My Muskegon Lake

Survey Report 2021

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Executive Summary

From January 2020 - December 2021, the Grand Valley State University (GVSU) Social Science Lab and the Robert B. Annis Water Resources Institute (AWRI) partnered with the West Michigan Shoreline Regional Development Commission (WMSRDC) and the Muskegon Lake Watershed Partnership (MLWP) to conduct a study of Muskegon residents' recreational activities at Muskegon Lake, their perspectives on the lake restoration, and their satisfaction with features available at public access sites along the lakeshore. The goal of the study was to inform planning and education efforts by identifying gaps in public knowledge about the lake and barriers to engaging in recreational or stewardship activities.

The research team conducted a survey of a representative sample of residents in the City of Muskegon. The survey was distributed by mail to 1,860 households from April - June 2021. In total, 294 completed questionnaires were returned to GVSU. Responses were received from households in all fifteen Muskegon neighborhoods, with the greatest number from Lakeside, Nelson, Nims, Beachwood-Bluffton, and Marquette neighborhoods. Although white respondents and respondents with bachelor's degrees are slightly overrepresented among survey respondents, a substantial portion of respondents identified as Black or African American (17%). Many long-time Muskegon residents responded to the survey, with the average length of residence being 42 years.

The survey results indicate that Muskegon residents are excited about many of the emerging opportunities brought about by the lake restoration, with the majority of survey respondents evaluating changes to the lake as positive. However, opinions about the lake restoration and engagement with the revitalized lake vary unevenly across the city, with residents from underserved neighborhoods expressing less optimistic views and visiting Muskegon Lake less frequently than residents from predominantly white, economically secure neighborhoods.

Residents who do visit the lake are particularly enthusiastic about the Lakeshore Trail. Many would like to see expanded opportunities for fishing from the shoreline and family-friendly parks. Survey respondents pointed out that more restroom facilities will be needed, and that keeping lakeshore amenities affordable will promote greater equity in enjoyment of Muskegon Lake.

Respondents also expressed some uncertainty about the current status of Muskegon Lake's environmental quality, suggesting continued opportunities for creative investments in public education and outreach as remediation work concludes.

This report begins with a review of background information relevant to the study and a description of research methods. Subsequent sections review the characteristics of survey participants and their responses to each of the major content areas covered in the questionnaire: life in Muskegon, residents' relationship with Muskegon Lake, and knowledge and impressions of the lake restoration process. The report closes by highlighting key observations and providing recommendations for action.

Background and Methods

Muskegon Lake was once a heavy industrial site with severe pollution, causing it to be designated as a Great Lakes Area of Concern (AOC) in 1987 through the Great Lakes Water Quality Agreement. Nine beneficial use impairments (BUIs) were defined, with contaminated sediment, hardening of the shoreline, and high levels of water pollution being primary problems. Through the collaboration of community groups, including the Muskegon Lake Watershed Partnership (MLWP), universities, and governmental and nongovernmental organizations, all of the Muskegon Lake BUIs have been removed or are in process of removal. The MLWP's focus is now shifting towards remediating the community's relationship with the restored lake by ensuring that Muskegon residents are informed about water quality and have opportunities to connect to the lake.

Past studies of socioeconomic impacts of the Muskegon Lake AOC restoration have surveyed recreationists about their uses of the lake (Isely et al. 2018). In contrast, the present survey aimed to collect data from a representative sample of all Muskegon residents - even those who rarely engage in lake-based activities - in order to develop strategies to promote greater engagement with Muskegon Lake and participation in stewardship activities.

The research team held meetings with a broad range of Muskegon stakeholders, including: MLWP members, representatives from the City of Muskegon, members of neighborhood associations, the staff of Community enCompass, the Muskegon County Health Dept., and researchers from AWRI. Based on topics of concern to these stakeholders, three key research questions regarding Muskegon residents' relationship with Muskegon Lake were identified.

RQ1: How can equity in access to the benefits of the lake restoration be promoted?
RQ2: What do residents know about Muskegon Lake and the remediation that has occurred?
RQ3: What will get residents connected to the lake and willing to protect its future?

To investigate these questions, the research team conducted a survey of a random sample of 1,860 households in the City of Muskegon. The questionnaire was designed to be completed digitally or on paper. It began with questions about residents' experiences in their neighborhoods and at Muskegon Lake. Respondents were then asked about their perceptions of the AOC restoration and their willingness to get involved in a variety of stewardship activities. The questionnaire concluded with a few items about the respondents themselves, so that the demographic profile of survey respondents could be compared to U.S. Census Bureau estimates for the City of Muskegon.

The number of surveys sent and the addresses to which they were sent were defined using a spatially random sampling strategy. Each City of Muskegon neighborhood was divided into Census block groups and linked to the U.S. Census Bureau American Community Survey (ACS) 2020 population estimates. This resulted in a total of 37 spatial sampling units composed of Muskegon neighborhood and Census block group boundaries (Figure 1). The number of households selected from each block group was determined based on each unit's percentage of the total population in the City of Muskegon, with a target of 1,400 total households included in the initial sample. Following recommendations for oversampling minoritized subpopulations (Kalton 2009), block groups estimated to have greater than 50% minoritized residents were sampled at a rate of 1.25 times the unit's percentage of the total city population, while block groups with fewer than 50% minoritized residents were sampled at a rate of 1 times the unit's proportion of the city population.

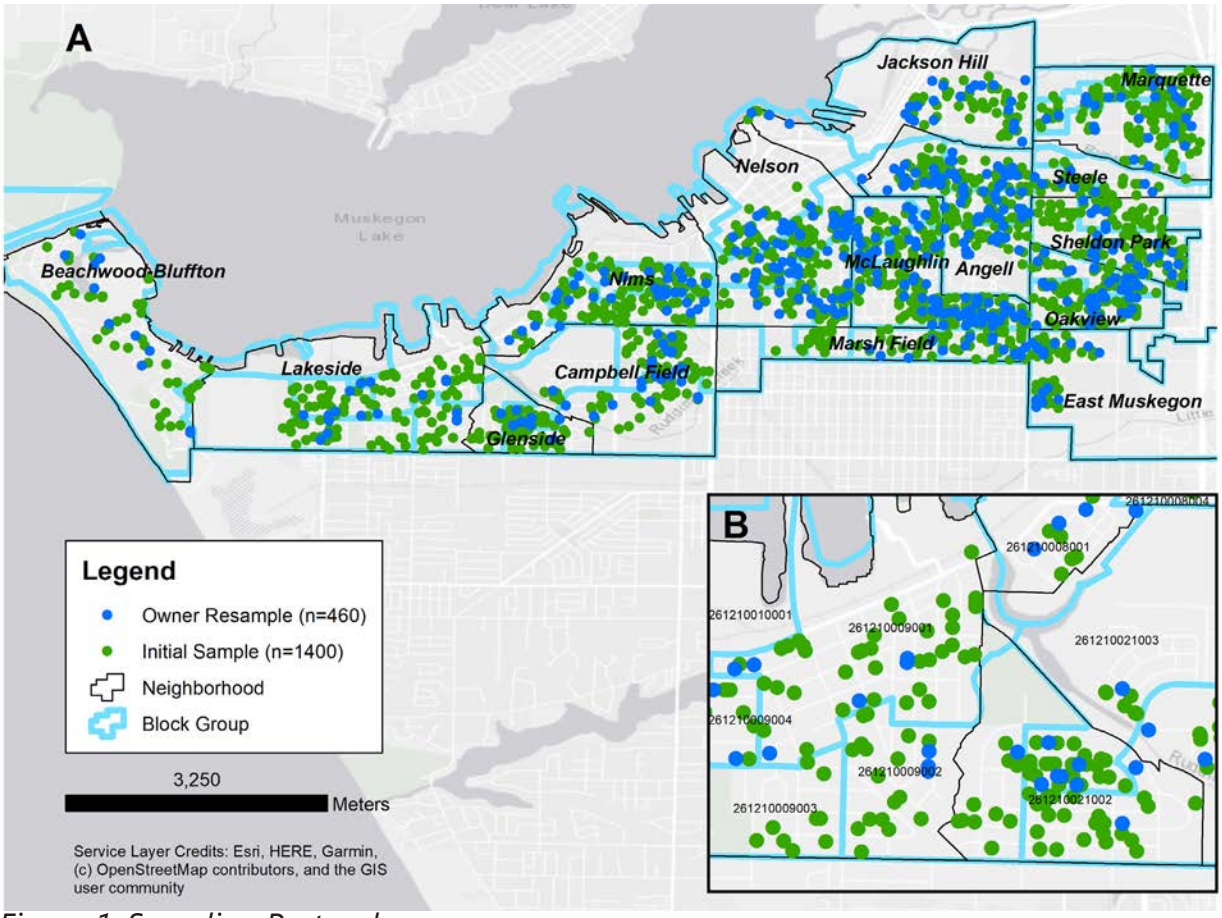

Figure 1. Sampling Protocol

The initial sample included both owner-occupied housing units (n=940) and presumed renter parcels (n=460). However, upon receiving responses from fewer than 3% of non-owner-occupied units after three contact attempts, a replacement sample of 460 parcels was generated. The block group and neighborhood locations of the replacement sample perfectly matched the locations of the renters, to preserve the spatial distribution of the sampled households. In total, 1,860 households in the City of Muskegon received requests to complete the survey.

