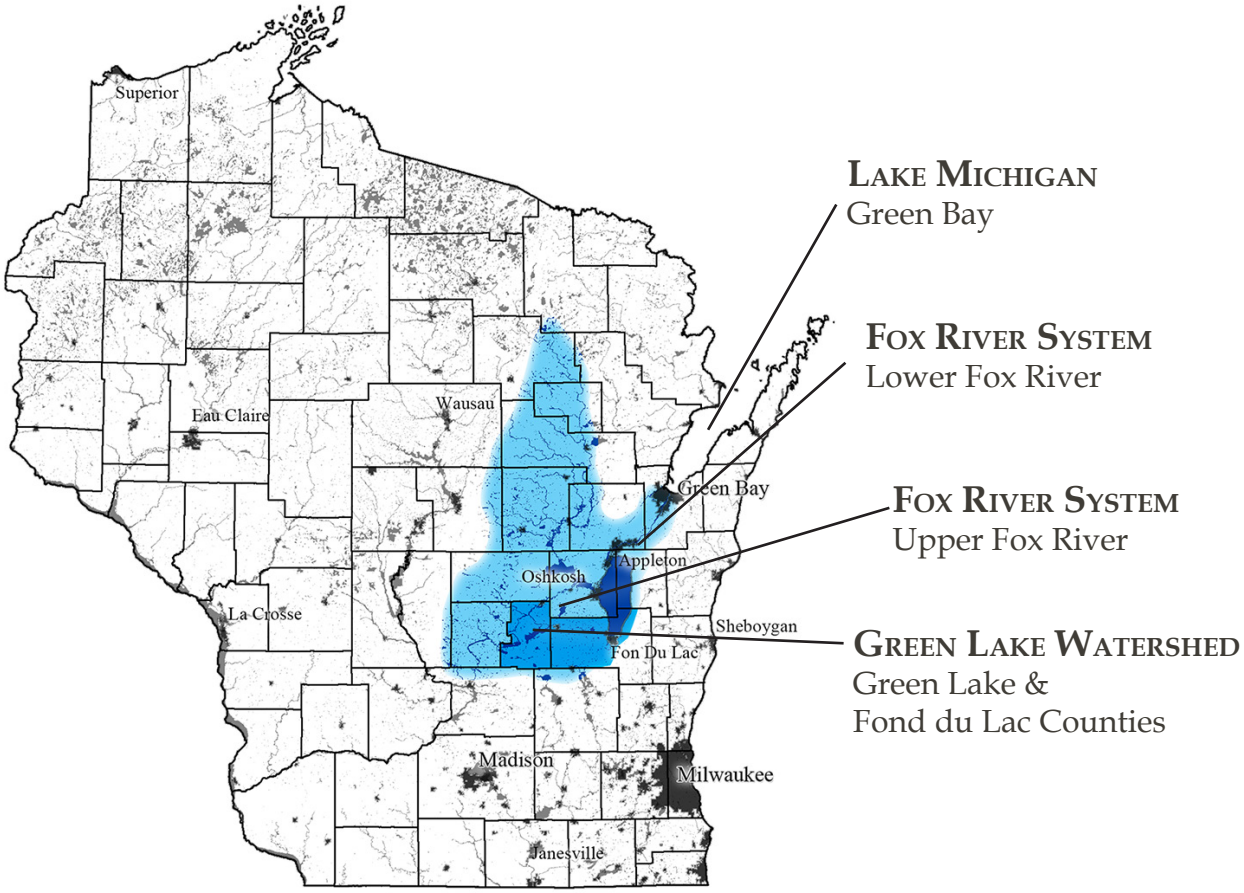
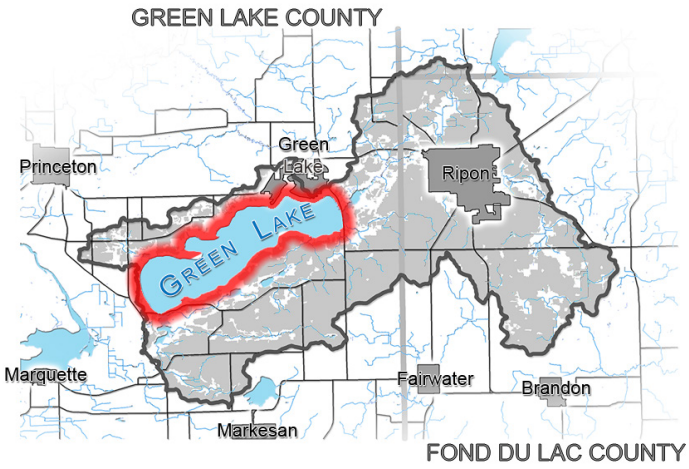
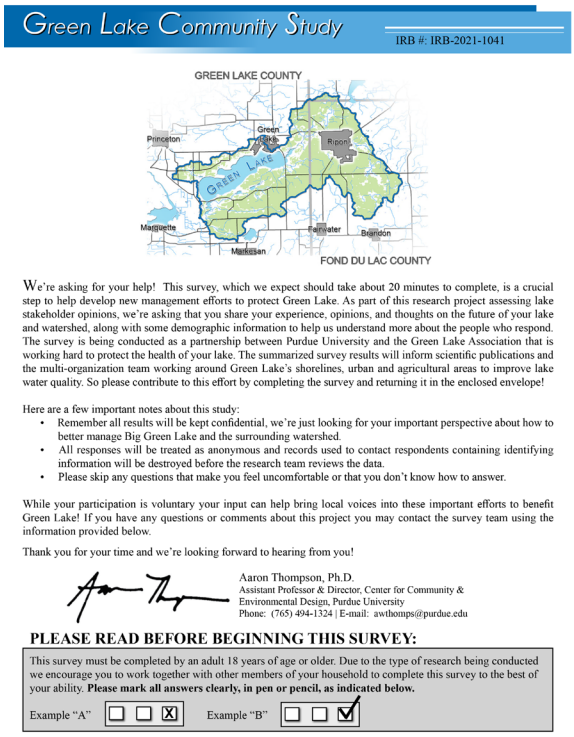
Project Location



Sample Development

The survey "sample" is the list of individuals recruited to participate in the study. The intent was to collect data from households near Green Lake. The State of Wisconsin's Cartographers Office maintains a database of parcel information, including names and mailing addresses based on local tax records. This information is publicly available, and we conducted a GIS analysis to identify shoreline properties and others located near Green Lake but not directly on the shoreline.





Green Lake Community Study

IRB #: IRB-2021-1041

GREEN LAKE COUNTY

Princeton

Green Lake

Ripon

Marquette

Berlinwater

Brandon

Markesan

FOND DU LAC COUNTY

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Phone: (765) 494-1324 | E-mail: awthomps@purdue.edu

PLEASE READ BEFORE BEGINNING THIS SURVEY:

This survey must be completed by an adult 18 years of age or older. Due to the type of research being conducted we encourage you to work together with other members of your household to complete this survey to the best of your ability. **Please mark all answers clearly, in pen or pencil, as indicated below.**

Example "A" ☐ ☐ ☒ Example "B" ☐ ☐ ☑

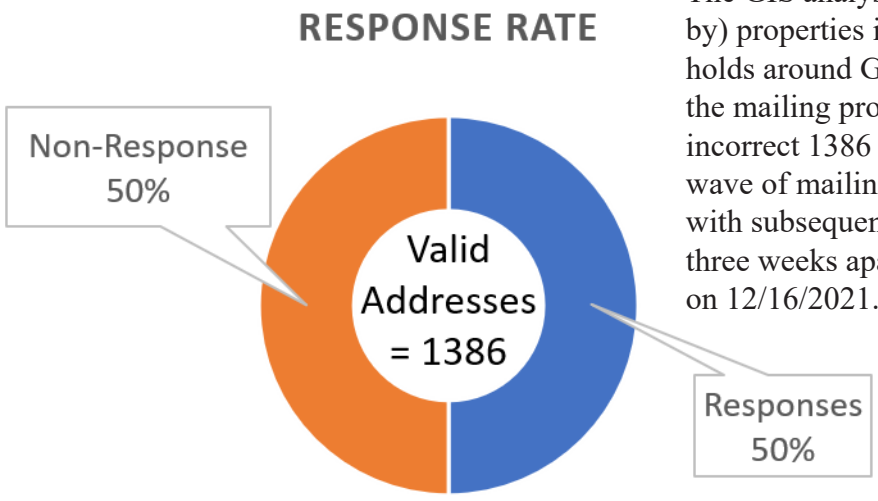
Survey Process

Data was collected using an 8-page mail questionnaire administered using a 5-contact process, adapted from Dillman's Tailored Design Method (2007). Recruitment of landowners to participate in the voluntary survey used the following contacts:

- Introductory Letter
- Survey Packet #1
- Reminder Postcard #1
- Survey Packet #2
- Reminder Postcard #2

Multiple contacts raises awareness and support participation by providing prompts and reminders. The quality of the final dataset is dependent upon participation from a large enough group of agricultural landowners to represent the diversity of views held by this community.

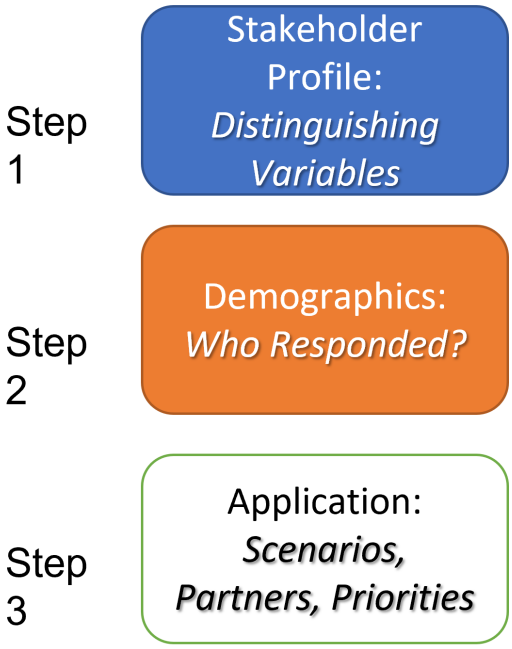
Response Rate



The GIS analysis of shoreline (and nearby) properties identified 1485 households around Green Lake, which through the mailing process was reduced due to incorrect 1386 valid addresses. The first wave of mailings was sent on 9/16/2021 with subsequent mailings approximately three weeks apart, and the survey closed on 12/16/2021. The final count was 693 completed surveys, with an equal number of non-responses for a 50 percent response rate.

A total of 99 bad addresses were identified through the five-contact mailing process. These addresses included undeliverable mail and those who contacted us to indicate that they no longer own property in Green Lake.

Analysis Plan



The survey analysis, completed by Dr. Aaron Thompson, uses a three-stage approach that supports the grouping of attitude segments within the respondents, presents a detailed overview of demographic information to clarify who is represented by the data, and reviews the policy and action implications in the applications section. The use of social science research in lake and water quality management is of particular interest to local decision-makers for various reasons. In this case, the Green Lake Association (GLA) seeks to evaluate the acceptability of proposed actions related to the future direction of water quality initiatives. This evaluation focuses on identifying a target for future community-based fundraising goals, establishing an appropriate desired future condition for the lake and watershed, and prioritizing the types of water quality threats that residents want to see. In the following pages, step 1 provides a detailed breakdown of the stakeholder profile that identifies distinct groups of survey respondents based on the key 'distinguishing' variables (attitudes toward Green Lake and resident type). The result of this process is the identification of 6 groups:

- Group 1: No Problem Attitudes, Full-Time Residents
- Group 2: No Problem Attitudes, Part-Time Residents
- Group 3: No Problem Attitudes, Seasonal Residents
- Group 4: Negative Impacts Attitudes, Full-Time Residents
- Group 5: Negative Impacts Attitudes, Part-Time Residents
- Group 6: Negative Impacts Attitudes, Seasonal Residents

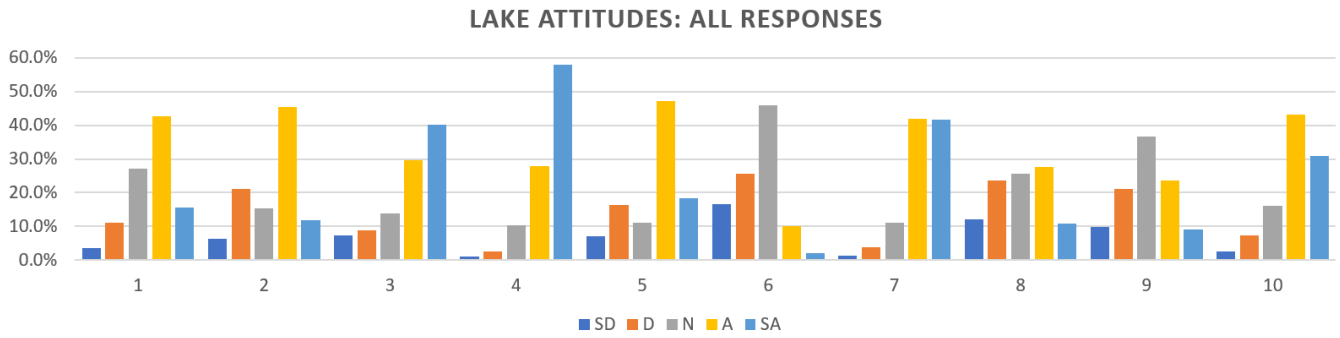
The results section provides a detailed explanation of these distinct groups of Green Lake residents. Following this explanation, the demographic and application sections provide additional information about these groups that will help answer these critical social questions and inform water quality efforts in Green Lake.

Stakeholder Profile: *Distinguishing Variables*

COMMUNITY PERCEPTION OF GREEN LAKE

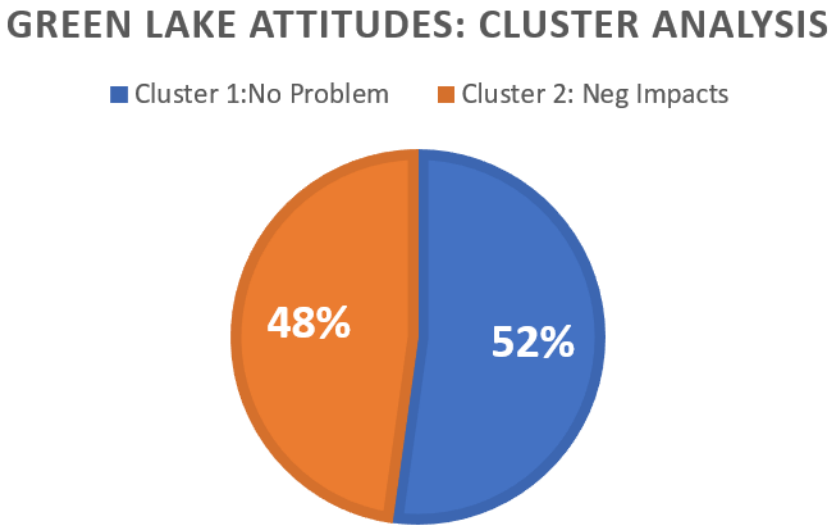
The attitude statements below result from multiple interviews with lake stakeholders across Wisconsin and represent key distinctions in belief systems held by individuals. The responses, both agreement and disagreement, with these attitude statements help reveal a pattern that helps us understand a consistent (and often lasting) impression of the individual's views of lake conditions.

The following statements assess opinions about the use and management of Big Green Lake. Most of these statements have been shared by lake stakeholders like yourself, so we're really just trying to see if you agree or not. For each of the following please respond by indicating how strongly you agree or disagree with the views expressed in each statement.	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA
I believe the water quality in Green Lake is better than most lakes in this part of Wisconsin. No Problem	-2	-1	0	1	2
Green Lake provides good conditions for swimming near the shore because the water clarity makes it easy to see what is underwater. No Problem	-2	-1	0	1	2
Being able to safely use a large motor on my boat is an important part of my recreation on Green Lake. No Problem	-2	-1	0	1	2
Over the past 3 or 4 years, there has been a large increase in the number of weeds and other unwanted vegetation in Green Lake. Neg. Impacts	-2	-1	0	1	2
There are bad days for water quality, but generally, Green Lake meets my needs as there are no days where I feel unsafe to swim or recreate in the water. No Problem	-2	-1	0	1	2
I'd like to eat more fish from Green Lake, but I don't feel safe due to concerns about water quality. Note: Factor analysis excluded this item.	-2	-1	0	1	2
Over the past 3 or 4 years, shoreline issues like swimmers itch, e-coli beach closings, and harmful algae blooms have become more common in Green Lake. Neg. Impacts	-2	-1	0	1	2
The presence of large algae blooms in Green Lake during the summer months has greatly reduced my desire to spend time here. Neg. Impacts	-2	-1	0	1	2
I am negatively affected by poor water quality as I see less wildlife (birds, fish, etc.) now at Green Lake than were here in the past. Neg. Impacts	-2	-1	0	1	2
Over the past 3 or 4 years, the water quality in Green Lake seems to be getting worse. Neg. Impacts	-2	-1	0	1	2

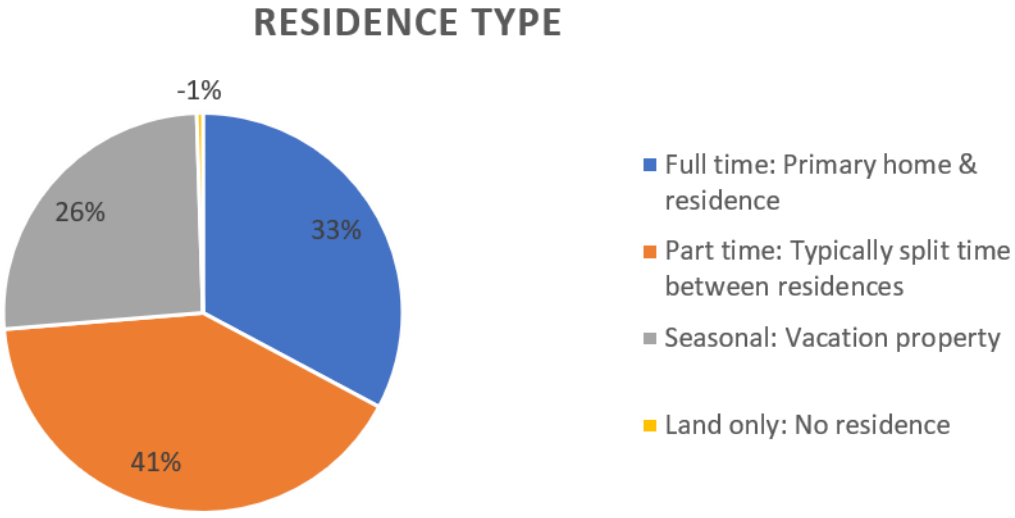


Respondent Typology: Method

A statistical analysis (referred to as factor analysis) was conducted following a review of the survey responses to these attitude statements. The analysis looks at all valid responses and works to identify patterns of agreement and disagreement between survey respondents. The factor analysis results revealed two distinct patterns among the 693 responses.