The questionnaire was distributed by mail following a modified tailored design method that included five waves of mailing (Dillman et al. 2014). A promotional video and graphics advertising the study were posted on the social media sites of several community organizations prior to the first mailing. The first mailing was a notification letter containing a QR code link to a digital version of the questionnaire. The second mailing contained a paper copy of the questionnaire and a QR code link. The third mailing was a thank you/reminder postcard with a QR code link to the survey. The fourth contact was a replacement paper questionnaire. A final notice letter was sent at the end of the study. Each participant was assigned an identification number to track responses so that individuals could be removed from the mailing list as they responded. The response rate was approximately 16%, with 294 individuals participating in the survey and 30 individuals declining to participate. While less than desirable, low response rates are unfortunately common in survey research due to the frequent use of this method for soliciting public input and associated respondent fatigue (Stedman et al. 2019).

Survey Respondents

A summary describing the demographic characteristics of the 294 survey respondents compared to ACS estimates (2015-2019) for the City of Muskegon appears in Table 1. The survey respondents were reasonably well distributed by sex and age. Female respondents were slightly overrepresented in the survey data, making up 58% of respondents compared to 42% of male respondents. The average age of respondents was 58 and the average number of years they had lived in Muskegon was 42, making older, long-term residents slightly overrepresented in the data.

Table 1. Characteristics of Participants (n=294)

	Respondents	ACS Estimates
Sex		
Male	42%	52%
Female	58%	48%
Age		
18-34 Years	8%	27%
35-54 Years	28%	25%
55-74 Years	52%	22%
75 Years and Over	12%	5%
Years Lived in Muskegon		
Less than 10 Years	13%	---
10-19 Years	9%	---
20-29 Years	8%	---
30-39 Years	13%	---
40-49 Years	14%	---
50-59 Years	14%	---
60-69 Years	18%	---
70 Years or More	11%	---
Race/Ethnicity		
White	75%	59%
Black or African American	17%	32%
Hispanic or Latino(a)	3%	10%
Multiracial	2%	7%
American Indian	2%	1%
Asian American or Pacific Islander	0%	<1%
Education Attainment		
Less than High School	1%	15%
High School Graduate	21%	36%
Some College	44%	36%
Bachelor's Degree	21%	9%
Graduate Degree	13%	4%
Home Ownership		
Owner	96%	49%
Renter	4%	51%

While 24% of survey respondents reported Black or African American, Hispanic or Latino(a), multiracial, or American Indian identities, white residents (75%) were overrepresented among survey respondents relative to their presence in the City of Muskegon, which the ACS estimates to be about 59% of the population. Survey respondents also had higher levels of education attainment than the average Muskegon resident. One-third of survey respondents had a bachelor's or advanced degree, compared to an estimated 13% of residents across the city. Very few respondents were renters (4%). While the sampling frame did include non-owner-occupied households, it is unknown whether the units were currently occupied at the time of contact.

All fifteen neighborhoods are represented in the survey data, although the number of survey responses returned varied considerably across Muskegon neighborhoods (Figure 2). The largest number of responses came from the Lakeside, Nelson, and Nims neighborhoods.

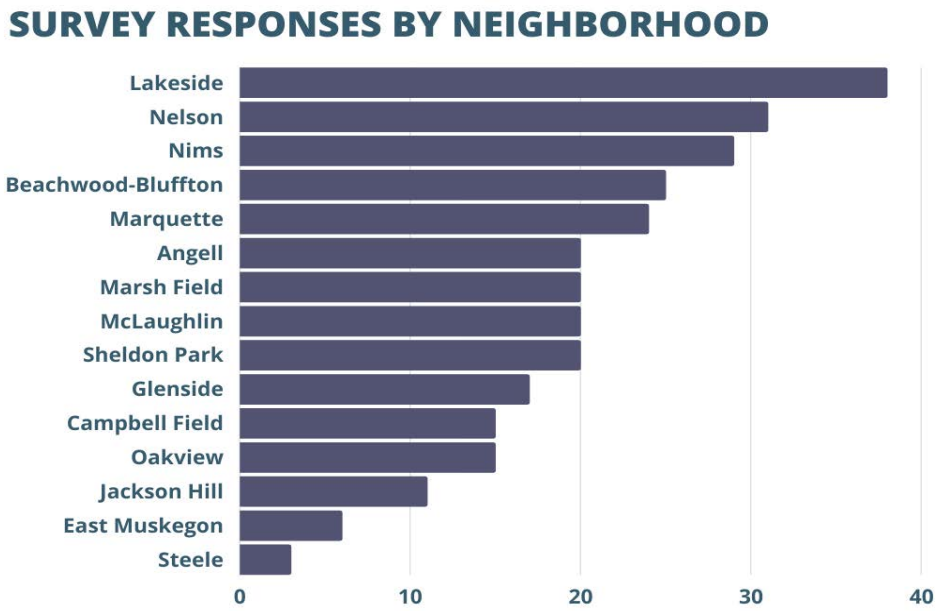

Figure 2. Number of Responses per Neighborhood

With fewer than 20 responses from Glenside, Campbell Field, Oakview, Jackson Hill, East Muskegon, and Steele, the respondents' neighborhoods could not be used as a geographic unit for statistical analysis. In order to retain a measure of place in our analysis, the respondents' neighborhoods needed to be aggregated to a larger unit that combined neighborhoods in a systematic way based on similar population characteristics.

The Opportunity Atlas, created by scholars at Harvard and Brown Universities in collaboration with the U.S. Census Bureau, offered a potential model. The Atlas is an interactive mapping tool that allows users to estimate the probability that a child born into any U.S. neighborhood experiences a particular life outcome, such as graduating college or becoming incarcerated. The tool is intended to connect social inequality to a geographic place, and is particularly useful for tracing how the American legacy of racism in urban housing policy continues to impact the life chances residents experience today. While opportunity is by no means a final sentence on life, it does suggest that financial and social security may be systematically more difficult for some individuals to achieve.

When considering which demographic indicators of well-being to use for grouping neighborhoods, factors associated with environmental justice stood out as particularly relevant to the first research question. Environmental justice advocates argue that residents from low-income, minoritized neighborhoods are disproportionately exposed to environmental burdens, and disproportionately excluded from environmental benefits. This reality has been thoroughly documented since the 1980s (Bullard 1994; Mohai et al. 2009).

With these frameworks in mind, data on the percentage of minoritized residents and the percentage of low-income residents in City of Muskegon Census block groups from the U.S. EPA EJSCREEN were used to create an opportunity indicator for each of the 15 Muskegon neighborhoods. High opportunity zones refer to neighborhoods where fewer than 50% of residents are racial/ethnic minorities and fewer than 50% of residents are low-income, which the EPA classifies as earning incomes "less than or equal to twice the federal poverty level." These are predominantly white, upper-income zones in Muskegon. Low opportunity zones refer to neighborhoods where more than 50% of residents are racial/ethnic minorities and more than 50% of residents are low-income. These are concentrated zones of poverty in Muskegon. Neighborhoods that contain a mix of incomes and racial/ethnic groups are classified as medium on the opportunity index.

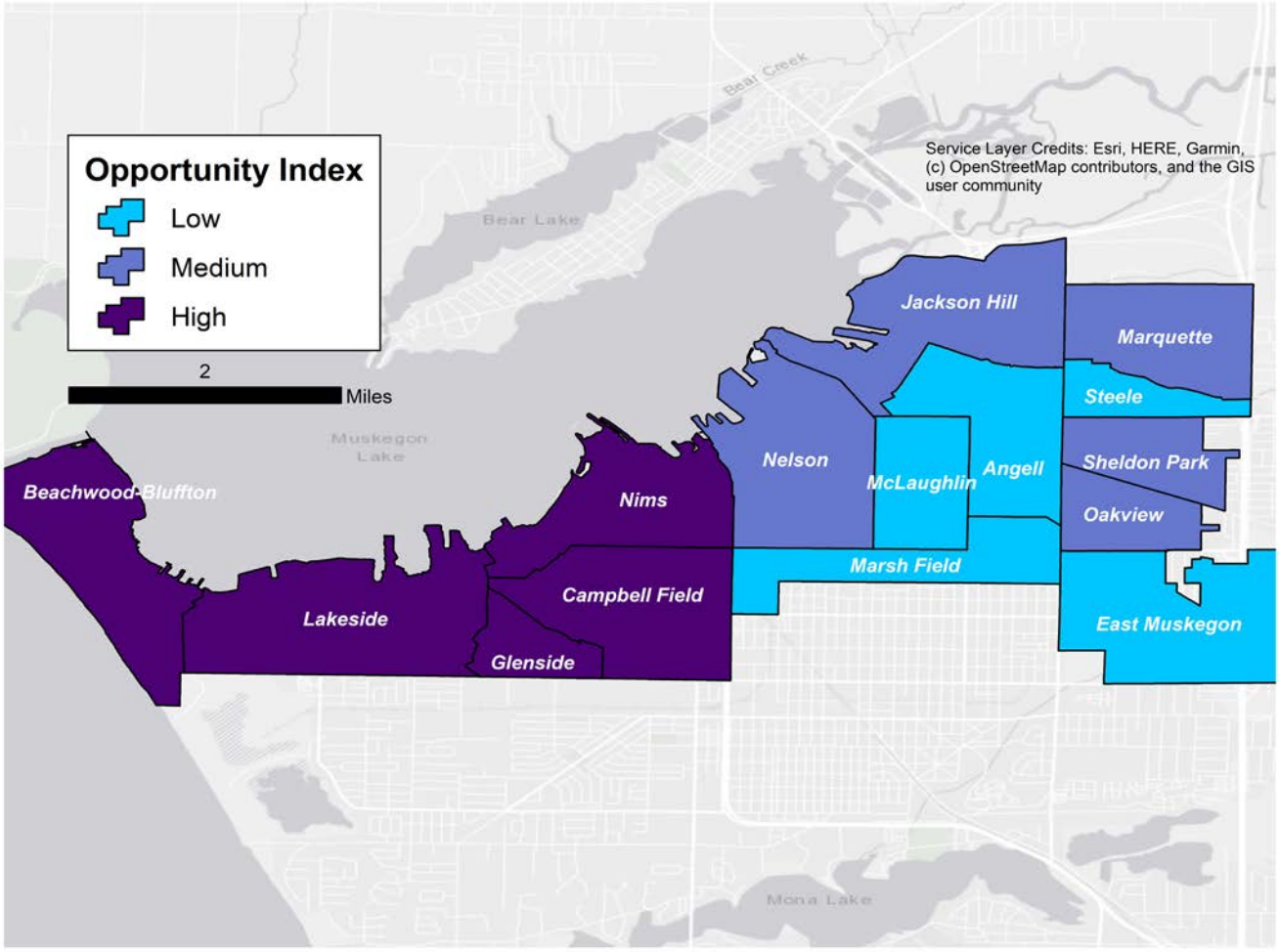

Figure 3. Muskegon Opportunity Index by Neighborhood

Survey respondents were evenly distributed across the three opportunity zones, with 35% of respondents living in high opportunity zones, 35% of respondents living in medium opportunity zones, and 30% of respondents living in low opportunity zones. A technique called Analysis of Variance (ANOVA) was used to compare the average scores of respondents from each of the three Muskegon opportunity zones on several survey items.

Living in Muskegon

To assess Muskegon residents' feelings about the social support and problems present in their neighborhood, respondents were asked several questions about neighborhood qualities they value and their perception that members of the neighborhood are capable of solving local problems.

First, respondents were asked four questions about the importance they place on having supportive interpersonal relationships and other forms of engagement in their neighborhood (Table 2). These items were modeled after other studies of attachment to place that distinguish a social dimension from a natural dimension of place attachment (Stedman 2002). Focusing here on the social dimension, answer options ranged from "not at all important" (1) to "very important" (4). The internal consistency of the items was evaluated using Cronbach's alpha (α), which measures the extent to which respondent's answers vary consistently across the set. The highest alpha value was achieved by removing the item stating, "The ability to be close to family and friends," because there is little variation in respondents' scores – most people valued this quality. With this item removed, α=.74, providing statistical justification for combining the three items into a single indexed variable measuring the concept "social sense of place (SOP)" by summing respondents' scores on each item.

Table 2. Attachment to One's Neighborhood

Variables	N	Mean	SD	MIN	MAX
How important are the following neighborhood qualities to you?					
Opportunities to be involved in community projects	285	2.8	0.9	1	4
Freedom to express my culture and traditions	283	2.9	1.0	1	4
Having a chance to serve in leadership roles	284	2.1	1.0	1	4
The ability to be close to family and friends	284	3.5	0.7	1	4
Social Sense of Place (SOP) Index α=.74	282	7.8	2.4	3	12
High Opportunity Zones	95	7.3	2.3	3	12
Medium Opportunity Zones	105	7.9	2.4	3	12
Low Opportunity Zones	84	8.4*	2.5	3	12
*p<.05					

An ANOVA statistical test was used to compare the mean values of the social attachment index variable for respondents from different Muskegon opportunity zones. A statistically significant difference was observed when comparing respondents from high and low opportunity zones, with respondents from high opportunity zones having mean scores slightly below the sample average (7.3) and respondents from low opportunity zones having mean scores above the sample average (8.4). This indicates that respondents from low opportunity zones in Muskegon place a greater importance on the availability of supportive interpersonal relationships and community engagement in their neighborhoods than do respondents from high opportunity zones.

PROBLEMS PRESENT IN NEIGHBORHOOD

Percent "Yes"

PROBLEM	LOW	MEDIUM	HIGH
Vandalism	67%	43%	21%
Gun violence	67%	38%	11%
Substance use	65%	46%	18%
Affordable food	62%	44%	19%
Vacant properties	60%	25%	11%
Affordable houses	55%	42%	26%
Personal safety	51%	36%	16%
Environmental	45%	40%	25%

Figure 4. Perception of Neighborhood Problems

Significant differences across Muskegon opportunity zones were also apparent in respondents' perceptions of problems in their neighborhoods and neighborhood characteristics associated with the capacity to resolve these problems. The questionnaire presented respondents with a list of eight neighborhood problems (see Figure 4), and asked whether they believe any are present in their neighborhood. Respondents could select, "Yes" or "No" for each problem in the list.

The percentage of "Yes" responses consistently decreased across all items as a respondent's opportunity zone score increased, with 45-67% of respondents from low opportunity zones affirming the presence of each problem in their neighborhoods, 25-46% of respondents from medium opportunity zones observing each problem, and 11-26% of respondents from high opportunity zones indicating that each issue is a problem in their neighborhood. ANOVA tests confirmed that these differences were robust and statistically significant across all three opportunity zones.

The questionnaire also asked respondents to assign their neighborhood a letter grade, "A to F" on six characteristics associated with local problem-solving capacity (Foster-Fishman et al. 2007). Letter grades were quantified for analysis on a five-point scale (A = 5 to F = 1). When examining differences in mean scores across opportunity zones (Figure 5), it is apparent that respondents from high and medium zones had similar assessments of characteristics associated with local problem solving in their neighborhoods, evaluating their neighborhoods' performance as about average on all items. In contrast, respondents from low opportunity zones had significantly lower mean scores on nearly every item, giving their neighborhoods an unsatisfactory evaluation on four out of six items.

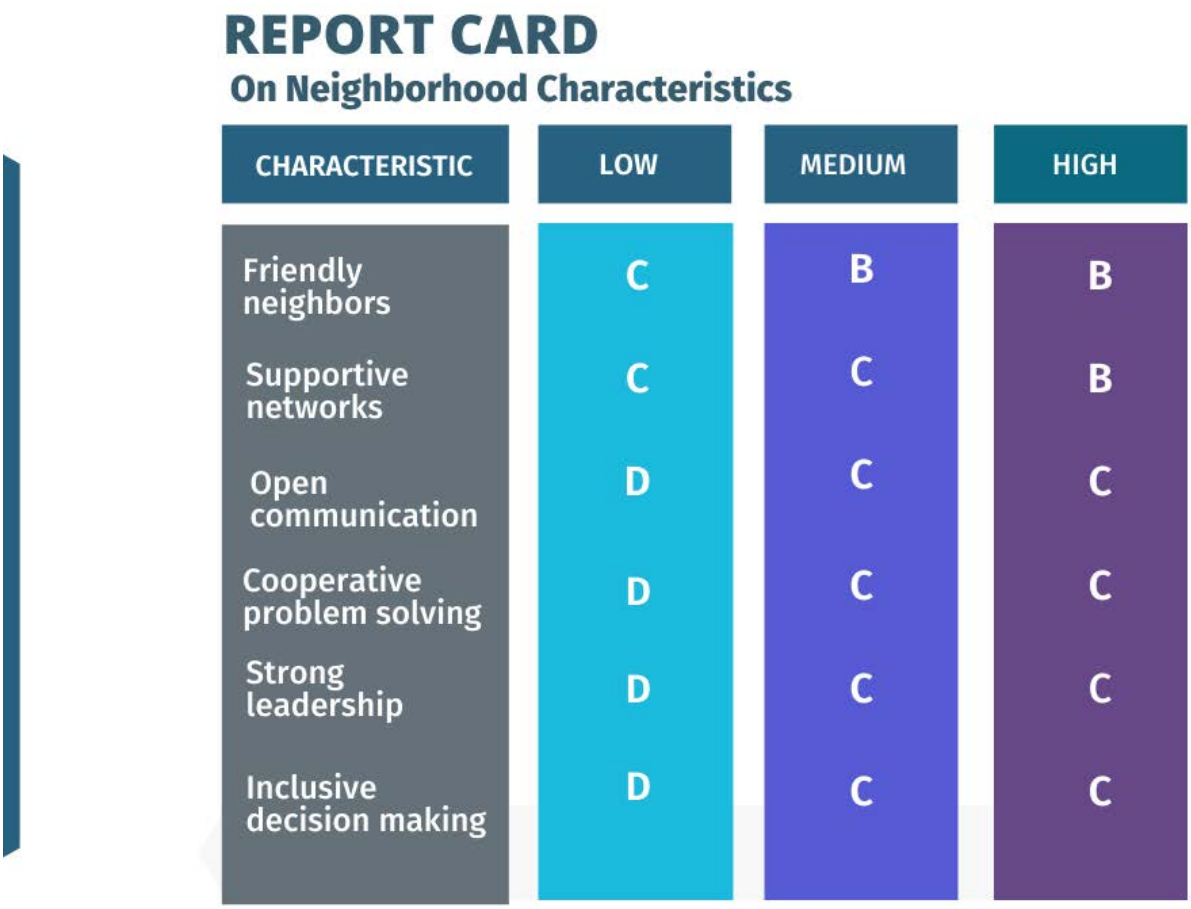

Figure 5. Evaluations of Local Problem-Solving Capacity

Restored AOC sites offer communities new cultural ecosystem services and economic opportunities (Allen et al. 2015), but these opportunities may heighten local anxieties about who will capture the benefits and who will be left out, or - even worse - pushed out. In the open comments at the end of the questionnaire, five participants mentioned concerns about gentrification occurring as an unintended consequence of lakeshore redevelopment in Muskegon. For example, one respondent wrote, "I hope that development along Muskegon Lake isn't all high-end homes/condos/apartments that are only aimed toward the wealthy. Also keep seniors in mind - affordable housing with one level living." Another said, "I grew up in the areas that are being restored. They look like they are being restored for high income [home buyers] and not everyone. Don't leave the African American community out!" These comments suggest that ensuring that the benefits of the AOC restoration are extended to historically marginalized subsets of the Muskegon community will require conscientious planning and creative entrepreneurial partnerships.