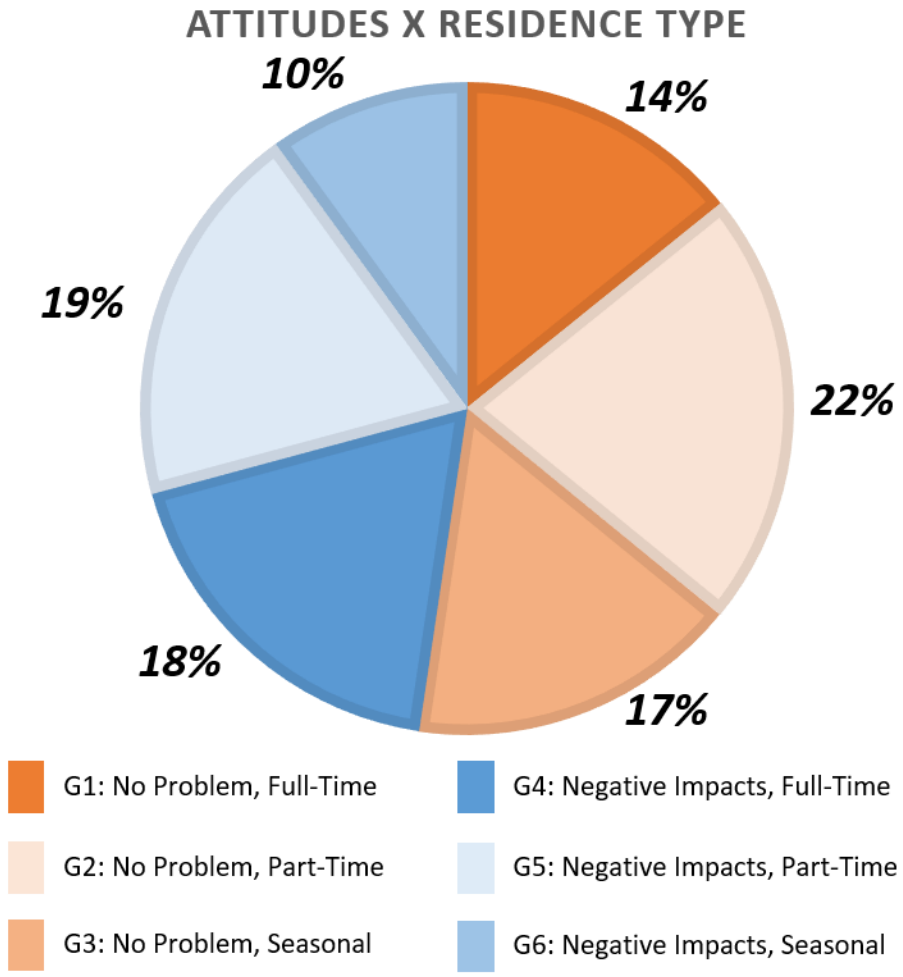


The first referred to hereafter as "no problem" indicates strong agreement with statements 1,2,3 and 5. Individuals whom we have grouped with this belief pattern generally see the water quality conditions of Green Lake meeting their needs while also revealing a tendency toward a set of lake activities often associated with motorboats. The second pattern referred to hereafter as "negative impacts" indicates strong agreement with statements 4,7,8,9, and 10. Those individuals grouped with this belief pattern reveal a general sense of fear about declining water quality conditions limiting their enjoyment of the lake.



Respondent Typology: Results

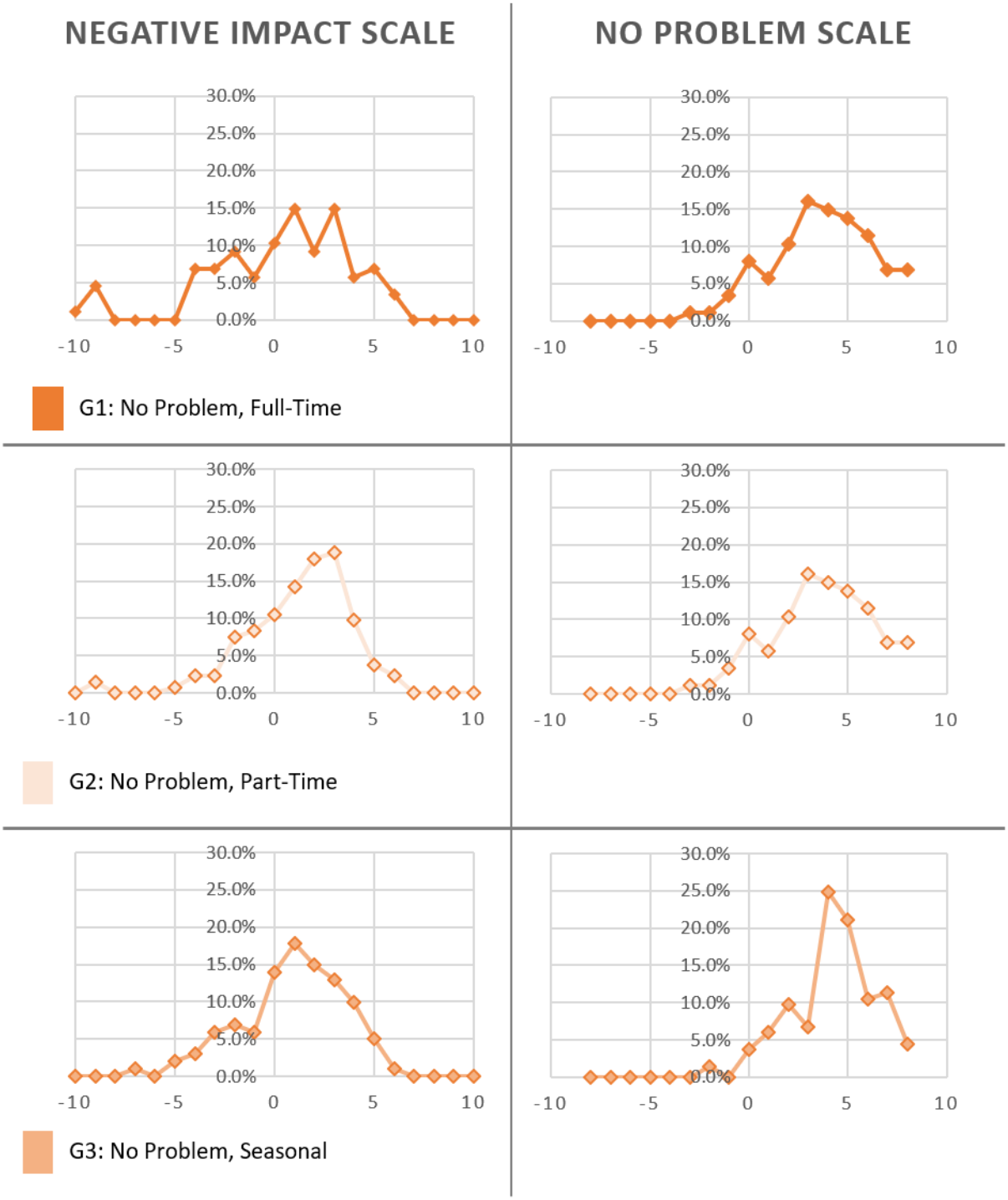
The next step in identifying distinct groups of survey respondents in the stakeholder profile was to combine the attitude belief groups with the residence type. The selection of residence type (full-time, part-time, or seasonal) as a variable of interest is the result of the difference of means tests that clearly showed statistically significant differences for application variables. The results, shown below, reveal six distinct stakeholder groups that will be used to analyze the survey data further.



One of the essential features of group identification in a stakeholder profile is to ensure that groups sizes are large enough to run statistical tests while small enough to provide meaningful differences that are translatable to the real world to be actionable. In this case, the stakeholder profile groups are well balanced in size and provide a relatively clear distinction between attitudes profiles and residency status at Green Lake.

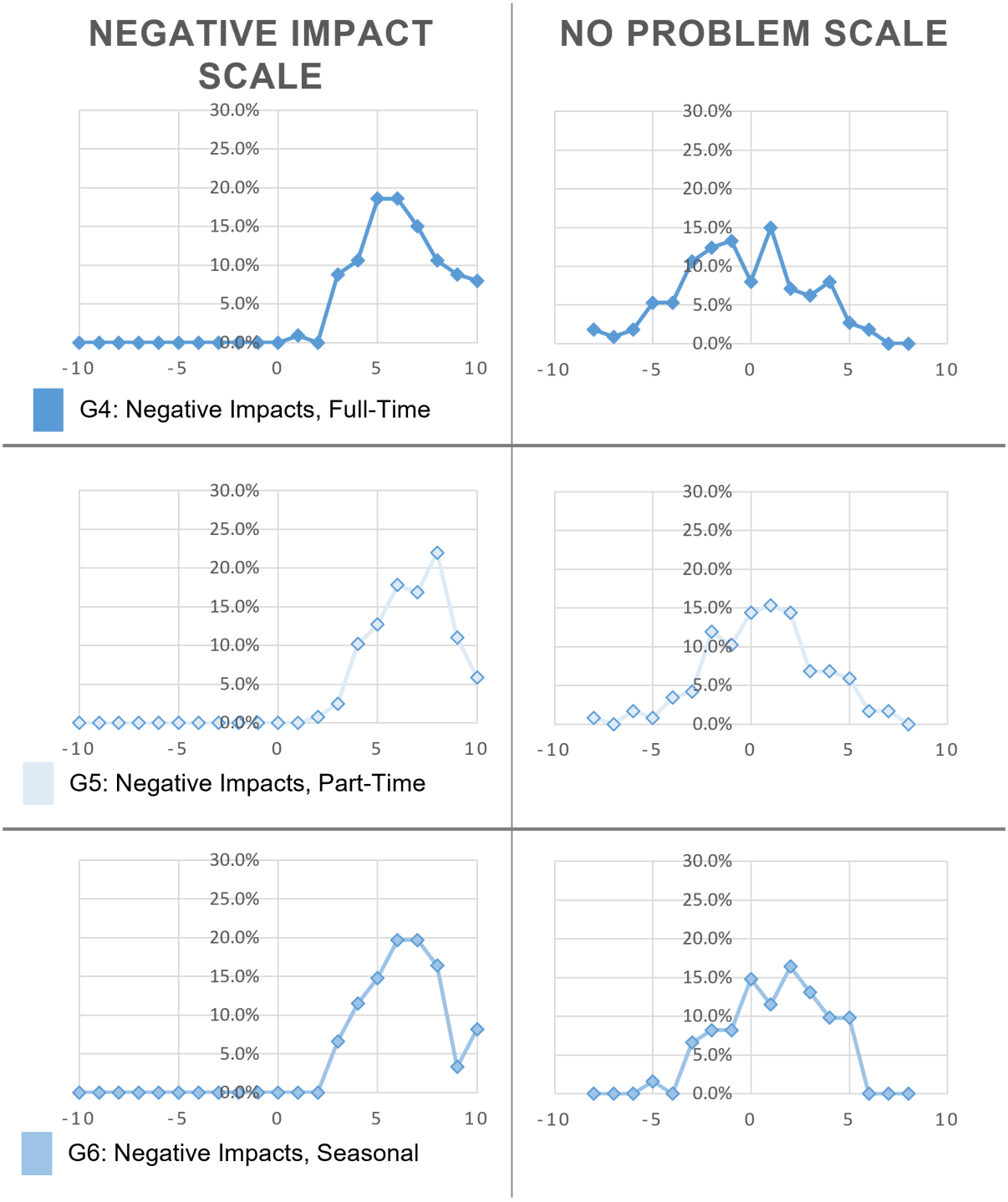
No Problem Groups

Recall that this group's attitude belief pattern does not necessarily mean that they do not see any problems, as reflected in the side-by-side comparison of scores below. Therefore, the scores for each item associated with the pattern have been added together to create a composite, or summated, scale score shown here.



Negative Impact Groups

Similarly, mixed attitudes with positive average support from those whose pattern of responses indicates that they are experiencing substantial negative impacts from water quality declines. The factors that differentiate the groups are the strength of agreement. Someone can believe that water quality in the past three years is significantly declining, while also believing that Green Lake is one of the better lakes in this part of Wisconsin.



Demographics: *Who Responded?*

The demographic analysis (step 2) presents information about average values from all respondents and a breakdown using the six distinct stakeholder groups identified in the stakeholder profile.

Demographic Information

Please answer the following questions about yourself, the **information will be used for classification purposes only**.

What is your gender? ☐ Male ☐ Female

In what year were you born? ☐

What is your highest level of formal education?
- ☐ Some high school
- ☐ High school graduate or GED
- ☐ Some college
- ☐ 2 year degree
- ☐ 4 year degree
- ☐ Graduate degree
- ☐ Other (specify) ☐

As a youth were you raised in Green Lake or a nearby community? ☐ Yes ☐ No

Do you describe Green Lake or a nearby community as your home? ☐ Yes ☐ No

How many years have you lived in Green Lake or a nearby community? (include both seasonal and full time) ☐

Has your family been coming to or living in Green Lake for more than 40 years? ☐ Yes ☐ No

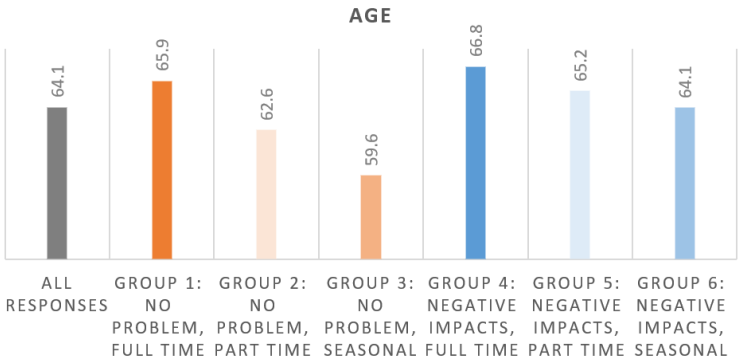
Which best describes your residence in Green Lake or a nearby community?
- ☐ **Full time:** Primary home & residence
- ☐ **Part time:** Typically split time between residences
- ☐ **Seasonal:** Vacation property
- ☐ **Land only:** No residence

In 2020 what types of property did you own in the Big Green Lake watershed? (If you own multiple properties please check all that apply).
- ☐ **Single residential property** – Typically between ¼ and 3 acres
- ☐ **Residential property with acreage** – Typically between 3 and 10 acres
- ☐ **Small commercial property** – Typically between ¼ and 3 acres
- ☐ **Large commercial property --** Typically between 3 and 10 acres
- ☐ **Small recreational property** – Typically between 10 and 40 acres
- ☐ **Large recreational property** – Typically between 40 and 100 acres
- ☐ **Small agricultural or rural property** – Typically between 40 and 100 acres
- ☐ **Large agricultural property** – Typically between 100 and 500 acres
- ☐ **Very large agricultural property** – Typically greater than 500 acres

Does your property contain shoreline on Big Green Lake? ☐ Yes ☐ No

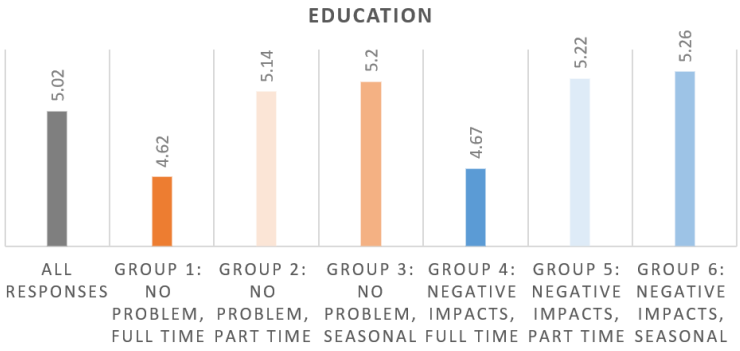
What is your approximate annual household income($)?
- ☐ Less than $25,000
- ☐ $25,000 to $50,000
- ☐ $50,001 to $100,000
- ☐ $100,001 to $150,000
- ☐ $150,001 to $250,000
- ☐ $250,000 to $1,000,000
- ☐ Greater than $1,000,000

To understand what we can learn from the survey of shoreline residents, we begin by discussing the characteristics of those who responded to the survey. The following demographic information does not in and of itself provide conclusions about how to engage these audiences in watershed planning; instead, it assists in understanding who voluntarily contributed to the watershed planning process by participating in the Green Lake Community Survey.



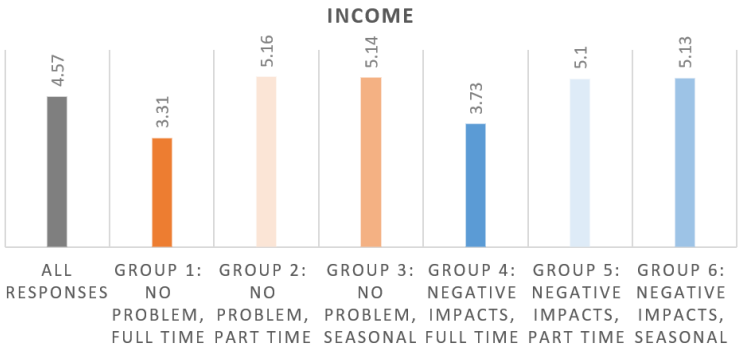
Age

The average age of all respondents is 64.1 years, with only minor variation among the six groups.



Education

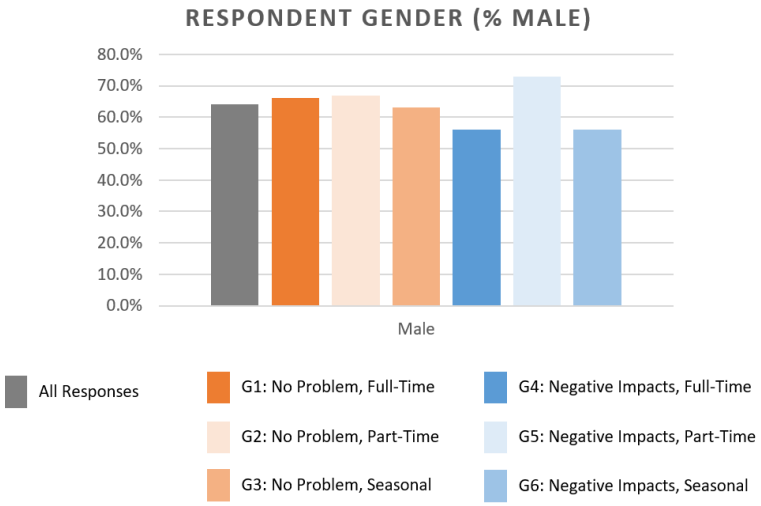
Overall education levels are very similar, with the average respondent having "a 4-year college degree." However, there is a statistically significant difference for full-time residents, whose average education is somewhat less but still above the state average.



Income

Average income levels for households responding to the survey are between $100,000 and $150,000 per year. This result is significantly above annual income estimates of $55,000 per year for households in Green Lake County, Wisconsin from the US Census Bureau.

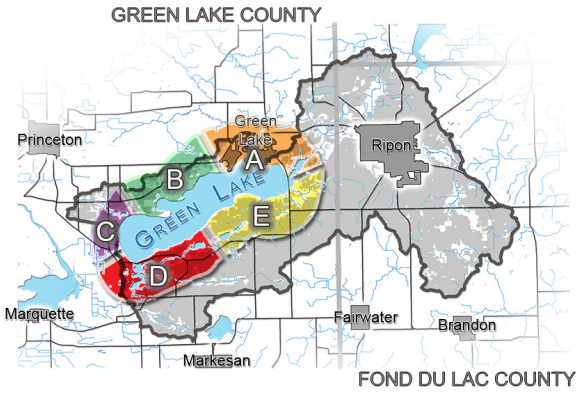
Gender

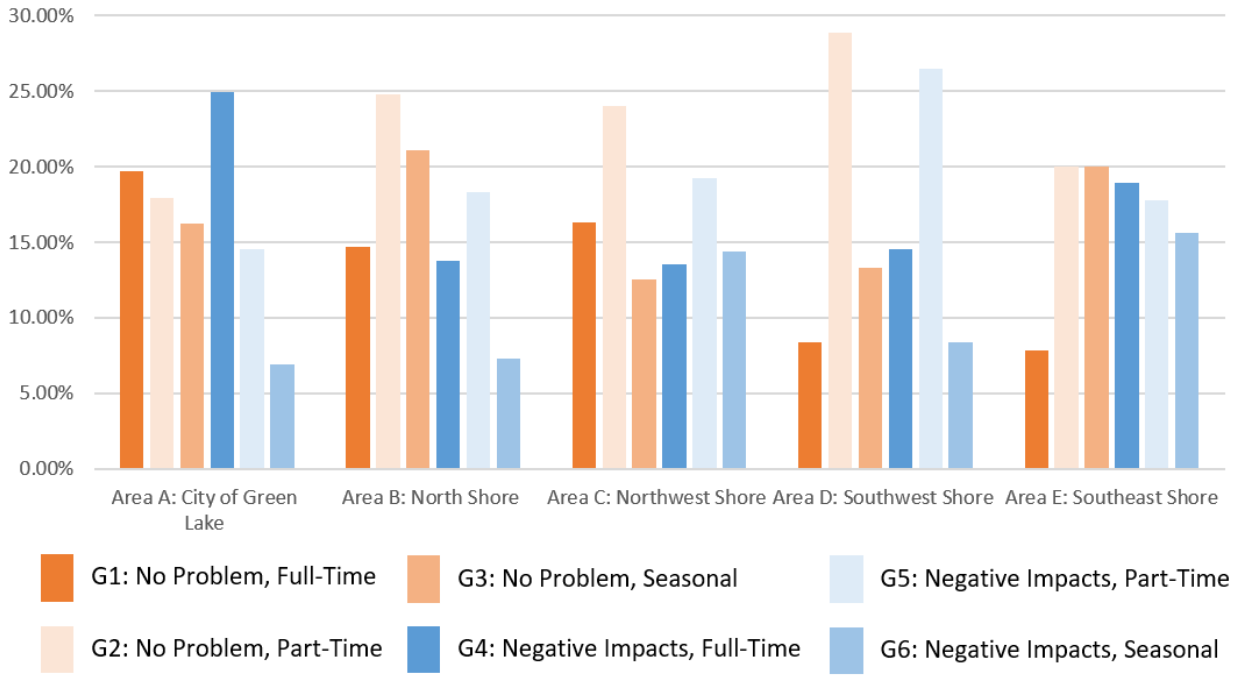


A slight gender imbalance in who responded to the surveys is shown by 63.8 percent of responses coming from males. This result is not unexpected, as this is common among lake surveys in Wisconsin. However, attempts were made to manage this bias by addressing mail to respondents, where applicable, to both the male and female owners of the property.

Geography

Strong participation in the voluntary mapping question from the survey helped produce robust estimates of group membership by the geographic area around Green Lake. Responses were aggregated into five general areas based on a similar principle of appropriate size for statistical analysis while also small enough to be useful for future programming.





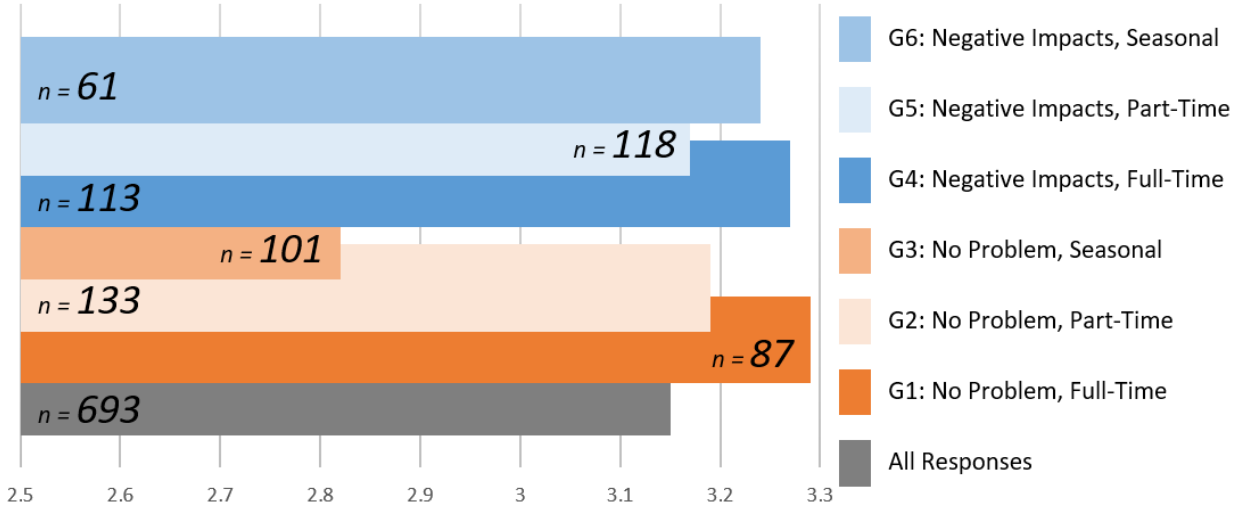
Awareness of GLA

The results reveal both high awareness of the Green Lake Association among shoreline area households and high levels of awareness of specific initiatives.

Green Lake Association

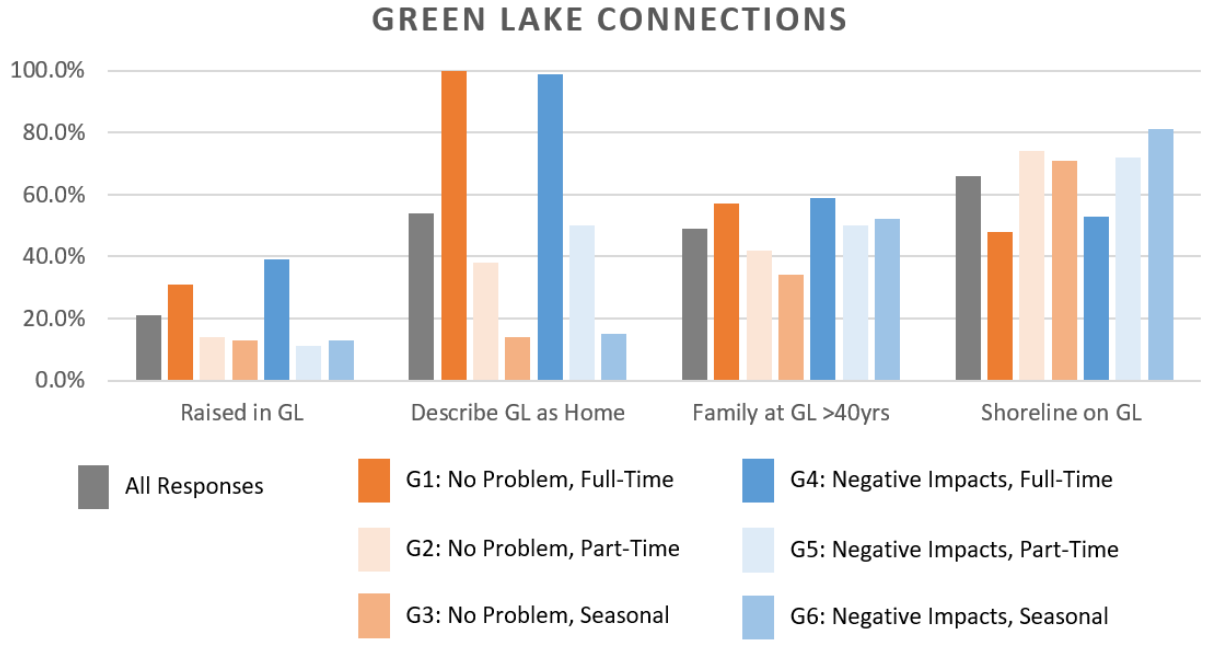
Have you heard about Green Lake Association's efforts? They work to promote the conservation of Green Lake by addressing negative water quality trends before they become a critical issue that will affect this lake over the long term. Please select the response that best describes your familiarity.

☐ Never heard about these efforts ☐ Heard of them, but don't know much about them ☐ Heard of them and know what they are doing ☐ I've attended meetings or events in the past

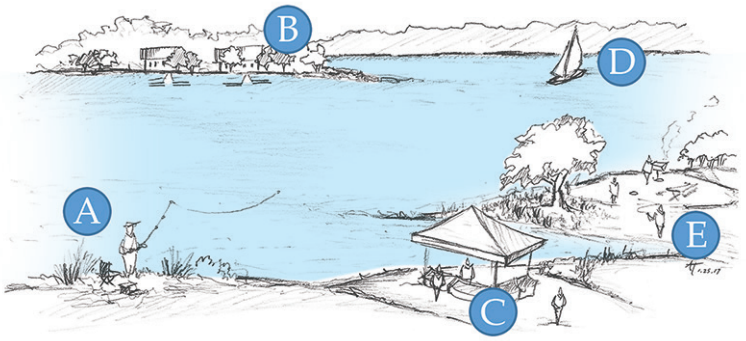


Green Lake Connections

The results below highlight place attachment indicators of connection to Green Lake. In particular, these focus on both length and personal memory connections.



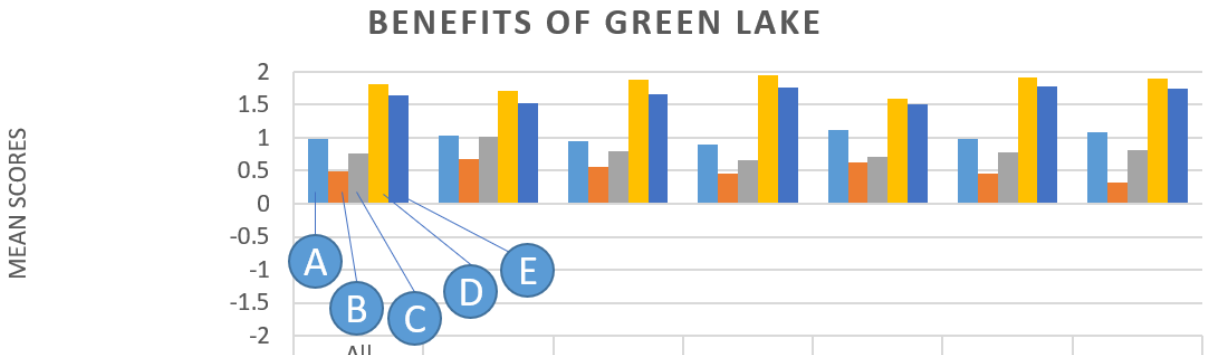
Benefits of Green Lake



Benefits of Green Lake

The following series of questions asks about possible community benefits of Green Lake. Please indicate your level of agreement with the following statements, which begin with **"I personally benefit from ..."**

	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA	Don't Know DK
I personally benefit from … access to fishing or hunting opportunities on Big Green Lake.	-2	-1	0	1	2	☐
… local tax dollars generated by shoreline development on Green Lake.	-2	-1	0	1	2	☐
… access to customers for local products, such as Farmers Markets, who are attracted to the area by amenities around Green Lake.	-2	-1	0	1	2	☐
… opportunities for water-based recreation, such as boating or swimming, on Green Lake.	-2	-1	0	1	2	☐
… places for friends, family, or other groups to gather and enjoy leisure time together around Green Lake.	-2	-1	0	1	2	☐



	All Responses	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Fishing/Hunting	0.98	1.03	0.95	0.9	1.12	0.99	1.08
Local Tax	0.49	0.67	0.56	0.45	0.63	0.46	0.32
Customers	0.77	1.02	0.8	0.66	0.71	0.78	0.82
Boating/Swimming	1.81	1.71	1.88	1.95	1.6	1.91	1.9
Family/Social Gathering	1.64	1.53	1.66	1.76	1.51	1.77	1.75

In general, the most likely time to find shoreline area landowners benefiting directly from Green Lake is when they are spending time boating/swimming or at family and social gatherings. However, they report strong agreement with all of the potential benefits of Green Lake that they were asked to assess.

Application:
Scenarios, Partners, Priorities

FUTURE OF GREEN LAKE

The preparation of the survey questionnaire focused extensively on how to present, given the limited space available, accurate and understandable scenarios outlining possible future directions for water quality in Green Lake. As a result, the summary of the current conditions presented below is based on information available in the Green Lake Management Plan, which provides much more extensive coverage than is possible in this format. Further, as the survey developed, new information became available from the Green Lake Association (including updated phosphorus concentrations showing a trend of worsening conditions) and was incorporated where possible.

What are conditions today?

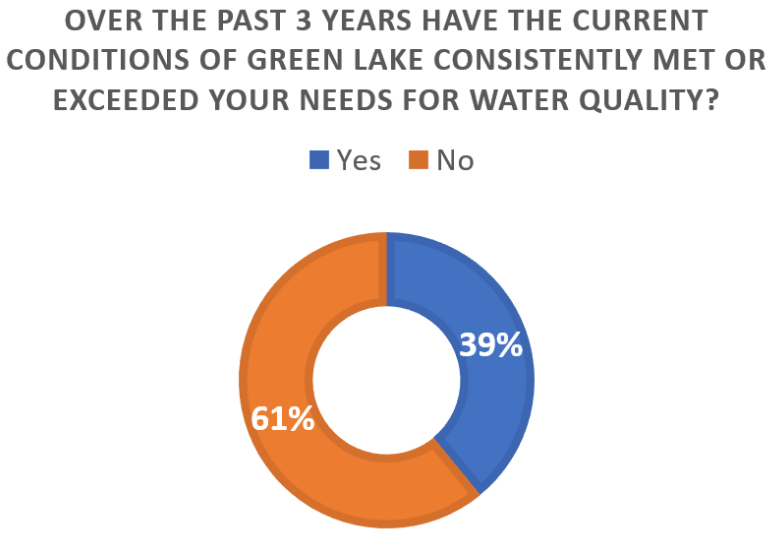
Nutrient Runoff  *Current Conditions*	Multiple sources of nutrients, from both natural runoff and as the results of human activity on the landscape, are allowing excess nutrients to reach Green Lake. This results in 19,800 pounds of phosphorus entering the lake each year.
Water Quality  *Current Conditions*	These excess nutrients build up in the water in Green Lake, resulting in a concentration of phosphorus that has led the lake to be considered impaired (or averaging about 19 micrograms per liter in the lake).
Algae Potential  *Current Conditions*	Phosphorus support robust plant (and weed) growth. The result is that it is possible for Green Lake to produce nearly10,000,000 pounds of weeds and algae growth with these additional nutrients each year.