In sum, the survey results revealed that neighborhood dynamics in Muskegon are an important predictor of residents' perceived quality of life. Survey respondents from neighborhoods classified as low opportunity zones in this analysis placed a high value on supportive interpersonal relationships in their neighborhoods, but they also had higher assessments of the presence of a wide range of community problems and lower assessments of their local capacity to resolve those problems compared to respondents from medium and high opportunity zones. The next section explores the extent to which these disparities have an impact on residents' engagement with Muskegon Lake.

Muskegon Lake and Me

To assess Muskegon residents' relationship with Muskegon Lake, respondents were asked several questions about how they feel when they visit the lake, how frequently they visit, what they like to do at the lake, and their satisfaction with accommodations at public access sites along the lakeshore.

Respondents were asked four questions about their attachment to Muskegon Lake (Table 3). These items were intended to measure a natural dimension of place attachment, complimentary to the social dimension of place attachment discussed in the previous section. Answer options ranged from "not at all true" (1) to "very true" (4). The internal consistency of all four items was high (α=.86), providing justification for combining the items into a single variable by summing respondents' scores on each item.

Table 3. Attachment to Muskegon Lake

Variables	N	Mean	SD	MIN	MAX
How true are the following statements for you?					
I feel happiest when I am at Muskegon Lake	288	2.7	1.0	1	4
Muskegon Lake is the best place to do the things I enjoy	292	2.5	1.0	1	4
I miss Muskegon Lake when I am away too long	292	2.4	1.1	1	4
I feel that I can be myself at Muskegon Lake	289	2.9	1.1	1	4
Natural Sense of Place (SOP) Index α=.86	286	10.6	3.4	4	16
High Opportunity Zones	101	11.3	3.3	4	16
Medium Opportunity Zones	98	10.7	3.3	4	16
Low Opportunity Zones	86	9.6*	3.4	4	16
*p<.05					

When comparing the mean values of respondents' attachment to Muskegon Lake across opportunity zones, it was apparent that respondents from low opportunity zones had significantly lower mean scores than respondents from high opportunity zones (9.6 compared to 11.3). This indicates that respondents from high opportunity zones in Muskegon place a greater importance on their engagement with Muskegon Lake than do respondents from low opportunity zones, who are less likely to report feeling a strong sense of attachment to the lake.

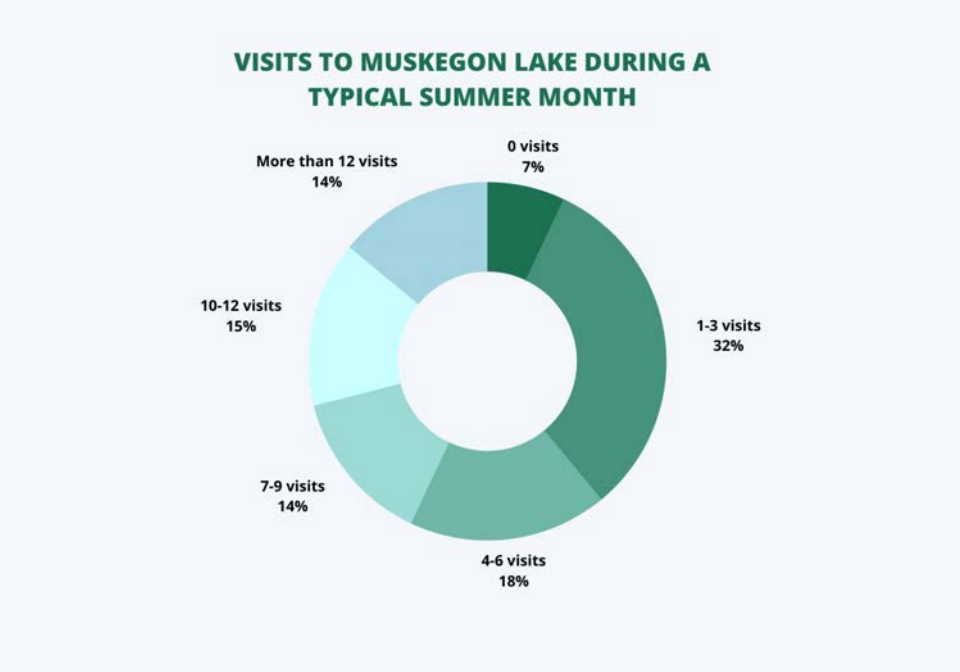

Figure 6. Frequency of Visits to Muskegon Lake

Instrumental aspects of individuals' engagement with the lake also provide a measure of its importance to Muskegon residents. Therefore, the respondents were asked how frequently they visit Muskegon Lake during a typical summer month and which activities they enjoy while visiting. As pictured in Figure 6, survey respondents represented a fairly even mix of rare, moderate, and frequent visitors to Muskegon Lake. However, only a small number of respondents said that they never visit Muskegon Lake (n=20). ANOVA tests revealed that the average frequency of visits among respondents from low opportunity zones in Muskegon is significantly lower than the population average (Table 4). The greatest difference is observed when comparing respondents from high and low opportunity zones. Whereas respondents from high opportunity zones make about 7-9 visits to Muskegon Lake per month, respondents from low opportunity zones visit the lake about 4-6 times per month.

Table 4. Visiting Muskegon Lake

Variables	N	Mean	SD	MIN	MAX
Frequency of Visits to Muskegon Lake	288	3.4	1.6	1	6
High Opportunity Zones	97	3.7	1.6	1	6
Medium Opportunity Zones	103	3.4	1.5	1	6
Low Opportunity Zones	87	3.0*	1.5	1	6
Distance to a Public Access Site (km)	293	1.9	1.7	0	19.2
High Opportunity Zones	101	1.0*	0.1	0	2.3
Medium Opportunity Zones	103	2.1*	1.6	0	4.8
Low Opportunity Zones	89	2.8*	2.1	0	19.2
Barriers to Visiting Muskegon Lake					
I've been told the lake is polluted	109	1.8	1.0	1	4
I don't have enough time to visit the lake	108	1.7	1.0	1	4
There is nothing I like to do at the lake	109	1.7	0.9	1	4
I don't have the equipment that I need	109	1.6	1.0	1	4
My own physical abilities	110	1.5	0.9	1	4
I don't know where I can access the lake	106	1.4	0.9	1	4
It is too expensive to visit the lake	108	1.2	0.6	1	4
I have a difficult time crossing Shoreline Drive	106	1.2	0.6	1	4
I don't have transportation to get to the lake	109	1.2	0.7	1	4

*$p<.05$

To examine whether some of the difference in frequency of visits across opportunity zones may be explained by the physical distance between a respondent's residence and the lake, GIS-based network analysis was used to compute the distance of each respondent's drivable route to the nearest public access site on the Muskegon Lake shoreline in kilometers. OpenStreetMap data and the ArcGIS Editor were used to create a road network and calculate the shortest route by drive time from each parcel to each public access site (Figure 7). The average distance between a respondent's residence and the nearest public access site increases at a statistically significant, consistent rate across opportunity zones (Table 4), with respondents from high opportunity zones living 1.0 km on average from a public access site, respondents from medium opportunity zones living 2.1 km from a public access site, and respondents from low opportunity zones living 2.8 km away. In turn, both distance to a public access site ($r=-.20$, $p<.01$) and the respondent's opportunity zone score ($r=.17$, $p<.01$) are significantly correlated with the frequency of their visits. Respondents who live further from the lake visit less frequently, and they are more likely to be residents from low opportunity zones.