- Green Lake is only 10% spring-fed from groundwater, meaning that the rest of the water comes from direct rainfall or runoff from the surrounding watershed.
- Once water makes its way from the landscape into Green Lake it is likely to stay for around 21 years.
- 1 pound of phosphorus, a nutrient that supports plant growth (commonly found in fertilizers), can generate 500 pounds of weeds and algae in the lake.

Studies have helped provide a better understanding of what the future may hold for Green Lake, but there are factors that can change future outcomes. To begin please answer the following question about current conditions.

Over the past 3 years have the current conditions of Green Lake consistently met or exceeded your needs for water quality?

Yes ☐	No ☐



Survey responses aligned with the phosphorus loading results, with a greater likelihood of noticeable algae blooms, and a majority of lake residents (61 percent) report that water quality Green Lake in the past three years has consistently failed to meet their needs.

MANAGEMENT SCENARIOS

The three scenarios include no new investment (status quo), new investment targeting stabilizing nutrient pollution, and restoration of the watershed present unique goals, timelines, management action, and funding. Further, each of these scenarios presents a different but likely associated set of costs and benefits.

Scenario #1: No new community investment in lake management efforts. Efforts are currently underway to manage nutrient runoff in the Green Lake watershed, but they are not enough to address the size of the problem.

Nutrient Runoff

• In this scenario the amount of phosphorus running off into Green Lake increase by 25 percent, causing overall lake heath to decline.

Management Effort

• Less money can be put toward reducing nutrient pollution and more money will be spent on weed removal.

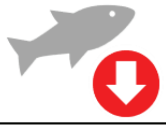
Water Quality

• Within 20 years poor water quality conditions will drive a moderate decrease in property values and tourism revenue.

Investment

• The benefit is that no new revenue will be needed for watershed management to maintain this trend.

Recreation Quality



•Further declines in water quality means more algae in Green Lake, and fewer fish species of interest to anglers.

Timeline

• Only short-term needs, like weed harvesting, will be funded with no direct impact on the causes of the water quality problem.

Scenario #2: Stabilize nutrient pollution. With funding it is possible to work with landowners and the community to reduce the amount of phosphorus runoff that reaches Green Lake.

Nutrient Runoff

• This scenario involves limiting runoff from agriculture and urban sources entering Green Lake and reducing phosphorus pollution by 40 percent.

Management Effort

• Significantly reducing phosphorus runoff from reaching the lake would require new investment on both public and private lands.

Water Quality

• This reduction may improve water quality enough for Green Lake to no longer be considered impaired.

Investment

• To reach this goal requires a minimum of a 20-year commitment of $250,000 each year in new revenue generated from the community to support these efforts.

Recreation Quality

•These changes will help support a healthy fishery, but there may still be continued algal blooms due to phosphorus already in the lake.

Timeline

• This scenario begins to address the causes of poor water quality by promoting investment in long-term solutions.

Scenario #3: Restore Green Lake. To achieve ideal recreation conditions, the phosphorus concentration in the lake needs to dramatically drop (closer to 12 micrograms per liter).

Nutrient Runoff

• In this scenario the community invests in restoring conditions that have supported excellent water quality in the past.

Management Effort

• Will require limiting phosphorus pollution, stream restoration projects, whole-lake treatments, and changing land management practices.

Water Quality

• Clean water with only minor issues seasonal issues with algal blooms.

Investment

• Achieving this goal will require a minimum of a 20-year commitment of $1,000,000 each year in new revenue generated from the community to support these efforts.

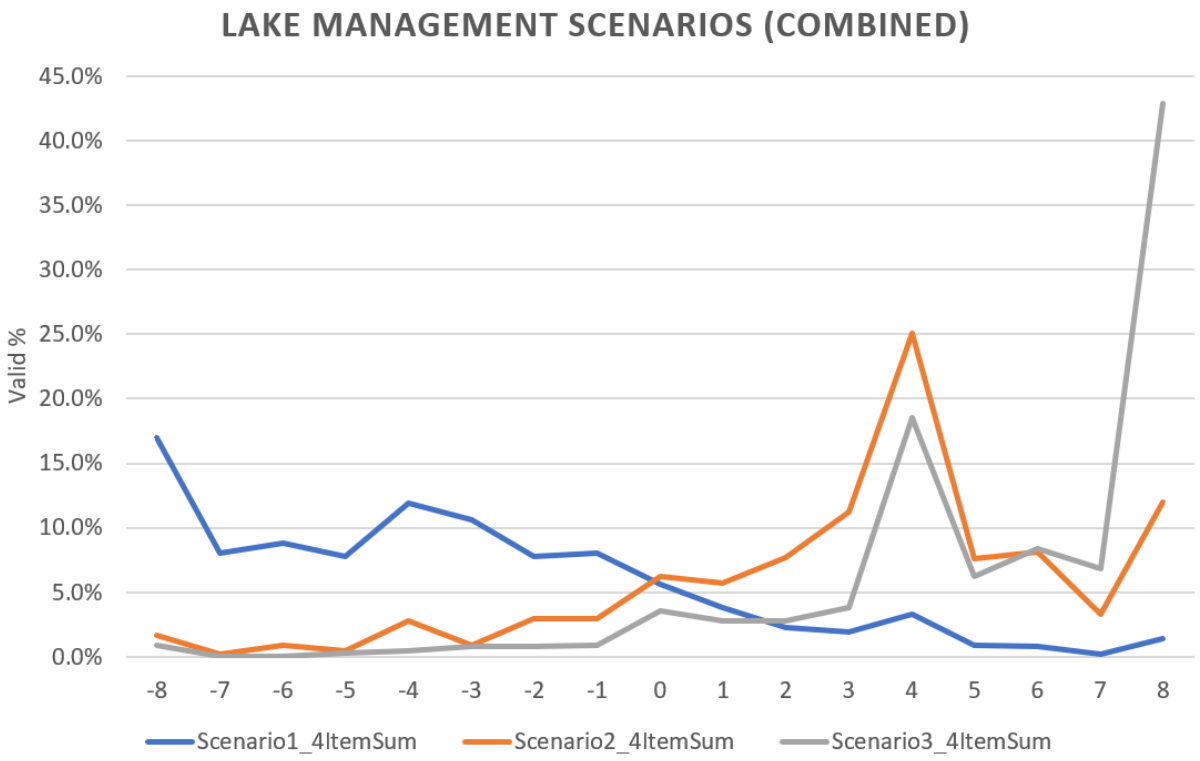
Recreation Quality

• Clean water for recreation and a strong fishery are likely to cause a moderate increase in property values and tourism revenue.

Timeline

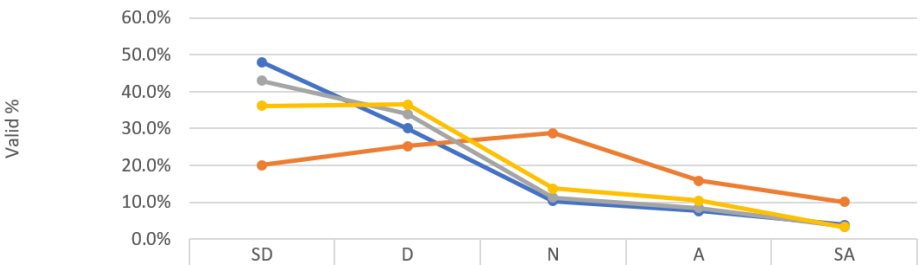
• This scenario address the causes of poor water quality with long-term solutions.

Following the presentation of each scenario, respondents evaluated the potential impact of this possible future on their recreation, community, environmental, and economic benefits. Combining these four responses into a single scaled variable (adding them together) helps create an overall evaluation of each scenario. The results of these summated rating scales are presented below based on the frequency of scores for each scenario.



Scenario Evaluations

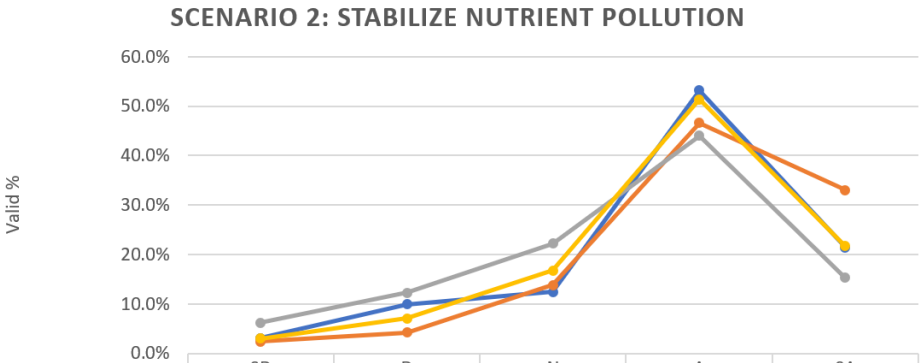
The following presents results for the scenario questions invidivually using all survey responses.



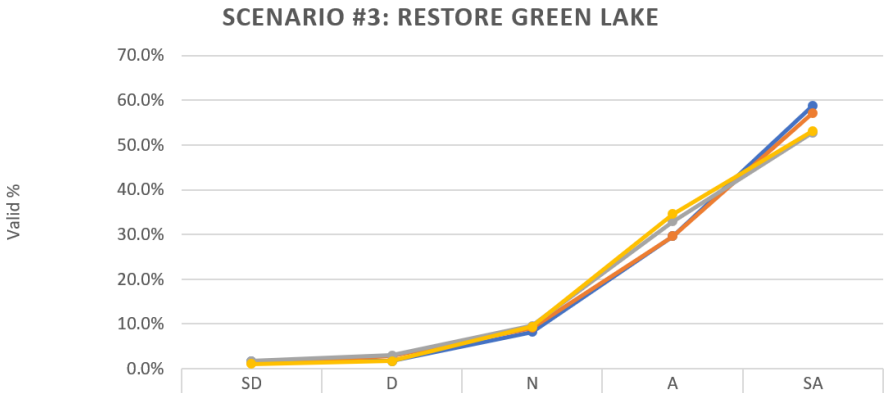
	SD	D	N	A	SA
S1_Recreation	48.0%	30.1%	10.3%	7.6%	3.9%
S1_Community	20.1%	25.2%	28.8%	15.9%	10.1%
S1_Environment	43.0%	33.9%	11.3%	8.4%	3.4%
S1_Economic	36.1%	36.5%	13.7%	10.4%	3.3%

The results show an agreement for each scenario evaluation question that this is a desirable future for between 10 and 25 percent of shoreline residents. However, a substantial majority (45 and 78 percent) indicate that they disagree or strongly disagree with this approach across the four evaluation questions.

Clearly, there is a change in trend between scenarios 1 and 2, with between 59 and 74 percent of shoreline residents reporting that they agree or strongly agree with this approach.



	SD	D	N	A	SA
S2_Recreation	3.1%	9.9%	12.4%	53.2%	21.4%
S2_Community	2.4%	4.2%	13.8%	46.6%	33.0%
S2_Environment	6.2%	12.3%	22.2%	44.0%	15.3%
S2_Economic	3.0%	7.1%	16.8%	51.4%	21.7%

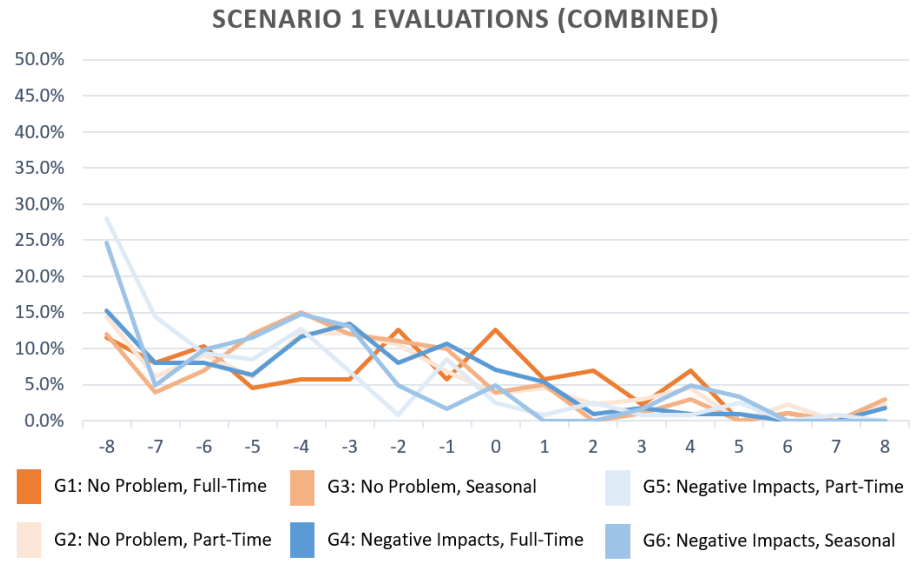


	SD	D	N	A	SA
S3_Recreation	1.7%	1.7%	8.2%	29.6%	58.8%
S3_Community	1.3%	2.8%	9.1%	29.6%	57.2%
S3_Environment	1.7%	3.0%	9.6%	32.9%	52.8%
S3_Economic	1.1%	1.7%	9.4%	34.6%	53.1%

Unlike the previous scenarios, there is almost no disagreement that this future would represent positive changes for the community and the lake's health. There is also no drop-off in "strongly agree" support, as seen in Scenario 2, which suggests that the community shares a common desired future condition without expressly considering complications like funding.

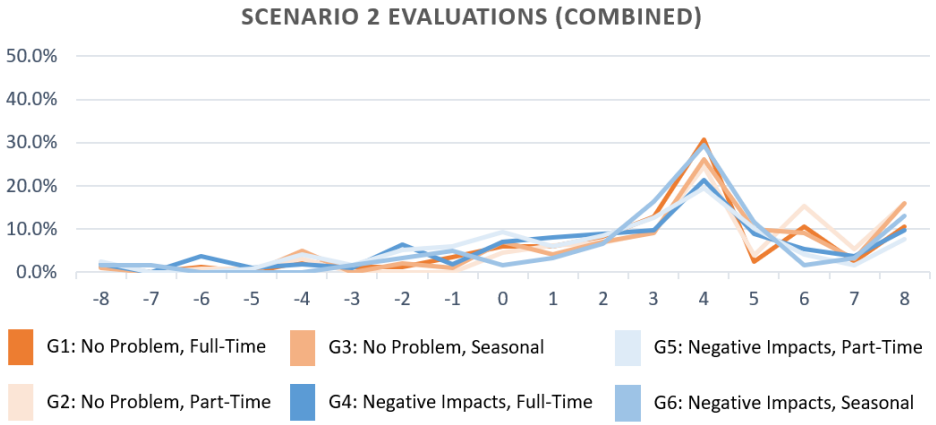
Stakeholder Group Evaluations

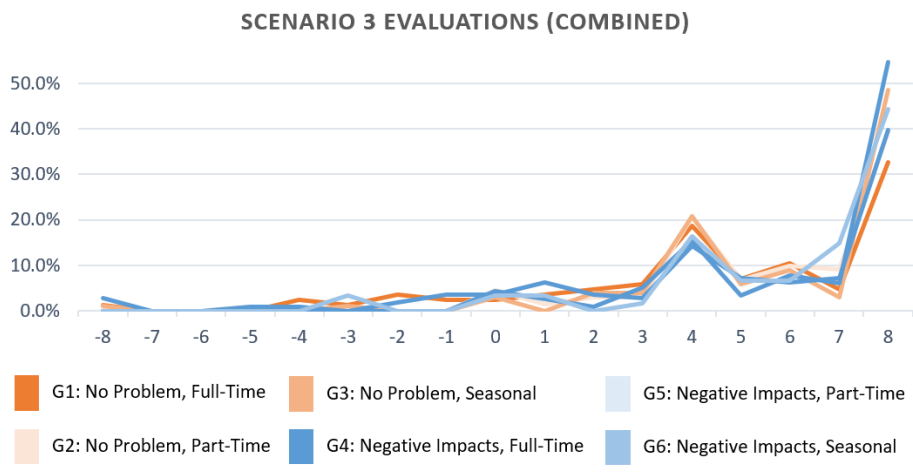
The following presents results for the scenario questions as a combined scale using responses for the six distinct groups identified in the stakeholder profile.



Continuing the trend seen in the previous figures that presented the questions individually, the results demonstrate a dislike of Scenario 1. However, with this visualization, it is now possible to see differences between the stakeholder groups concerning the strength of their opposition to this future.

The spike in the graph around the +4 indicates broad-based agreement exists among approximately 25 percent of all residents, regardless of their stakeholder group, for this scenario. However, we also can observe in more detail the shared drop-off in "strongly agree" responses that reflect the more mixed disagree to strongly agree range of responses.

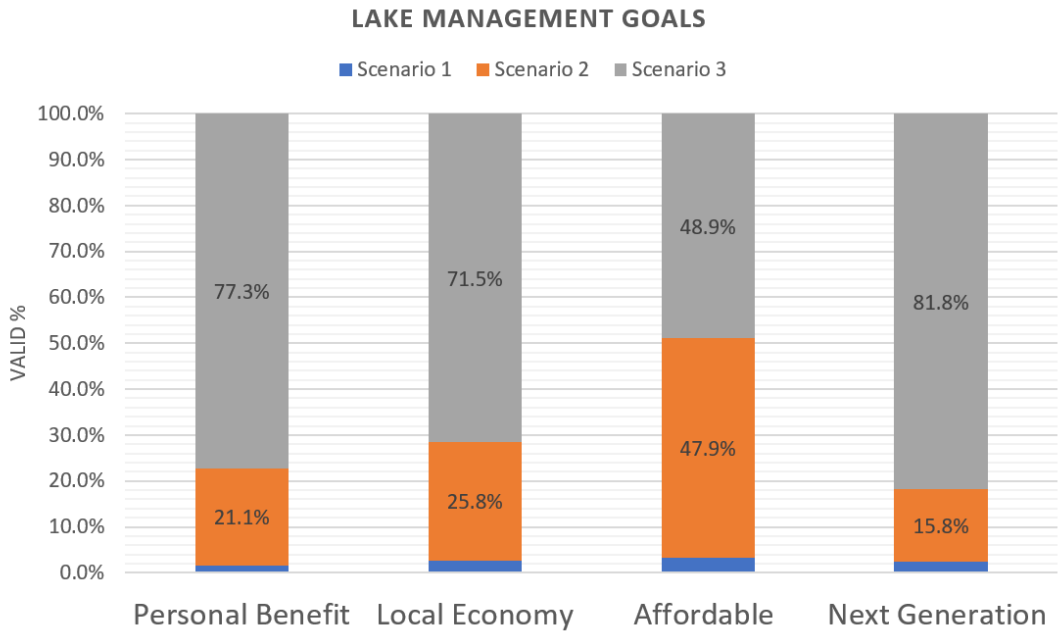




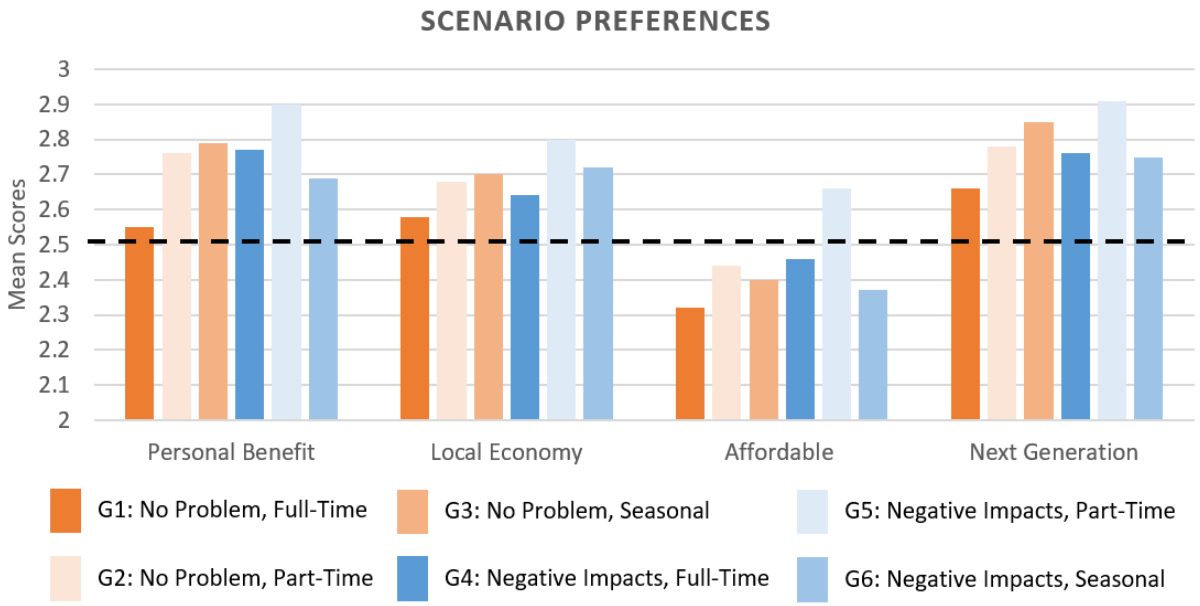
Again, very few responses indicate any negative response to Scenario 3. There is also strong agreement, but there are also noticeable differences in the strength of support between "no problem" and negative impacts" groups.

Lake Management Goals

The final set of questions asked survey respondents to pick which of the three scenarios best met their personal, economic, affordability, and future generation goals for Green Lake. The results here clearly show a desire for Scenario 3, but perhaps more telling is the drop-off in terms of support when asked about the ability of the community to afford water quality investment.



Differences between the stakeholder groups exist for which scenario they prefer; however, the difference on average is between solid support for Scenario 2 or Scenario 3. There is no indication that Scenario 1 is a broadly supported or desired future condition for Green Lake from any of the questions used to explore community support for new funding initiatives.



Water Quality Threats: Prioritizing Response

Prioritizing a response to nutrient pollution is an essential aspect of lake management, especially as stakeholders less familiar with watershed-scale drivers may be quick to criticize efforts seen as unrelated to their problems on the lake. The response format is presented on this page, showing two questions for municipal, community, and agricultural sources of phosphorus. On the next page, these two items have been combined into an average score for each source to present the analysis as a prioritization of focus rather than an endorsement of any specific strategy.

THREAT: How much of a threat to water quality in Green Lake is each potential source of nutrient pollution? *Please rate from (0) not a threat to (3) severe threat -- meaning that it should be addressed as soon as possible.*

INTEREST: What is your level of interest in supporting efforts to raise community funding to address each potential source of nutrient pollution? *Please rate from (0) no interest to (3) very interested.*

BENEFIT: How much benefit to water quality do you believe would come from funding efforts to address each potential source of nutrient pollution across the Green Lake Watershed? *Please rate from (0) no benefit -- would not improve water quality to (3) very beneficial -- would significantly improve water quality.*

Agricultural Sources	**THREAT** *to water quality*	**INTEREST** *in funding action*	**BENEFIT** *to the watershed*
ROW CROP FARMING contributes phosphorus as heavy rains cause erosion in farm fields and carry both spread sludge and fertilizers into the water.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit

Municipal Sources

WASTEWATER TREATMENT FACILITIES contribute phosphorus through regulated releases of liquid effluent to lakes and rivers.

STORMWATER SYSTEMS can also contribute phosphorus to lakes and rivers as runoff from properties, urban streets, and parking lots containing nutrients washes into the drains.

Community Sources

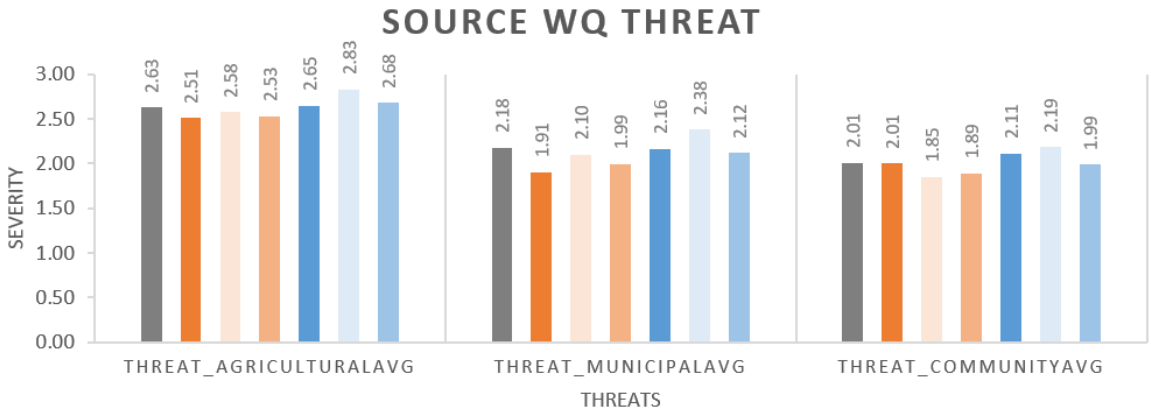
PRIVATE SHORELINE MANAGEMENT that have had natural vegetation removed are not as capable of catching and using excess nutrients before they reach the water.

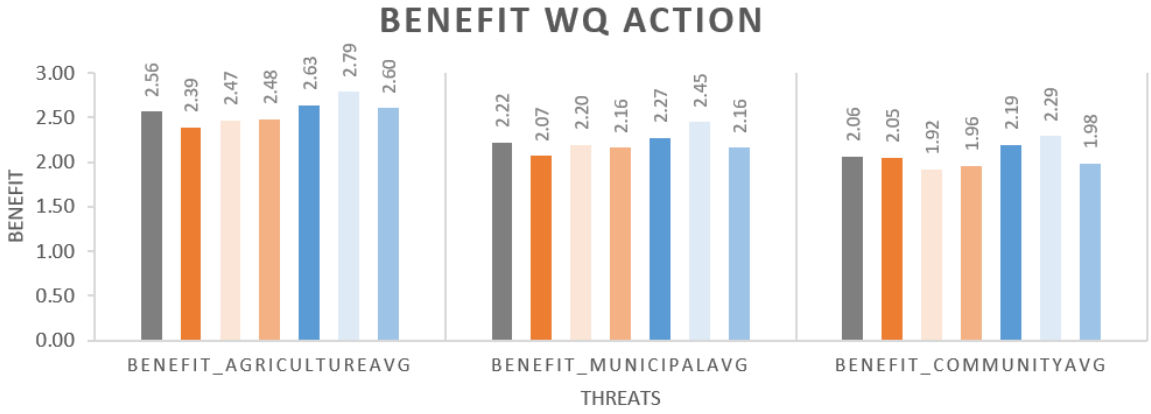
COMMUNITY PARKS often have large turf areas (golf courses, boat launches, athletic fields) where fertilizer is frequently applied and can run off into the water.

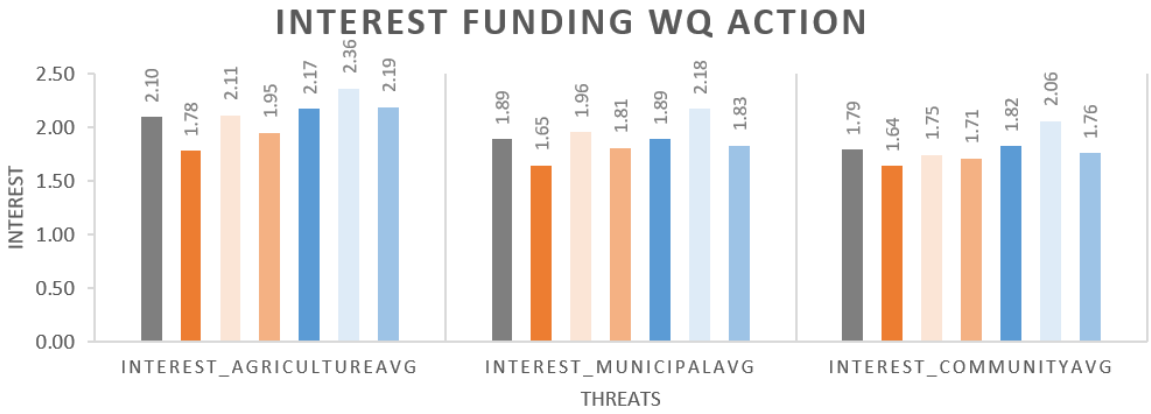
Agricultural Sources

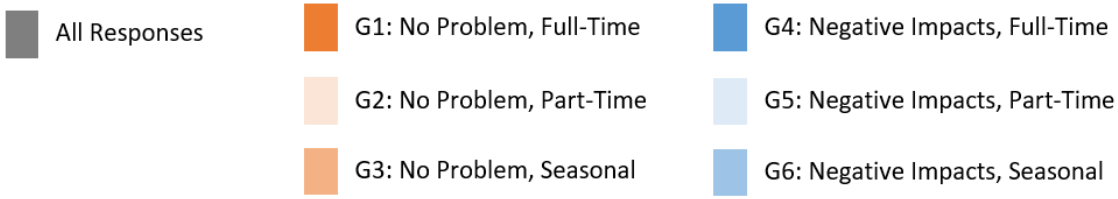
ROW CROP FARMING contributes phosphorus as heavy rains cause erosion in farm fields and carry both spread sludge and fertilizers into the water.

ANIMAL FARMING contributes phosphorus to lakes and rivers as heavy rains or snowmelt runs over fields and feedlots carrying fertilizer and manure into the water.


SOURCE WQ THREAT
SEVERITY
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2.63 2.51 2.58 2.53 2.65 2.83 2.68
2.18 1.91 2.10 1.99 2.16 2.38 2.12
2.01 2.01 1.85 1.89 2.11 2.19 1.99
THREAT_AGRICULTURALAVG
THREAT_MUNICIPALAVG
THREAT_COMMUNITYAVG
THREATS

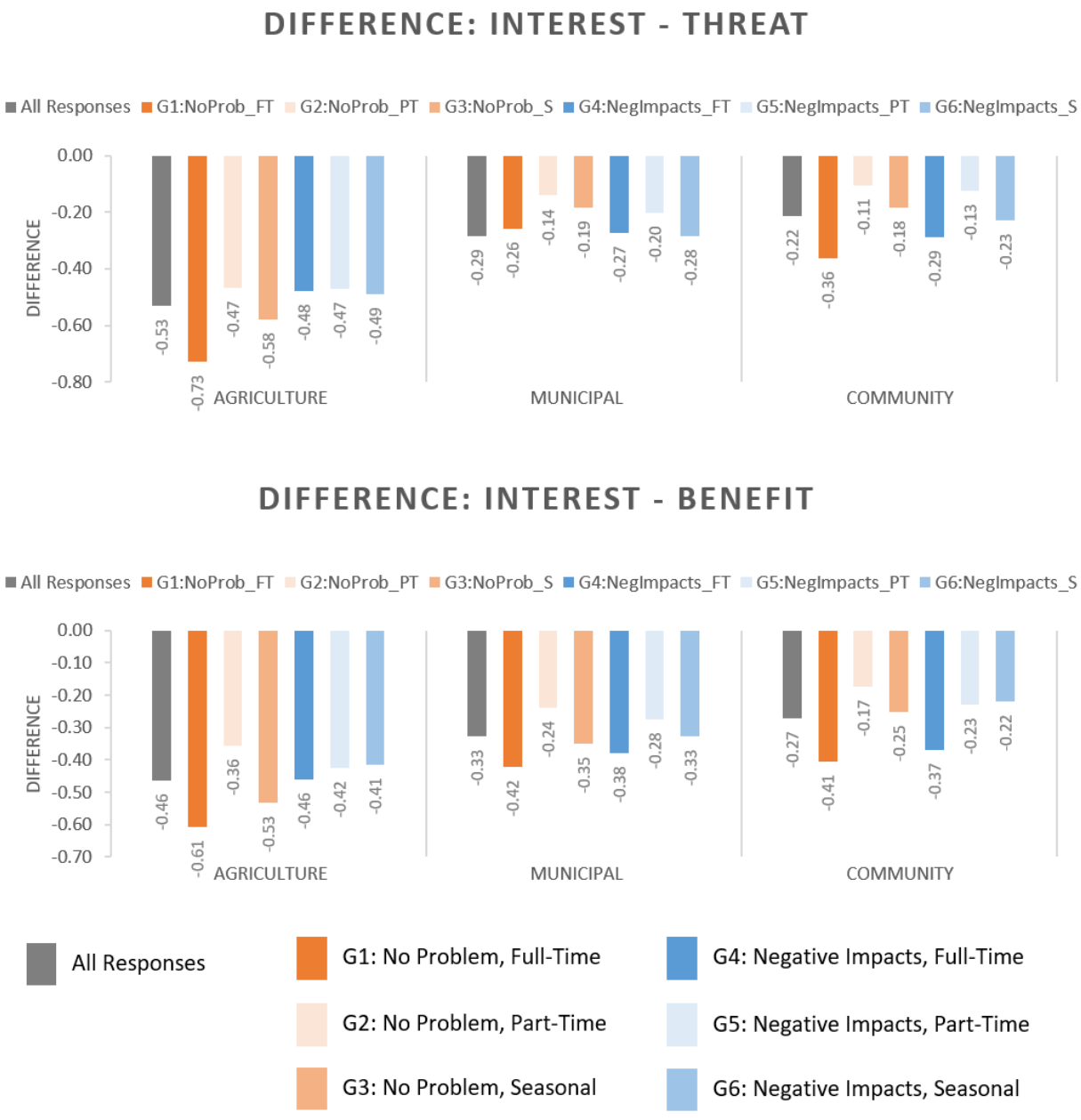

BENEFIT WQ ACTION
BENEFIT
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2.56 2.39 2.47 2.48 2.63 2.79 2.60
2.22 2.07 2.20 2.16 2.27 2.45 2.16
2.06 2.05 1.92 1.96 2.19 2.29 1.98
BENEFIT_AGRICULTUREAVG
BENEFIT_MUNICIPALAVG
BENEFIT_COMMUNITYAVG
THREATS


INTEREST FUNDING WQ ACTION
INTEREST
2.50
2.00
1.50
1.00
0.50
0.00
2.10 1.78 2.11 1.95 2.17 2.36 2.19
1.89 1.65 1.96 1.81 1.89 2.18 1.83
1.79 1.64 1.75 1.71 1.82 2.06 1.76
INTEREST_AGRICULTUREAVG
INTEREST_MUNICIPALAVG
INTEREST_COMMUNITYAVG
THREATS


All Responses
G1: No Problem, Full-Time
G2: No Problem, Part-Time
G3: No Problem, Seasonal
G4: Negative Impacts, Full-Time
G5: Negative Impacts, Part-Time
G6: Negative Impacts, Seasonal

Water Quality Threats: Challenges

An unexpected disparity in the results appeared during the analysis, which showed a distinct decline in the interest in funding action. As shown below, there is a consistently negative trend between both the threat and benefit of these management activities and the willingness to raise community funding to address the threat.