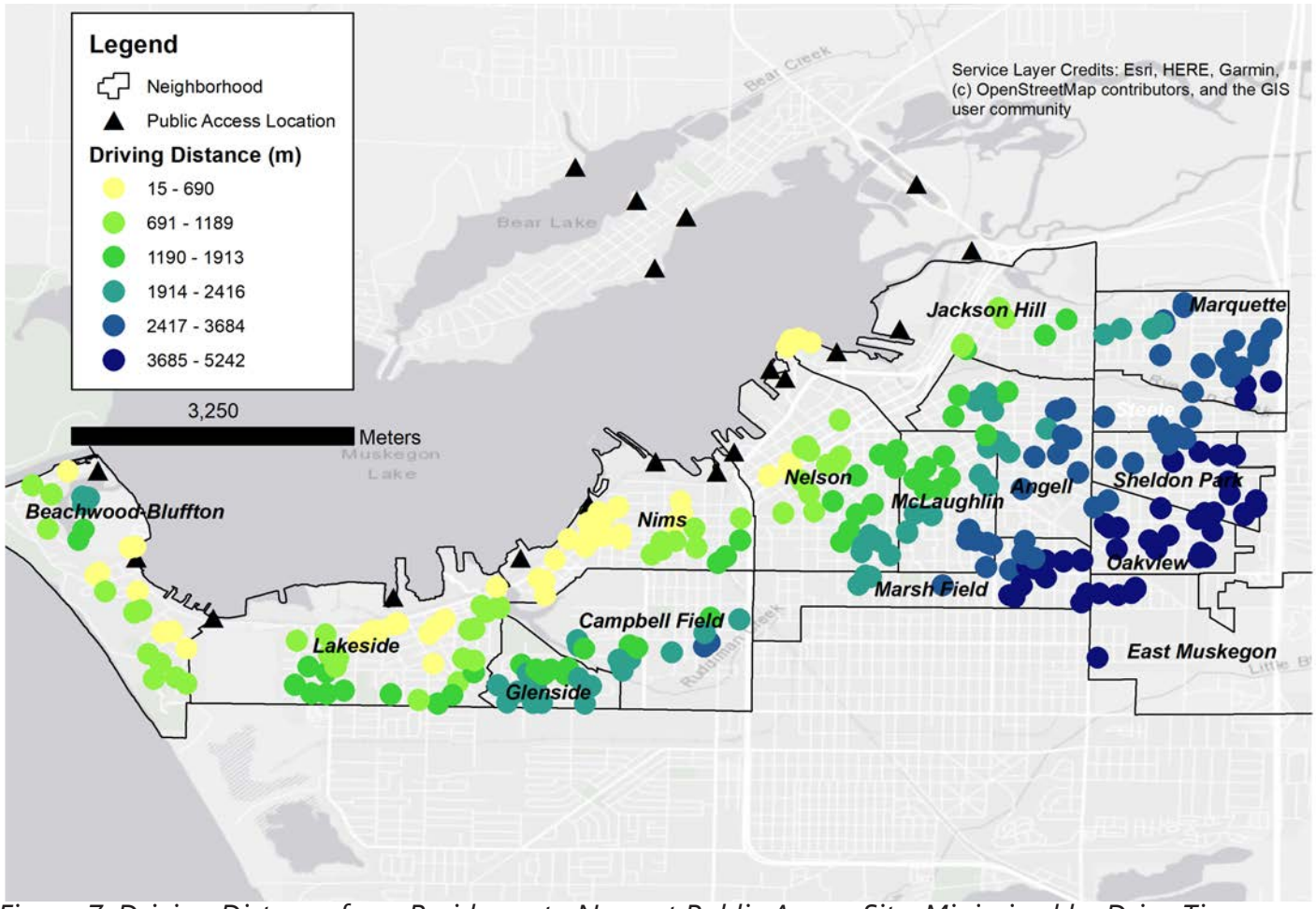

Figure 7. Driving Distance from Residence to Nearest Public Access Site, Minimized by Drive Time

The questionnaire included nine statements about potential factors limiting individuals' ability to visit Muskegon Lake (see Table 4). Respondents were asked to indicate how much each issue limited their ability to visit, with answer options ranging from "not at all" (1) to "a lot" (4). Among the 112 respondents who visit the lake rarely (1-3 visits per month) or not at all, thinking that the lake is polluted, not having enough time to visit the lake, lack of activities of interest at the lake, and lack of access to needed equipment were cited as "a little" bit of the reason that their visits to the lake are limited. Notably, mean scores on most items are in the "not at all" range.

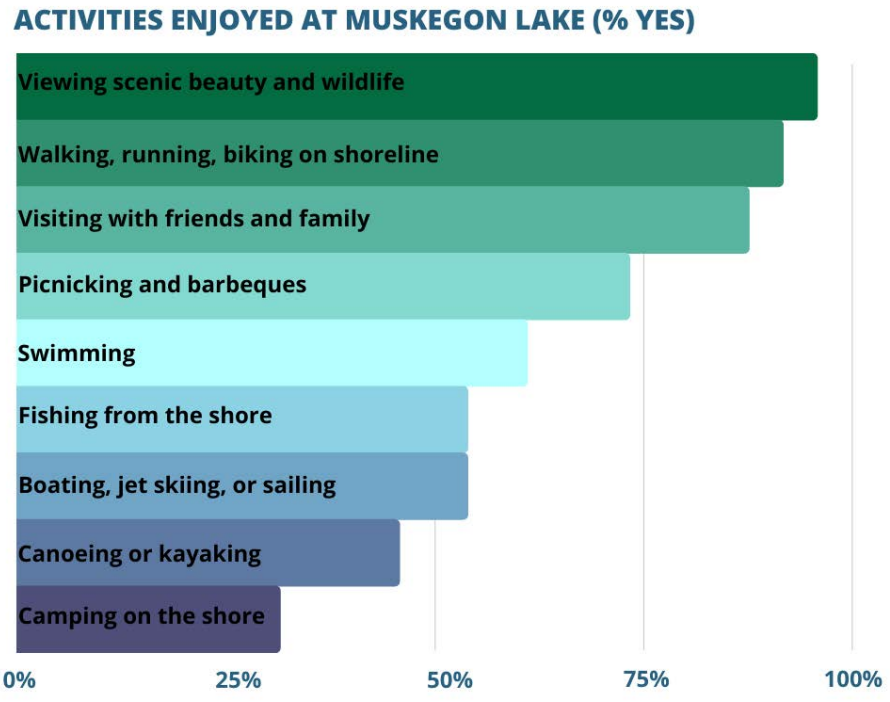

Figure 8. Percent of Respondents Engaging in Lake Activities

When Muskegon residents do find the time to visit the lake, what do they like to do there? The questionnaire contained a list of water-based activities and asked respondents to indicate which, if any, they enjoy at Muskegon Lake (Figure 8). Wide majorities of participants indicated that they enjoy the lake's scenery and opportunities to view birds and wildlife (94%), and many survey respondents frequent the Lakeshore Trail (90%). Visiting with family and friends (86%), and having picnics and barbeques (72%) were also popular activities. About half of respondents said that they engage in activities that require specialized equipment, such as fishing along the shoreline (53%); boating, jet skiing, or sailing (53%); or canoeing or kayaking (45%). Just under one-third of respondents (31%) camp at Muskegon Lake.

When asked to evaluate their satisfaction with features available at public access sites along the Muskegon Lake shoreline, survey respondents evaluated pedestrian and biking paths as the most satisfactory feature, giving them an average score of eight out of ten points (Figure 9). This is consistent with the high reported rates of participation in walking, running, or biking along the shoreline, and signals that the Lakeshore Trail is an important attraction drawing visitors to Muskegon Lake. In contrast, kayak storage received an average evaluation of four out of ten points, indicating an area of need. Public restrooms, fish cleaning stations, and the availability of food stands also received low evaluations (five out of ten).

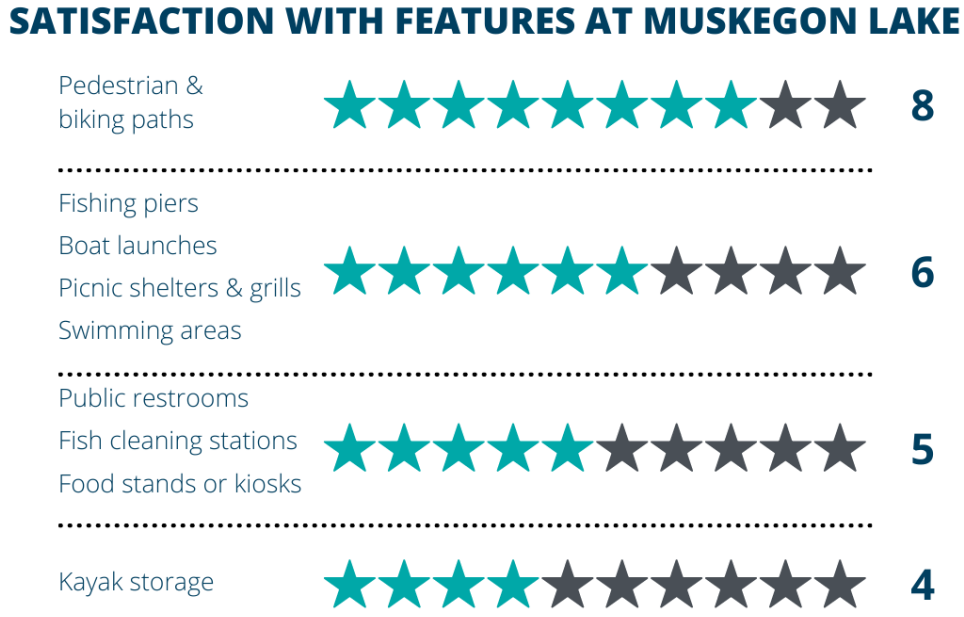

Figure 9. Evaluations of Features at Public Access Sites (1-10)

The questionnaire contained an open field for respondents to write in suggestions for improving public access areas at Muskegon Lake. Responses were organized by theme and tallied (Table 5). The most frequently mentioned improvement was increasing the number and convenience of access points to Muskegon Lake. Respondents also stated that handicap accessibility is limited, and that better signage and promotion of public access amenities are needed.

Increasing the number of clean restroom facilities was another frequently mentioned improvement, with twenty respondents remarking that better or more bathrooms and drinking fountains are needed along the lakeshore. Cleanliness was often mentioned along with bathrooms, but respondents also complained about litter and trash along the shoreline. Several respondents said that there are not enough functioning boat launches (due to high water levels), and a few more said that there are not enough kayak launches or storage facilities. Comments about increasing the number of boat launches, as with parking, were often mentioned alongside suggestions that these amenities should be free of charge. Increasing the availability of beaches, picnic areas and shelters, and swimming areas often were mentioned together. Several respondents would like to see more multi-use parks along the lakeshore, with playgrounds, picnic areas and grills, a wading beach, and kayak launches all co-located.

While survey respondents were mostly enthusiastic about the Lakeshore Trail, they also noted the importance of fixing areas that have been damaged by high water levels and expressed frustration that sections of the trail have been unusable for two years. Some would also like to see the length of the bike trail extended. One respondent suggested, "We need seating at various spots on the Shoreline Trail from the Veterans Park to Fisherman's Landing and a refreshment machine at the building at Fisherman's Landing for walkers."

Fishers would like to have more areas to access the lake from the shore, including fishing piers and docks. Fishers also need more fish cleaning stations, and one respondent mentioned that a bait and tackle shop would be nice. In open comments at the end of the questionnaire, three people mentioned impacts of lakeshore development on fishing access, saying, "All of the development has made it impossible to fish from the shore," and, "What I have noticed over the years is that there are many new housing and other structures being built which has only cut back the access to the lake for fishing."

Table 5. Suggestions for Improving Public Access by Category of Comment

Category	Representative Quote(s)	N
More or improved access	"More areas to access the lake." "Wheelchair access." "Make it affordable."	29
Restrooms and/or drinking fountains	"More restrooms that are routinely cleaned."	20
Boat and kayak launches	"More boat launches and cheaper to use." "Boat rental at easy access."	20
Improved cleanliness	"Less trash." "Cleanliness of water."	16
More free parking	"More parking areas." "Parking for boat trailers." "No charge for seniors."	14
Trail improvements	"Repair low areas on bike path." "Longer walking, running, bike trail."	13
Fishing access/amenities	"More fishing piers." "More fish cleaning stations."	12
More beach access	"A better defined public beach area."	10
More picnic shelters	"A nice picnic area on the water."	10
More swimming areas	"A community park with pavilion and beach for swimming."	8
More food options	"More activities and food areas and store."	7
Other comments	"New playground for kids." "Boardwalks to view lake." "Dog park."	9

In reviewing key findings from this section of survey items, it is clear that residents' relationships with Muskegon Lake vary based on where in the city they live, with inequalities at the neighborhood level spilling over to affect residents' engagement with the lake. Muskegon Lake is a particularly special place for residents who live close to public access sites on the lake and in high opportunity zones. These individuals have a strong affective attachment to the lake and visit it frequently. Residents who live further from the lake and in low opportunity zones are less likely to be emotionally attached to the lake or to visit it often, citing concerns about water quality in the lake, and lack of time, equipment, and interest as primary reasons for not visiting. Among people who do visit the lake, the pedestrian and biking trails are a major attraction that residents would like to see maintained and expanded. Residents would also like to see affordable opportunities for fishing and family fun near the lake expanded, and they point out that increasing the number of clean bathrooms and parking areas will be important as more Muskegon families develop an interest in visiting the lake. The next section considers what respondents know about Muskegon Lake's history and current water quality, as well as what actions they are willing to take to protect the lake's future.

The Muskegon Lake Legacy

To evaluate Muskegon residents' knowledge and opinions of the Muskegon Lake AOC restoration, the survey asked respondents about the information they have encountered regarding the restoration, their opinions about the impacts that the AOC restoration has had on the lake since it was initiated in 1987, and their perception of Muskegon Lake's current environmental quality. Finally, respondents were asked about their interest in getting involved in stewardship activities that promote protection of the lake for future generations.

Survey results indicate that there are limitations in current methods of circulating information in the Muskegon community about Muskegon Lake's AOC history and organizations working to restore the vitality of the lake. When asked if they know what a Great Lakes Area of Concern is, 41% of respondents indicated that they were unfamiliar with this term, 36% of respondents said that they did know what an AOC is, and 23% of respondents were unsure. Over half of respondents (54%) had never heard of the Muskegon Lake Watershed Partnership (MLWP), 36% were familiar with this organization, and 9% were unsure. When asked if they knew where to find information to learn about protecting water quality, nearly half of respondents agreed that they did, one-quarter indicated that they did not, and one-quarter of respondents were unsure.

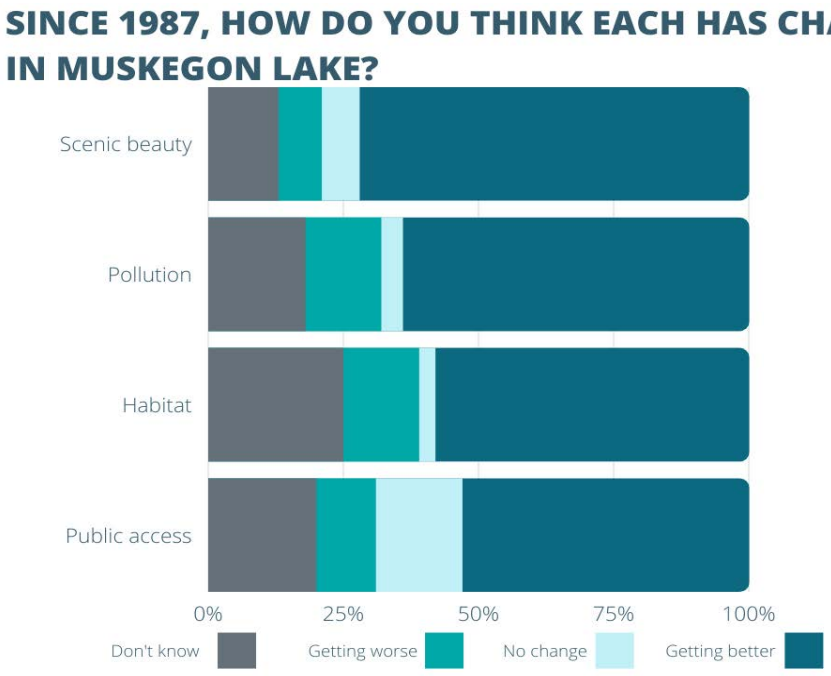

Figure 10. Perceptions of AOC Restoration Impacts

Likewise, substantial portions of survey respondents felt unable to evaluate changes in Muskegon Lake brought about by the AOC restoration. Respondents were asked to evaluate how four characteristics of Muskegon Lake have changed since 1987 (Figure 10). Answer options were on a five-point scale ranging from "a lot worse" (1) to "a lot better" (5). One-quarter of respondents said that they "don't know" how much the quality of fish and wildlife habitat has changed, 20% were unable to evaluate changes in opportunities for public access to the lake, 18% did not know how much the amount of pollution in Muskegon Lake has changed, and 13% were unsure about how the scenic beauty of the lake has changed over time. However, the larger proportion of respondents who *did* feel confident in offering opinions on these questions had overwhelmingly positive views of the changes in Muskegon Lake. On each item, over half of all respondents said that the changes to Muskegon Lake have made the lake "slightly" to "a lot" better.