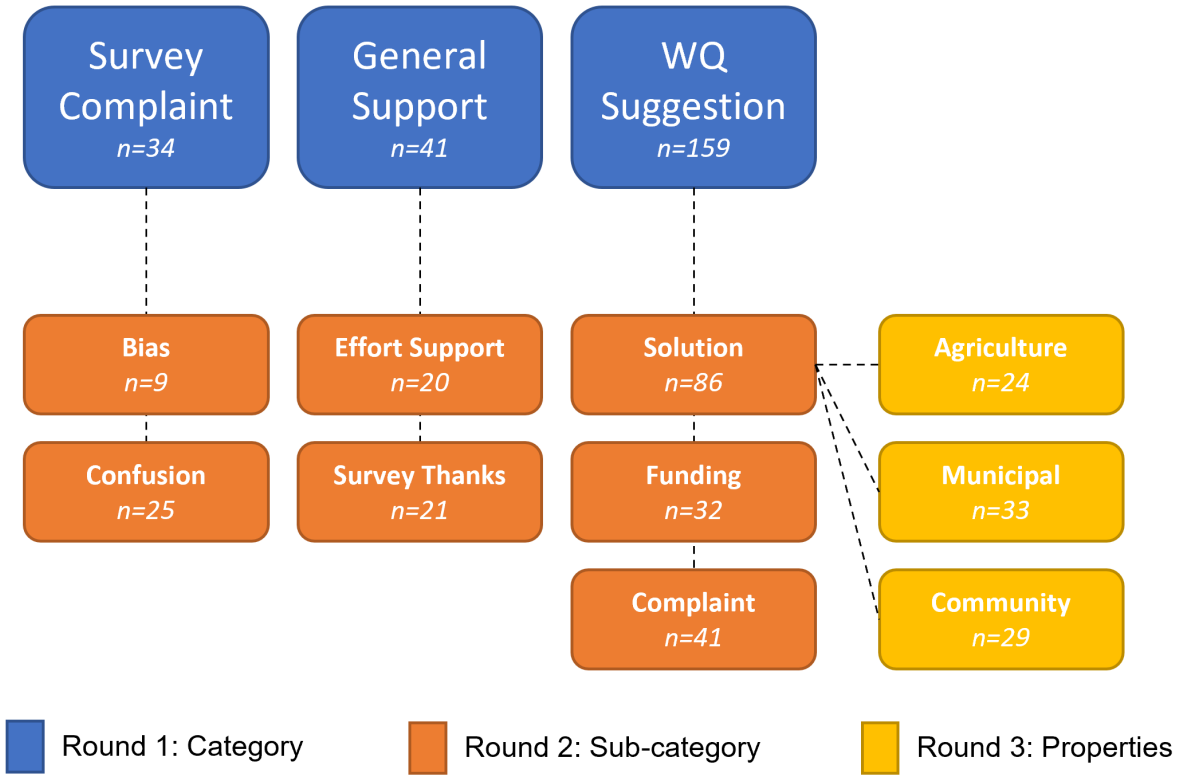
Qualitative Data Analysis

Your Views

Please record any additional thoughts and any comments about this survey in the space provided.

At the end of the survey, respondents were provided with an opportunity to share additional thoughts or ideas. More than 230 respondents took this opportunity to share either a few words or, in some cases, more extensive insight into their experience on Green Lake. To those who took the extra time, thank you for the opportunity to learn more about your experiences. The qualitative analysis presented on the following pages was not planned initially but has been completed and summarized to ensure that these statements are valued and shared.

QUALITATIVE RESULTS



An open coding procedure assisted in summarizing the open comments, which were volunteered by those that completed the survey. The process involves reviewing the comments in a structured way that first breaks down responses into categories. Subsequent rounds of statement review further refined the grouping of statements into sub-categories and properties, as discussed in the following sections.

Qualitative Data Results

Survey Complaint *n=34*

REPRESENTATIVE STATEMENTS

Bias *n=9*

"This survey is designed to garner some gov't intervention in the lives of private citizens. The questions are loaded to one scenario..... to extract the most money for a total solution which cannot be definitive." *{Supported by 4 statements}.*

Confusion *n=25*

"The source threat-level questions were hard to answer because we don't have good background on the levels that the source contributes, so the answers were based on perception instead of fact." *{Supported by 15 statements}.*

A few individuals expressed concerns about the potential for bias within the survey, precisely the results of the scenario questions. While few, it is essential to respond and assure these residents that this analysis does not rely on the response to any particular question to guide the Green Lake Association. The scenario approach used here responds to the unique context of Green Lake, presenting what is known to the best of our ability while also trying to communicate costs and benefits clearly. In the real world, work remains to translate these findings into specific proposals that answer the questions raised by survey respondents.

General Support *n=41*

REPRESENTATIVE STATEMENTS

Effort Support *n=20*

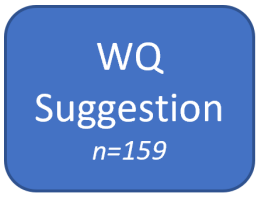
"Please restore G. L. to its best possible water quality! Not only for our family, but future generations. The ecosystem is fragile. It needs to be restored! We on one 60 ft. of frontage, do everything possible, but it is so small in comparison to the large estate and farms! Thank you for this effort!" *{Supported by 20 statements}.*

Survey Thanks *n=21*

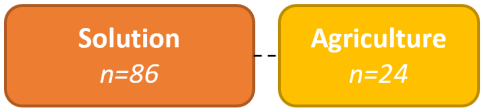
"Thanks for creating this survey. We will watch for an announcement of the results." *{Supported by 21 statements}.*

Many respondents took the opportunity to express thanks to GLA, and to a lesser degree, those responsible for organizing this survey, for their efforts to include local voices when making decisions about managing water quality challenges in Green Lake.

Qualitative Data Results



REPRESENTATIVE STATEMENTS

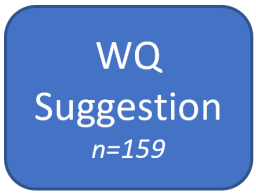


{Point} “The Green Lake Water Quality Management Plan clearly states that the excess phosphorus in the lake is from farm run off. If I {do} construction on my lake front property I am required to construct a silt barrier. However a farmer can plow right up to a creek without a silt barrier. It appears that the farm lobby in Madison is much more powerful than the Wisconsin DNR.”

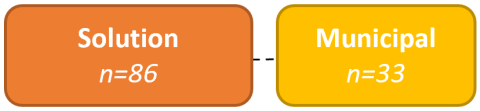
{Counter Point} “Coming from a dairy farm family, my family's farm already has - and adheres to - a strict animal waste management/manure system as outlined by the DNR …
However, in living in close association with those from waterfront properties, we have observed more chemical treatments being done to grass and/or landscaping with little to no care for the Green Lake waters.”

Very few specific suggestions were made about how to approach agriculture, as written comments instead identified the contributions of agricultural runoff to deteriorating lake conditions. However, as the counterpoint shows, the agricultural community is paying attention to the actions being taken by shoreline residents who directly benefit from the lake.

Qualitative Data Results



REPRESENTATIVE STATEMENTS



{Point 1} “Ski boat wakes cause severe shore line erosion. They should not be allowed. Or a horse power rating reduction.”

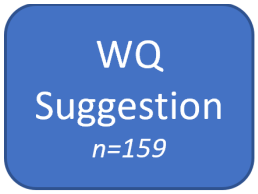
{Point 2} “I think one of the questions that should have been asked is our opinion on the threat from private wastewater systems (septic) around Green Lake. Currently, 70% of Green Lake is sewered and 30% is not sewered. Many of these septic systems are older than 30 years old, and in my opinion many of these septic systems are also leaking into Green Lake.”

{Point 3} “Shoreline construction has dramatically changed in the past 2 years. Scores of boathouses have been added. Many new homes are clearing all vegetation and exposing dirt without regard to good erosion practices.”

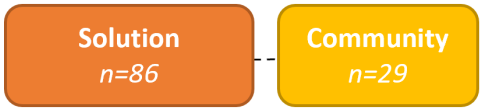
{Point 4} “Property purchases have skyrocketed over last year or more and many new remodels and/or new constructions with people with lots of money, removing vegetation, trees for clearance to shoreline, many boat houses being cut into shoreline for constructed - appears to be little code enforcement without the 9 districts on the lake - Everyone wants their piece of the pie without requeued to lake effect now or adding to future problems.”

The most robust discussion of steps needed to protect water quality was at the municipal scale. These suggestions include everything from enforcement of development restrictions, limiting the number of events being hosted on the lake, enforcing speed or motor size restrictions on the lake, and expanding sewer services to more rural parts of the shoreline.

Qualitative Data Results



REPRESENTATIVE STATEMENTS



{Point 1} ”We hope to help protect the lake personally by not using fertilizers on our lawns + keeping leaves onto storm drains etc... We have donated to the GLA but believe municipal properties, etc... should be funded by city, state + county.”

{Point 2} “Residents are not always aware of the types of products recommended for use in lawns (e.g. not to use fertilizers with phosphorus). I believe more awareness is needed and perhaps incentives for those who only live in the area for a few months in summer.”

{Point 3} “It's all about respect of private property! Educate, not force.”

These comments focused on challenges closer to home, including comments about personal lawns, neighbor’s properties, and the parks and golf courses around Green Lake. Many of the statements suggested that incentivizing or requiring improved water runoff management from residential lawns is necessary. However, as the final comment clearly states, there were also a few statements to the contrary warning of resistance to anything that was not wholly voluntary.

Qualitative Data Results

WQ Suggestion
n=159

REPRESENTATIVE STATEMENTS

Funding
n=32

{Point 1} "More time and money needs to be invested to improve water quality versus study water quality."

{Point 2} "I am extremely concerned about the deteriorating water quality of Green Lake over the past few years. If it continues to worsen, I fear that boating and/or swimming in the lake may become unsafe and that property values ultimately will be destroyed."

{Point 3} "This is a resource that we can not afford to compromise on. We must spend What is necessary is to do the scenario that will end in the greatest interest. Otherwise, money is being wasted on a partial fix."

{Point 4} "We pay a fortune in property taxes - with little benefit to our property or family. They should use those funds."

{Point 5} "I feel that all users of this lake need to pay. Launching fee(sticker)is a way to generate funds."

{Point 6} "A compromise between scenario #2 and scenario #3 seems like a good option. Also, the option for residents to pay out of pocket for weed cutting to deal with the near term weed issues would be welcome. The weed cutter and cutting of the past 3 years has been woefully inadequate!"

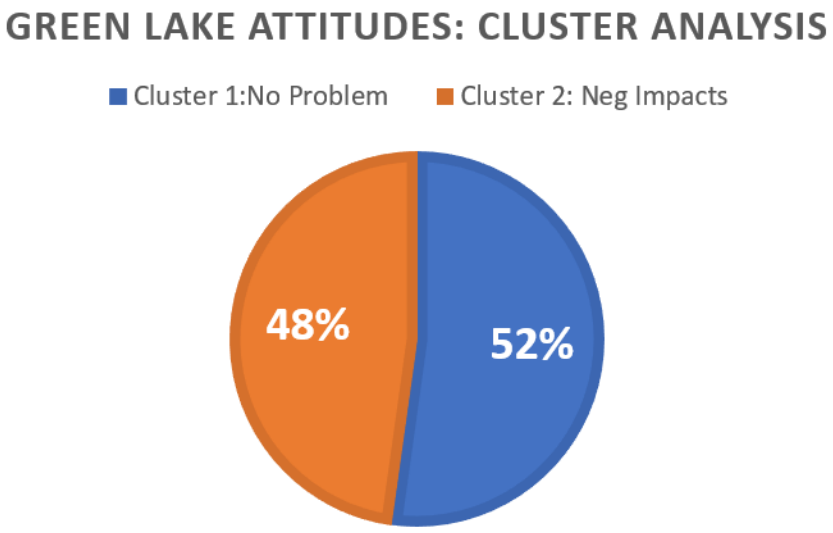
Complaint
n=41

{Point 1} "More time and money needs to be invested to improve water quality versus study water quality."

{Point 2} "I am extremely concerned about the deteriorating water quality of Green Lake over the past few years. If it continues to worsen, I fear that boating and/or swimming in the lake may become unsafe and that property values ultimately will be destroyed."

Unsurprisingly the survey open comments section solicited strong emotions related to declining water quality, the current efforts to address these challenges, and the always contentious issue of who is to pay for restoration. However, within these statements, there is a clear connection between the fear of declining water quality and the loss of both experience and property value sometime in the future (although there is no evidence to suggest that is currently occurring).

Conclusion #1: Water Quality Trends



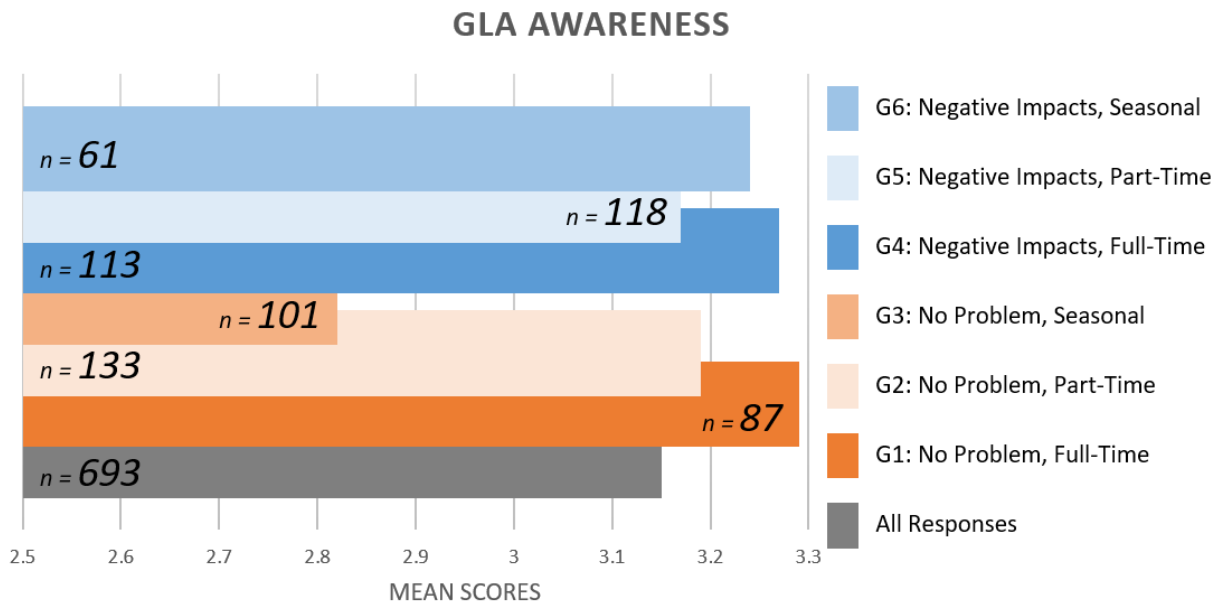
Declining Water Quality

The survey results indicate a clear trend that a majority of residents perceive that water quality is declining in Green Lake. While overall, responses to the attitude scales reveal two distinct views on this topic. For the 52 percent reporting strong support of the "no problem" scale, they share that current water quality is not a detriment for their preferred recreational activities (including boating with large motors). However, it is also important to note that 35% of those who expressed "no problems" attitudes reported that water quality has not consistently met their needs in the past three years.

The other half of residents (48 percent) report that current water quality over the past three years leads to increases in problems with swimmers itch, e-coli beach closings, and harmful algae blooms in Green Lake. Respondents shared the following statements to support this view:

- "I am extremely concerned about the deteriorating water quality of Green Lake over the past few years. If it continues to worsen, I fear that boating and/or swimming in the lake may become unsafe and that property values ultimately will be destroyed."
- "Algal blooms have been much more noticeable in last 2-3 years. Definitely support reducing phosphorus usage, even if that means eliminating it altogether. The sooner we can improve water quality the better."
- "Unfortunately this September we were uncomfortable to go in the lake to kayak and boat. We had what looked like green paint around our dock. We did not know if it was safe to go in the water. The fall season is beautiful in Green Lake, it was disappointing not to be able to participate in water activities before putting away the boat and kayaks."

Conclusion #2: GLA Awareness



Familiarity with Lake Management

The survey results reveal that the Green Lake Association (GLA) is well known for its water quality initiatives, with mean question responses indicating that the average resident has "heard of them and knows what they do." Further, between 84 and 85 percent of residents indicate that they are familiar with GLA's healthy streams, partnerships with agriculture, and community education programs. The survey also showed that, on average, GLA is the most trusted organization working in the watershed, with the average resident reporting that they are likely to very likely to work with GLA to address local water quality issues.