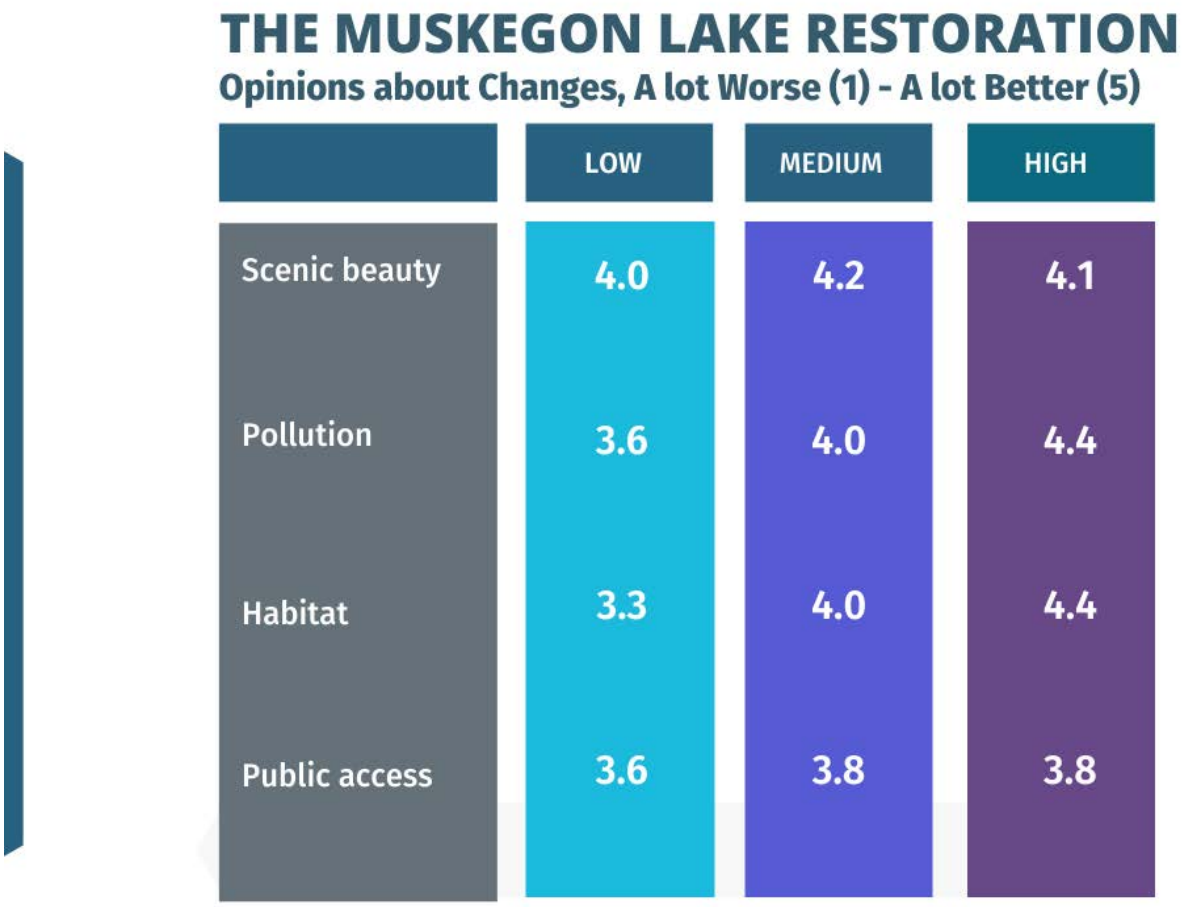

Figure 11. Mean Scores on Impacts of AOC Restoration by Opportunity Zone

ANOVA tests were used to compare opinions about the changes in Muskegon Lake across opportunity zones (Figure 11). Assessments of changes in the lake's beauty were largely positive and similar across opportunity zones. Likewise, respondents from all neighborhoods indicated that - on average - opportunities for public access to the lake have stayed about the same over time. Statistically significant differences were observed in assessments of changes to pollution in the lake and the quality of fish and wildlife habitat, with mean scores increasing steadily as respondents' opportunity zone scores increased. Not only did respondents from low opportunity zones have more negative assessments of their neighborhoods, they also had more negative assessments of the impacts the AOC restoration has had on remediating pollution and restoring aquatic habitat.

To gain more insight on residents' concerns about specific pollutants or problems in Muskegon Lake, survey respondents were asked how severe they believe various water quality impairments and consequences of poor water quality are in the lake (Figure 12). Answer options ranged from "not a problem" (1) to "severe problem" (4). Among respondents who answered these items, assessments were in the moderate range (3) for most pollutants and consequences. Notably, substantial proportions of respondents (20-33%) said that they "don't know" about the severity of chemical pollutants in Muskegon Lake, (i.e. nutrients, *E. coli* bacteria, contaminated fish). Fewer than 15% of respondents were unsure about their ability to assess visible pollutants and problems, (i.e. trash in the water, invasive plant and animal species). This indicates that residents may benefit from further communication about the current status of water quality in Muskegon Lake.

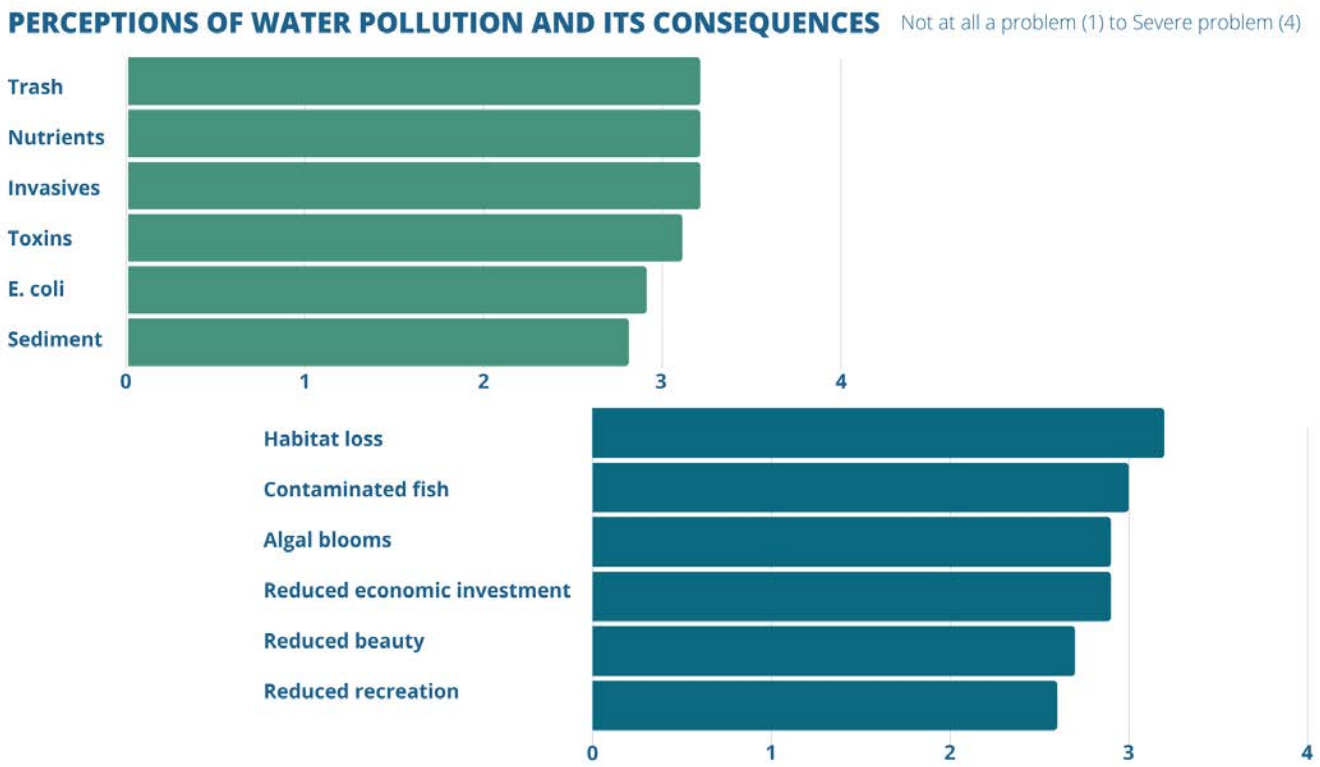

Figure 12. Mean Scores (1-4), Perceived Pollutants and Consequences of Poor Water Quality

It is also important to keep an eye forward on factors that promote engagement in activities protecting the lake's future. To explore interest in lake stewardship activities, survey respondents were asked if they would be willing to volunteer for a shoreline cleanup event, plant native plants along the shoreline, join a Facebook group, attend an MLWP meeting, or donate money to support shoreline stewardship efforts (Figure 13). Survey respondents were most enthusiastic about participating in hands-on stewardship activities, with 57% saying that they were willing to volunteer for a shoreline cleanup event and 48% willing to assist with planting native plants along the shoreline. Joining a Facebook group is a relatively easy, low-investment activity, and 44% of respondents were willing to do this. In contrast, fewer respondents were interested in taking the time to attend an MLWP meeting (40%), and only about one-third would donate money to support cleanup efforts.

To learn more about the characteristics of individuals who are willing to participate in each stewardship activity, a logistic regression statistical analysis was used to compare the relative importance of several factors in predicting a change in a respondent's willingness to engage in stewardship activities.

Figure 13. Percent of Respondents Willing to Engage in Stewardship

Factors accounted for include demographic characteristics of the participant (education level, length of residence in Muskegon, and the respondent's opportunity zone score), social and natural dimensions of attachment to place, and prior exposure to MLWP. Regression results appear in Table 6. An odds ratio (OR) represents the percentage of the increase or decrease in the odds that a respondent is likely to participate in a stewardship activity, all other factors held constant. The standard error (SE) is an estimate of survey respondents' deviation from the actual population mean on each item. Values that reach a threshold of statistical significance ($p < .05$), signifying that the corresponding factor meaningfully impacts the odds that a respondent is willing to participate in stewardship activities, are denoted with asterisks.

Table 6. Factors Predicting Willingness to Participate in Stewardship Activities

Variables	Volunteer OR (SE)	Plant on Shore OR (SE)	Join FB Group OR (SE)	Attend MLWP OR (SE)	Donate Money OR (SE)
Demographic Characteristics					
Education Level	1.26 (.11) *	1.19 (.11)	1.11 (.11)	1.13 (.12)	1.24 (.12)
Length of Residence	0.98 (.01) **	0.98 (.01) **	0.98 (.01) *	1.00 (.01)	1.00 (.01)
Opportunity Zone	0.95 (.19)	0.82 (.18)	0.82 (.18)	0.93 (.20)	0.58 (.21) **
Place Attachment					
Social SOP	1.17 (.06) *	1.20 (.06) **	1.11 (.06)	1.41 (.07) ***	1.34 (.07) ***
Natural SOP	1.04 (.04)	1.08 (.04)	0.97 (.04)	1.10 (.05) *	1.12 (.05) *
Knowledge of MLWP	1.15 (.15)	0.98 (.15)	1.09 (.15)	1.58 (.16) **	0.97 (.16)
Constant	0.23 (.92)	0.09 (.94) **	0.94 (0.9)	0.00 (1.1) ***	0.02 (1.1) ***
Psuedo R^2	0.13	0.13	0.07	0.18	0.16

*$p<.05$

**$p<.01$

***$p<.001$

Across all models, the respondents' attachment to their neighborhood (social SOP) and the length of time they have lived in Muskegon most consistently predict the odds that they are willing to engage in stewardship activities. The odds that respondents who had high social SOP scores are willing to volunteer for a shoreline cleanup are 17% higher than respondents with lower social SOP scores. Respondents who were highly attached to their neighborhoods are at 20% increased odds of being willing to assist with planting native plants on the shoreline, 41% increased odds of being willing to attend an MLWP meeting, and 34% increased odds of being willing to donate money for cleanup projects. In contrast, length of residence in Muskegon is negatively associated with stewardship activities. The odds that long-time residents are willing to volunteer, plant native plants, or join a Facebook group are 2% lower than residents who are newcomers. This reflects the high correlation between length of residence in Muskegon and the age of the respondent ($r=.52$, $p<.001$).