The attitude typology groups revealed additional challenges for GLA's outreach as evidence exists that those less familiar with GLA efforts are more likely to accept current water quality. First, the issue is most visible between seasonal residents, with distinct attitudes correlated with GLA awareness. One reason for this correlation is that seasonal residents reported the lowest connections to Green Lake (raised here, referred to as home, length of time at Green Lake) among all attitude groups. Second, GLA is helping educate residents about water quality issues in Green Lake, and this result suggests that this is working with more engagement with GLA, resulting in greater awareness of threats to lake health. However, beyond simply continuing its efforts to engage residents, the survey also suggests that work is needed to help educate about the issues in more detail, as issue confusion about factors affecting lake health was frequently shared by survey respondents. The following quotes highlight examples of the lack of information challenge:

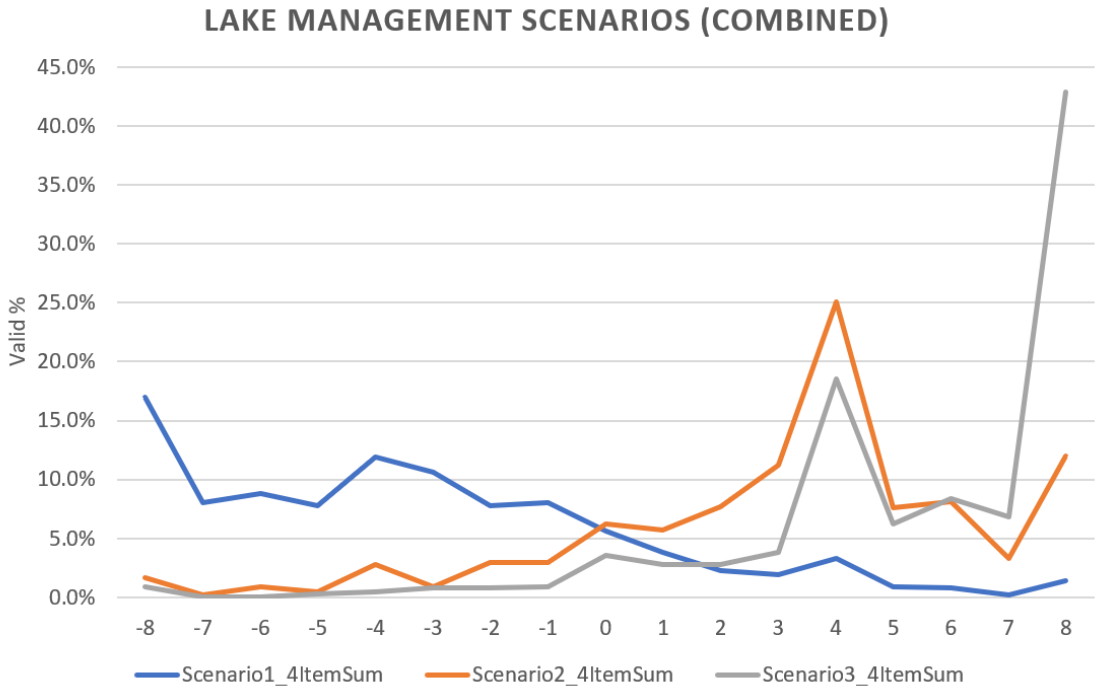
- "Did not feel I could accurately respond as I did not know the answers to so many of your questions and had to guess. I have no idea how much row crop farming, animal farming etc affects the lake."
- "Does the average treatment plant empty water into Green Lake? Why does the DNR allow building within the 75 foot set back on the shore of Green Lake?"

- "What proof do you have that scenario 2 and 3 will improve the lake....Green Lake is unique in WI do you have any similar lakes where these practices have fixed/repaired a lake...show us the proven activities that have worked to repair such a lake?"

Furthermore, the issue confusion became clear through many responses similar to the following:

- "I understand there are safe ways to chemically treat the shoreline water early in the spring that helps to retard algae and weed growth. Has this been looked at?"
- "The limestone used in streams to control erosion is emanating large amounts of phosphorous/pollutants that feed Green Lake."

Conclusion #3:



Strong Awareness Overall

Survey responses reveal a clear pattern that the strongest supporters of action and local funding of GLA's activities to improve water quality on Green Lake are residents in the "negative impacts" attitude group who are part-time residents. This group of residents (group 5) are the least supportive of maintaining the current approach outlined in Scenario 1, while they hold the most positive assessments of both Scenarios 2 and 3. The views expressed by members of this group are represented in the following quote:

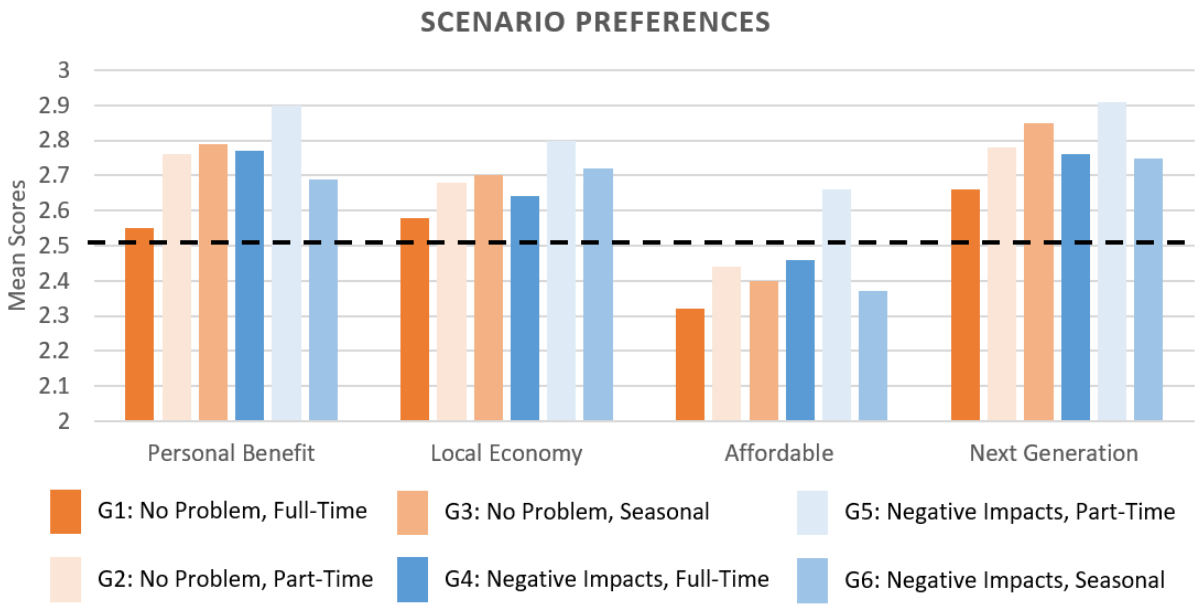
- "There is clearly a great need for improvement when it comes to water quality. It makes us nervous for the future of Green Lake. We have dogs that swim in Green Lake as well as young children in our family. It is concerning. We appreciate any and all attention being brought to this Green Lake issue and are appreciative of the efforts being made by the GLA and GL Sanitary District as well as other community members and organizations. We are

representing a younger generation on Green Lake but are still fully engaged in what needs to be done in order to save Green Lake and do our part by following guidelines about runoff from our own property. We hope other home owners and community members take this issue seriously."

However, this conclusion has positives and negatives concerning developing actionable guidance from the results. Specifically, relative to the part-time residents, there is lesser support for enhanced funding of GLA efforts among full-time residents. Many factors likely influence this result, but foremost the survey reveals that full-time residents (many of whom are retired) expressed concerns about their ability to pay for necessary action to address the water quality threats. The demographic analysis supports these concerns as full-time residents, on average, reported incomes that were significantly lower than either part-time or seasonal residents. Some of this difference in income is mitigated because these individuals are not maintaining the costs associated with second homes, but the following quotes help put these concerns in perspective.

- "I like Green Lake to fish, summer & winter. I don't make much money, but still belong to the Green Lake Association."
- "The efforts of the Green Lake Association are making a difference but much more needs to be done. Donations and community taxes will not be enough either. The DNR needs to get state level funding and grants as well to fully address the water quality."

Conclusion #4: Future Management Scenarios



Funding Challenges

Building upon the prior conclusion, it is clear that support from residents is firm for increasing future funding to respond to threats to water quality in Green Lake. However, as we acknowledged during the design of the survey section focusing on future management scenarios, these results help provide a direction but are not without their own bias. Expressly, studies have noted that willingness to pay survey questions may not align with either ability or ultimate support of

specific proposals (Floress et al., 2017). As a result, the analysis approach used here is intended to help triangulate an answer to the Green Lake Association's (GLA) question – what level of financial support are lake residents willing to accept to protect the future water quality of Green Lake?

The survey revealed strong support for Scenario 3, which outlines a robust increase in community funding to support GLA and other partner initiatives. When selecting preferred scenarios, all typology groups reported an average response between Scenarios 2 and 3 for personal, community, affordability, and next-generation considerations. Combined evaluations of questions about each scenario individually further support these results where the data support the following trends:

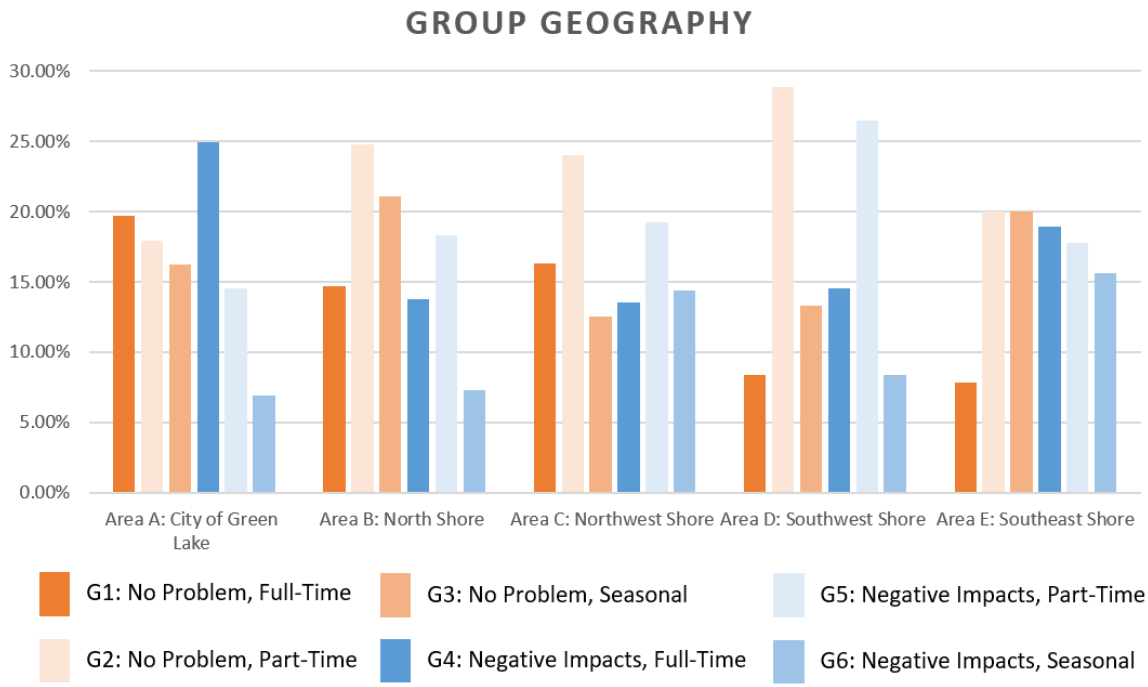
- An overwhelming majority of residents see Scenario 1 as unacceptable, with average responses to the combined evaluation questions (possible range of -8 strongly disagree to +8 strongly agree) are -3.37.
- We observe a dramatic increase in support for Scenario 2 with a mean score of 3.14 (possible range of -8 strongly disagree to +8 strongly agree). The distribution of responses shows that most respondents generally agree with the approach outlined in Scenario 2 that would focus on stabilizing nutrient pollution.
- The mean score for Scenario 3 increases to 5.49 (possible range of -8 strongly disagree to +8 strongly agree) on the combined evaluations. This result strongly indicates support for the approach outlined in this scenario to invest now in restoring the watershed.

However, it is essential to note that there is also a distinct downward shift in responses to the preferred scenario question for affordability, "Which scenario best describes a future that matches the Green Lake community's ability to raise funding for watershed protection?" The results indicate concerns about the community's ability to afford Scenario 3, which is further supported by results from the Sources and Risk assessment questions. Specifically, we observe lesser support in "funding action" than assessing the risk or benefit of action from addressing nutrient pollution sources. Many respondents provided written comments about this funding question, including the following:

- "GLA, GL Sanitary District, and GL Conservation seem to all be working to improve conditions in around GL watershed. However, actual process on water quality is much too slow. Perhaps all can get more aggressive with their actions."
- "We pay a fortune in property taxes - with little benefit to our property or family. They should use those funds."
- "I do not believe the residence of Green lake should shoulder the financial burden of cleaning up the lake. The farmers, golf courses that surround Green Lake are the major contributors of the pollution. Let them shoulder the financial burden."

Note: These are individual responses shared here to help reveal the diversity of opinions. Only 32 out of 693 survey responses addressed the topic of funding specifically in the written comments.

Conclusion #5: Geography of Action



Local Messaging

The geographic distribution of the attitude typology groups provides further evidence that outreach to lake communities requires a strategic approach designed to serve multiple audiences. This recommendation is to respond to different types of residents, and different attitude profiles, in their setting around the lake. For example, it is not surprising that full-time residents are the dominant group in the City of Green Lake. Neither should it be surprising that in parts of the lake where underlying conditions (wind patterns, nutrient inflows, or other factors) lead to clearer water conditions in the summer that there is a greater percentage of those who feel as though there is "no problem" with current lake conditions.

Further, residents relate to the conditions directly in and around their own homes. This distinction is important as the messaging around water quality rarely refers to these local specifics, instead relying on the health of the overall lake approach. The following quotes from survey respondents support this type of neighborhood-scale perspective.

- "Specifically near white creek, where Green Lake is almost totally uninhabitable for migratory birds. Local fish kills are abundant and the weeds have taken over."
- "Fix Silver Creek by getting rid of the duckweed so it stops entering the east and of Green Lake."
- "Our properties are on Beyers Cove which is not comparable to the waters of lake yet is in need of major restoration at this time for the ultimate health of the big lake, property values, recreational use and wildlife survival."

References:

Dillman, D. A. 2007. Mail and Internet surveys: The tailored design method--2007 Update with new Internet, visual, and mixed-mode guide. John Wiley and Sons.

Floress, K., García de Jalón, S., Church, S., Babin, N., Ulrich-Schad, J.D., Prokopy, L.S. (2017). Toward a theory of farmer conservation attitudes: Dual interests and willingness to take action to protect water quality. Journal of Environmental Psychology 53: Pages 73-80.

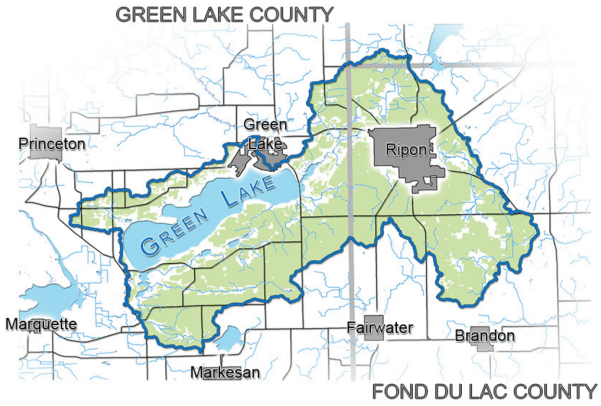
Appendix Contents:

- Survey Cover Letter
- Survey Questionnaire
- Reminder Postcard

Survey Invitation Letter

Green Lake Community Study

IRB #: IRB-2021-1041



We're asking for your help! This survey, which we expect should take about 20 minutes to complete, is a crucial step to help develop new management efforts to protect Green Lake. As part of this research project assessing lake stakeholder opinions, we're asking that you share your experience, opinions, and thoughts on the future of your lake and watershed, along with some demographic information to help us understand more about the people who respond. The survey is being conducted as a partnership between Purdue University and the Green Lake Association that is working hard to protect the health of your lake. The summarized survey results will inform scientific publications and the multi-organization team working around Green Lake's shorelines, urban and agricultural areas to improve lake water quality. To contribute to this effort by completing the survey please follow the instructions below.

There are two ways for you to participate in this survey:

Option #1: Complete the survey electronically now at **https://bit.ly/GreenLakeSurvey**

Please enter this code _____ into the survey portal where prompted to avoid duplicate surveys arriving at your address, which helps us keep costs down. The code is unique to you, but we destroy the list before analyzing the results to maintain your privacy.

Option #2: A survey booklet will arrive by mail in 7-10 days. Complete the questionnaire and return it in the provided postage-paid envelope.

Here are a few important notes about this study:

- Remember all results will be kept confidential, we're just looking for your important perspective about how to better manage Big Green Lake and the surrounding watershed.
- All responses will be treated as anonymous and records used to contact respondents containing identifying information will be destroyed before the research team reviews the data.
- Please skip any questions that make you feel uncomfortable or that you don't know how to answer.

While your participation is voluntary your input can help bring local voices into these important efforts to benefit Green Lake! If you have any questions or comments about this project you may contact the survey team using the information provided below.

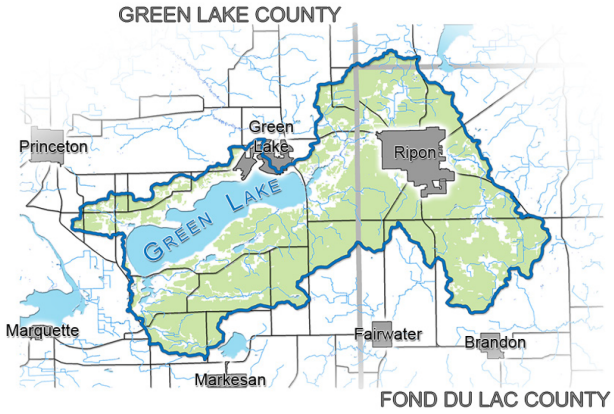
Thank you for your time and we're looking forward to hearing from you!

Aaron Thompson, Ph.D.
Assistant Professor & Director, Center for Community & Environmental Design, Purdue University
Phone: 765.494.1324 | E-mail: awthomps@purdue.edu

Survey Questionnaire

Green Lake Community Study

IRB #: IRB-2021-1041



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Thank you for your time and we're looking forward to hearing from you!

Aaron Thompson, Ph.D.
Assistant Professor & Director, Center for Community & Environmental Design, Purdue University
Phone: (765) 494-1324 | E-mail: awthomps@purdue.edu

PLEASE READ BEFORE BEGINNING THIS SURVEY:

This survey must be completed by an adult 18 years of age or older. Due to the type of research being conducted we encourage you to work together with other members of your household to complete this survey to the best of your ability. **Please mark all answers clearly, in pen or pencil, as indicated below.**

Example "A" ☐ ☐ ☒ Example "B" ☐ ☐ ☑

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Survey Questionnaire

Big Green Lake

Green Lake Association (or GLA)

Have you heard about the **Green Lake Association's (GLA)** efforts to promote the conservation of Green Lake by addressing negative water quality trends before they become a critical issue that will affect this lake over the long term? Please select the response that best describes your familiarity with GLA.

☐ Never heard of them	☐ Heard of them, but don't know what they do	☐ Heard of them and know what they do	☐ I've attended meetings or events in the past

GLA Community Initiatives: Are you aware of the following projects that are underway or have been recently completed in your community by GLA and their partners? Please read the description of each of the following programs and answer "yes" or "no".

Healthy Streams: This work focuses on the health of streams feeding Green Lake and includes the restoration of more than 4 miles of stream banks, culvert removals, and community tree planting to reduce the amount of soil erosion making it into streams that flow into the lake.	Yes ☐	No ☐
Partnering with Agriculture: This work recognizes farmers and agricultural landowners within the watershed who are taking action to reduce nutrient pollution through events like annual conservation field days and promoting demonstrations of new conservation practices.	Yes ☐	No ☐
Community Education: This work informs the community of how to take personal action to address threats to the health of Green Lake. Much of this work is through newsletters, social media, or volunteers such as those at boat landings sharing information about invasive species.	Yes ☐	No ☐

Benefits of Green Lake

The following series of questions asks about possible community benefits of Green Lake and how you (or your family and friends) use Green Lake and the surrounding shoreline. Please indicate your level of agreement with the following statements, which begin with **"I personally benefit from ..."**

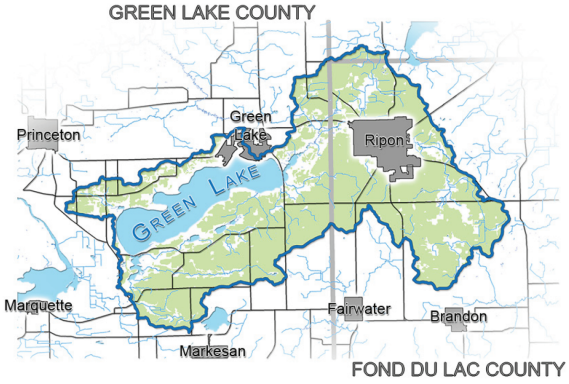
	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA	Don't Know DK
I personally benefit from … opportunities for water-based recreation, such as boating or swimming, on Green Lake.	-2	-1	0	1	2	☐
… local tax dollars generated by shoreline development on Green Lake.	-2	-1	0	1	2	☐
… access to customers for local products, such as Farmers Markets, who are attracted to the area by amenities around Green Lake.	-2	-1	0	1	2	☐
… access to fishing or hunting opportunities on Big Green Lake.	-2	-1	0	1	2	☐
… places for friends, family, or other groups to gather and enjoy leisure time together around Green Lake.	-2	-1	0	1	2	☐

Which part of the watershed is yours?

We're asking you to give us a general idea of the part of the watershed you call home, such as Green Lake versus Fond du Lac County, to help us better understand community priorities across the watershed. *Remember if any questions make you uncomfortable feel free to skip to the next question.*

Please draw a circle about this size that best describes the general area where you live or manage land in the Green Lake watershed.

Example



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Survey Questionnaire

Community Perception of Green Lake

The following statements assess opinions about the use and management of Big Green Lake. Most of these statements have been shared by lake stakeholders like yourself, so we're really just trying to see if you agree or not. For each of the following please respond by indicating how strongly you agree or disagree with the views expressed in each statement.	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA
I believe the water quality in Green Lake is better than most lakes in this part of Wisconsin.	-2	-1	0	1	2
Green Lake provides good conditions for swimming near the shore because the water clarity makes it easy to see what is underwater.	-2	-1	0	1	2
Being able to safely use a large motor on my boat is an important part of my recreation on Green Lake.	-2	-1	0	1	2
Over the past 3 or 4 years, there has been a large increase in the number of weeds and other unwanted vegetation in Green Lake.	-2	-1	0	1	2
There are bad days for water quality, but generally, Green Lake meets my needs as there are no days where I feel unsafe to swim or recreate in the water.	-2	-1	0	1	2
I'd like to eat more fish from Green Lake, but I don't feel safe due to concerns about water quality.	-2	-1	0	1	2
Over the past 3 or 4 years, shoreline issues like swimmers itch, e-coli beach closings, and harmful algae blooms have become more common in Green Lake.	-2	-1	0	1	2
The presence of large algae blooms in Green Lake during the summer months has greatly reduced my desire to spend time here.	-2	-1	0	1	2
I am negatively affected by poor water quality as I see less wildlife (birds, fish, etc.) now at Green Lake than were here in the past.	-2	-1	0	1	2
Over the past 3 or 4 years, the water quality in Green Lake seems to be getting worse.	-2	-1	0	1	2

Trust In Organizations

We would like to know your level of trust in organizations that are working to address water quality issues in the Green Lake Watershed. For each of the following how likely are you to work with the organization to address water quality issues in Green Lake?	Very Unlikely VUL	Unlikely UL	Neutral N	Likely L	Very Likely VL	Don't Know DK
Wisconsin Department of Natural Resources (WDNR): A state agency that provides landowners with financial and technical assistance to support the installation and upkeep of conservation practices.	-2	-1	0	1	2	☐
County Land Conservation Department: A local agency that provides landowners with financial and technical assistance to support the installation and upkeep of conservation practices.	-2	-1	0	1	2	☐
Green Lake Sanitary District: A local district created to protect Green Lake by providing leadership on sanitation and related air, land, and water quality matters.	-2	-1	0	1	2	☐
Green Lake Association: A group of local citizens who are interested in addressing water quality challenges.	-2	-1	0	1	2	☐
University of Wisconsin Extension: Local university professionals that provides landowners with educational programs and publications.	-2	-1	0	1	2	☐

Community Survey

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Survey Questionnaire

Big Green Lake

Future of Green Lake

Lake and watershed experts working in partnership with the Green Lake Association have learned a lot about the lake itself and the watershed that drains into it, so here is a quick summary:

What are conditions today?

Nutrient Runoff  *Current Conditions*	Multiple sources of nutrients, from both natural runoff and as the results of human activity on the landscape, are allowing excess nutrients to reach Green Lake. This results in 19,800 pounds of phosphorus entering the lake each year.	• Green Lake is only 10% spring-fed from groundwater, meaning that the rest of the water comes from direct rainfall or runoff from the surrounding watershed.
Water Quality  *Current Conditions*	These excess nutrients build up in the water in Green Lake, resulting in a concentration of phosphorus that has led the lake to be considered impaired (or averaging about 19 micrograms per liter in the lake).	• Once water makes its way from the landscape into Green Lake it is likely to stay for around 21 years.
Algae Potential  *Current Conditions*	Phosphorus support robust plant (and weed) growth. The result is that it is possible for Green Lake to produce nearly10,000,000 pounds of weeds and algae growth with these additional nutrients each year.	• 1 pound of phosphorus, a nutrient that supports plant growth (commonly found in fertilizers), can generate 500 pounds of weeds and algae in the lake.

Studies have helped provide a better understanding of what the future may hold for Green Lake, but there are factors that can change future outcomes. To begin please answer the following question about current conditions.

Over the past 3 years have the current conditions of Green Lake consistently met or exceeded your needs for water quality?

Yes ☐	No ☐

Please review each of the following possible future scenarios intended to help you understand this complex system and then respond to the questions that follow.

Scenario #1: No new community investment in lake management efforts. Efforts are currently underway to manage nutrient runoff in the Green Lake watershed, but they are not enough to address the size of the problem.

Nutrient Runoff 	• In this scenario the amount of phosphorus running off into Green Lake increase by 25 percent, causing overall lake heath to decline.	**Management Effort** 	• Less money can be put toward reducing nutrient pollution and more money will be spent on weed removal.
Water Quality 	• Within 20 years poor water quality conditions will drive a moderate decrease in property values and tourism revenue.	**Investment** 	• The benefit is that no new revenue will be needed for watershed management to maintain this trend.
Recreation Quality 	•Further declines in water quality means more algae in Green Lake, and fewer fish species of interest to anglers.	**Timeline** 	• Only short-term needs, like weed harvesting, will be funded with no direct impact on the causes of the water quality problem.

Survey Questionnaire

Community Survey

Please respond to the following questions about **Scenario #1**. For each of the following please respond by indicating how strongly you agree or disagree with the views expressed in each statement.

	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA
Recreation Impact: The future described in Scenario 1 would allow Green Lake to completely meet my needs for water-based recreation.	-2	-1	0	1	2
Community Impact: The future described in Scenario 1 makes me want to continue to be a member of the Green Lake community.	-2	-1	0	1	2
Environmental Impact: The future described in Scenario 1 does enough to take care of the birds, fish, and other wildlife that are part of the Green Lake ecosystem.	-2	-1	0	1	2
Economic Impact: The future described in Scenario 1 will allow the community around Green Lake to continue to attract seasonal tourists and new residents.	-2	-1	0	1	2

Scenario #2: Stabilize nutrient pollution. With funding it is possible to work with landowners and the community to reduce the amount of phosphorus runoff that reaches Green Lake.

Nutrient Runoff

• This scenario involves limiting runoff from agriculture and urban sources entering Green Lake and reducing phosphorus pollution by 40 percent.

Management Effort

• Significantly reducing phosphorus runoff from reaching the lake would require new investment on both public and private lands.

Water Quality

• This reduction may improve water quality enough for Green Lake to no longer be considered impaired.

Investment

• To reach this goal requires a minimum of a 20-year commitment of $250,000 each year in new revenue generated from the community to support these efforts.

Recreation Quality

•These changes will help support a healthy fishery, but there may still be continued algal blooms due to phosphorus already in the lake.

Timeline

• This scenario begins to address the causes of poor water quality by promoting investment in long-term solutions.

Please respond to the following questions about **Scenario #2**. For each of the following please respond by indicating how strongly you agree or disagree with the views expressed in each statement.

	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA
Recreation Impact: The future described in Scenario 2 would allow Green Lake to completely meet my needs for water-based recreation.	-2	-1	0	1	2
Community Impact: The future described in Scenario 2 makes me want to continue to be a member of the Green Lake community.	-2	-1	0	1	2
Environmental Impact: The future described in Scenario 2 does enough to take care of the birds, fish, and other wildlife that are part of the Green Lake ecosystem.	-2	-1	0	1	2
Economic Impact: The future described in Scenario 2 will allow the community around Green Lake to continue to attract seasonal tourists and new residents.	-2	-1	0	1	2

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Survey Questionnaire

Big Green Lake

Future of Green Lake

Scenario #3: Restore Green Lake. To achieve ideal recreation conditions, the phosphorus concentration in the lake needs to dramatically drop (closer to 12 micrograms per liter).

Nutrient Runoff

• In this scenario the community invests in restoring conditions that have supported excellent water quality in the past.

Management Effort

• Will require limiting phosphorus pollution, stream restoration projects, whole-lake treatments, and changing land management practices.

Water Quality

• Clean water with only minor issues seasonal issues with algal blooms.

Investment

• Achieving this goal will require a minimum of a 20-year commitment of $1,000,000 each year in new revenue generated from the community to support these efforts.

Recreation Quality

• Clean water for recreation and a strong fishery are likely to cause a moderate increase in property values and tourism revenue.

Timeline

• This scenario address the causes of poor water quality with long-term solutions.

Please respond to the following questions about **Scenario #3**. For each of the following please respond by indicating how strongly you agree or disagree with the views expressed in each statement.	Strongly Disagree SD	Disagree D	Neutral N	Agree A	Strongly Agree SA
Recreation Impact: The future described in Scenario 3 would allow Green Lake to completely meet my needs for water-based recreation.	-2	-1	0	1	2
Community Impact: The future described in Scenario 3 makes me want to continue to be a member of the Green Lake community.	-2	-1	0	1	2
Environmental Impact: The future described in Scenario 3 does enough to take care of the birds, fish, and other wildlife that are part of the Green Lake ecosystem.	-2	-1	0	1	2
Economic Impact: The future described in Scenario 3 will allow the community around Green Lake to continue to attract seasonal tourists and new residents.	-2	-1	0	1	2

Preferred Future Scenario

Please answer each of the following by selecting Scenario #1, Scenario #2, or Scenario #3 that you believe best answers each question.	Scenario #1	Scenario #2	Scenario #3
Personal: Which scenario best describes a future that benefits you, or your family, the most?	1	2	3
Local Economy: Which scenario best describes a future that benefits local businesses and provides opportunities for individuals in Green Lake to earn a living?	1	2	3
Affordable: Which scenario best describes a future that matches the Green Lake community's ability to raise funding for watershed protection?	1	2	3
Next Generation: Which scenario best describes a future that serves both current residents and the next generation in Green Lake?	1	2	3

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Survey Questionnaire

Sources & Risk

Read the potential phosphorus source descriptions provided below to learn more about where phosphorus may come from that is entering Green Lake. **For each potential source, please respond to these 3 questions:**

THREAT: How much of a threat to water quality in Green Lake is each potential source of nutrient pollution? *Please rate from (0) not a threat to (3) severe threat -- meaning that it should be addressed as soon as possible.*

INTEREST: What is your level of interest in supporting efforts to raise community funding to address each potential source of nutrient pollution? *Please rate from (0) no interest to (3) very interested.*

BENEFIT: How much benefit to water quality do you believe would come from funding efforts to address each potential source of nutrient pollution across the Green Lake Watershed? *Please rate from (0) no benefit -- would not improve water quality to (3) very beneficial -- would significantly improve water quality.*

Municipal Sources	**THREAT** *to water quality*	**INTEREST** *in funding action*	**BENEFIT** *to the watershed*
WASTEWATER TREATMENT FACILITIES contribute phosphorus through regulated releases of liquid effluent to lakes and rivers.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit
STORMWATER SYSTEMS can also contribute phosphorus to lakes and rivers as runoff from properties, urban streets, and parking lots containing nutrients washes into the drains.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit

Community Sources	**THREAT** *to water quality*	**INTEREST** *in funding action*	**BENEFIT** *to the watershed*
PRIVATE SHORELINE MANAGEMENT that have had natural vegetation removed are not as capable of catching and using excess nutrients before they reach the water.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit
COMMUNITY PARKS often have large turf areas (golf courses, boat launches, athletic fields) where fertilizer is frequently applied and can run off into the water.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit

Agricultural Sources	**THREAT** *to water quality*	**INTEREST** *in funding action*	**BENEFIT** *to the watershed*
ROW CROP FARMING contributes phosphorus as heavy rains cause erosion in farm fields and carry both spread sludge and fertilizers into the water.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit
ANIMAL FARMING contributes phosphorus to lakes and rivers as heavy rains or snowmelt runs over fields and feedlots carrying fertilizer and manure into the water.	[3] Severe Threat [2] Medium Threat [1] Little Threat [0] Not a Threat	[3] Very Interested [2] Some Interest [1] Little Interest [0] No Interest	[3] Very Beneficial [2] Some Benefit [1] Little Benefit [0] No Benefit

Community Survey

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Survey Questionnaire

Big Green Lake

Demographic Information

Please answer the following questions about yourself, the **information will be used for classification purposes only**.

What is your gender? ☐ Male ☐ Female

In what year were you born? ☐

What is your highest level of formal education?
- ☐ Some high school
- ☐ High school graduate or GED
- ☐ Some college
- ☐ 2 year degree
- ☐ 4 year degree
- ☐ Graduate degree
- ☐ Other (specify) ☐

As a youth were you raised in Green Lake or a nearby community? ☐ Yes ☐ No

Do you describe Green Lake or a nearby community as your home? ☐ Yes ☐ No

How many years have you lived in Green Lake or a nearby community? (include both seasonal and full time) ☐

Has your family been coming to or living in Green Lake for more than 40 years? ☐ Yes ☐ No

Which best describes your residence in Green Lake or a nearby community?
- ☐ **Full time:** Primary home & residence
- ☐ **Part time:** Typically split time between residences
- ☐ **Seasonal:** Vacation property
- ☐ **Land only:** No residence

In 2020 what types of property did you own in the Big Green Lake watershed? (If you own multiple properties please check all that apply).
- ☐ **Single residential property** – Typically between ¼ and 3 acres
- ☐ **Residential property with acreage** – Typically between 3 and 10 acres
- ☐ **Small commercial property** – Typically between ¼ and 3 acres
- ☐ **Large commercial property** -- Typically between 3 and 10 acres
- ☐ **Small recreational property** – Typically between 10 and 40 acres
- ☐ **Large recreational property** – Typically between 40 and 100 acres
- ☐ **Small agricultural or rural property** – Typically between 40 and 100 acres
- ☐ **Large agricultural property** – Typically between 100 and 500 acres
- ☐ **Very large agricultural property** – Typically greater than 500 acres

Does your property contain shoreline on Big Green Lake? ☐ Yes ☐ No

What is your approximate annual household income($)?
- ☐ Less than $25,000
- ☐ $25,000 to $50,000
- ☐ $50,001 to $100,000
- ☐ $100,001 to $150,000
- ☐ $150,001 to $250,000
- ☐ $250,000 to $1,000,000
- ☐ Greater than $1,000,000

Your Views

Please record any additional thoughts and any comments about this survey in the space provided.

Thank you!

For completing this survey, please return it to us in the included pre-paid envelope.

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Reminder Postcard

Green Lake Community Study *IRB #: IRB-2021-1041*

Dear Green Lake Watershed Stakeholder,
We haven't heard back from you on the Green Lake Community survey seeking your opinions about future lake management decisions. If you've already taken the time to complete the survey thank you for your assistance, if not please take this opportunity to complete the survey by visiting:

https://bit.ly/GreenLakeSurvey

and when prompted entering your invitation code:

CODE #

For questions or if you would prefer a paper copy please contact:
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