Respondents' attachment to Muskegon Lake (natural SOP) was less important overall than their attachment to their neighborhoods in predicting their willingness to participate in stewardship activities. Respondents with high levels of attachment to Muskegon Lake were at 10% increased odds of being willing to attend an MLWP meeting. The odds that respondents with high natural sense of place scores would be willing to donate money for cleanup projects were 12% higher than respondents with lower natural SOP scores, indicating that residents' affection for Muskegon Lake is important for motivating financial investments in its future.

When considered in relation to the importance of place attachment items, the respondent's opportunity zone score mattered less in predicting the likelihood that they are willing to get involved in shoreline stewardship in all cases except donating money. The odds that respondents from low opportunity zones were willing to donate money for cleanup projects were 42% lower than respondents from medium and high opportunity zones. This suggests that, while residents from low opportunity zones may be less able or willing to commit financial investments to stewardship projects, they are otherwise just as likely as other residents to be willing to lend a hand or get involved with MLWP. In fact, residents from low opportunity zones may be *more* willing to participate in these activities given that they tended to have *higher* social SOP scores, which are associated with an increase in the odds that a respondent is willing to engage in most stewardship activities.

Interestingly, while respondents with higher levels of education were at 26% increased odds of being willing to volunteer for a shoreline cleanup, education level was generally not an important factor for predicting the odds that a respondent is willing to get involved in stewardship activities. Considering that education level is often highly correlated with household income, this means that the survey respondents who are most likely to have formal exposure to environmental education and a greater amount of disposable income are not any more likely to be interested in most stewardship activities. In fact, survey respondents who highly value interpersonal relationships in their neighborhoods and live in low opportunity zones were the most likely to be willing to get involved.

Finally, respondents were given a list of issues that may limit their ability to participate in stewardship activities (Figure 14) and asked to rate how much each factor limits their ability to get involved, with answer options ranging from "not at all" (1) to "a lot" (4). Notably, a large proportion of respondents said that not having transportation, interest, or the physical ability to participate were *not at all* factors limiting their participation. Instead, the belief that they do not have enough time, information, or money to participate were the most commonly cited barriers.

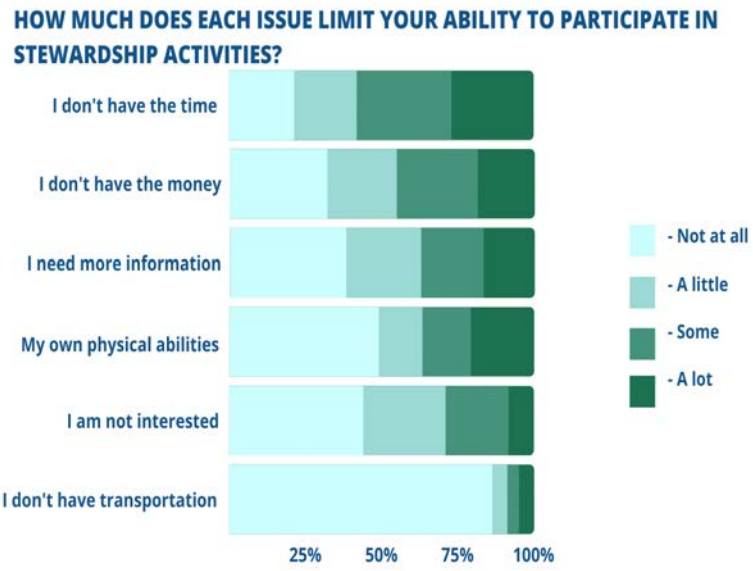

Figure 14. Barriers to Participating in Lake Stewardship

As removal of Muskegon Lake's final BUIs draws to a close, opportunities abound for strategic outreach and communication about the current status of environmental quality in and around the lake. Residents have largely positive views of the changes brought about by the AOC restoration, but there are some lingering concerns about environmental quality, particularly invisible chemical pollutants. Survey respondents were most interested in getting involved in hands-on stewardship activities, like shoreline cleanups and planting native plants. This is particularly the case for residents who had strong scores on the social place attachment items, which tended to be residents from low-income communities of color in Muskegon. It's not for lack of interest that residents do not participate in stewardship, but many do feel that they don't have the time, money, or information about how to get involved.

Conclusions

This study assessed public opinions about the impacts of the Muskegon Lake restoration and people's relationship with the lake through a mail survey of a random sample of Muskegon residents. The survey sought to evaluate the extent to which environmental benefits of the lake restoration are equally experienced by residents across the city, current levels of knowledge about the status of environmental quality in the lake, and residents' interest in recreational and stewardship activities.

Other studies of the impacts of AOC restorations attest to the socio-economic benefits realized by the revitalization of cultural ecosystem services in restored waterways (Liesch and Graziano 2021). However, less is known about the extent to which these benefits are equitably distributed among residents. The results of this study identified statistically significant differences in Muskegon residents' perceptions of security in their neighborhoods and capacity for resolving local problems based on the percentage of minoritized and low-income residents within each neighborhood. Where the legacy of discriminatory housing policies plaguing many postindustrial American cities persists in creating concentrated zones of poverty in Muskegon, residents reported more negative views of their neighborhoods. These pessimistic perceptions spilled over into their assessments of Muskegon Lake, with residents from areas of the city classified as "low opportunity zones" in this analysis living further from the lake, visiting it less frequently, having less affective attachment to the lake, and having more negative assessments of the AOC restoration's success with remediating pollution. These findings suggest that justice in access to the benefits of the Muskegon Lake restoration is not a given. Rather, expanding access to the environmental benefits of the restoration may require a slight shift in focus, with planning efforts now decentering the lake and instead concentrating on uplifting vulnerable neighborhoods within the city.

At the same time that residents from disadvantaged neighborhoods note many local problems of concern, they place a high value on supportive interpersonal relationships in their neighborhoods. This investment in socially supportive local networks translates to a heightened interest in getting involved in stewardship activities. While other studies suggest that highly resourced and organized communities are more likely to participate in civic activities and watershed stewardship (Brinkman et al. 2012; Foster-Fishman et al. 2007), this pattern did not hold in the Muskegon context. Survey respondents with higher levels of education, and presumably a greater amount of disposable income, were not more likely to be interested in most shoreline stewardship activities. Instead, respondents who value interpersonal relationships in their neighborhoods - residents from low opportunity zones- were the most willing to get involved.

It follows that, along with the ethical imperative to support leaders from underserved Muskegon neighborhoods in their visions for uplifting their communities, there is an instrumental imperative to forge connections with the residents who expressed the highest interest in volunteering for lake stewardship efforts. As residents who are overburdened with other problems in their neighborhoods- like vandalism or gun violence - experience relief from these immediate security concerns, they may be freer to make investments in self-actualizing activities - like visiting Muskegon Lake and contributing to shoreline stewardship efforts.

The belief that lake stewardship requires a heavy time or financial commitment was cited as the biggest limitation to participation, along with not having enough information. This indicates that a strategic communication approach will need to focus on simple stewardship activities that can be completed on a flexible schedule. Community events should facilitate engagement in the most commonly enjoyed activities - being near the lake with loved ones, enjoying its beauty, and learning more about the lake biome and the ecosystem services it provides.

Partnering with other community groups to circulate information among members connected to their communication networks may broaden the scope of outreach efforts. When asked about their community organizational affiliations, survey respondents mentioned many church affiliations, with area Catholic, Christ Temple, Covenant Community, Baptist, Lutheran, and Presbyterian churches mentioned by several individuals. Respondents also mentioned being active participants in their neighborhood associations, the Chamber of Commerce, the Muskegon Yacht Club, the Hackley Public Library, and Love INC. By circulating information to their members, existing community organizations can be fruitful stewardship allies, helping to get the word out about family-oriented stewardship activities that connect young Muskegon residents to the lake.

The survey results highlight a need for further public outreach about the current status of Muskegon Lake's environmental quality. Over 20% of respondents were unable to evaluate the severity of chemical pollutants in Muskegon Lake, and only one-third had heard of MLWP or knew what an AOC is. This highlights a need for maintaining and expanding partnerships with area K-12 educational institutions. Investments currently being made in this area are well-founded and should continue. Given the widespread popularity of the Lakeshore Trail, increasing opportunities for interactive, educational experiences through signage, self-guided tours, or activities like scavenger hunts along the trail may be effective ways to leverage the outreach potential of this lakeshore attraction.

The survey results also indicate that there is cause for great celebration. Respondents had overwhelmingly positive opinions about the impacts of the Muskegon Lake restoration, with the majority of respondents indicating that the scenic beauty, amount of pollution, quality of fish and wildlife habitat, and amount of public access have improved over the past three decades. Open comments left at the end of the questionnaire underscored enthusiasm for emerging opportunities associated with the restoration. Eight participants expressed their appreciation, writing comments like, "Clean up over the last 20 years has been great. You can see the results of this in the rapid development along the south shore of the lake. We hope to see the lake stewardship and development continue." Another commented, "Muskegon has made enormous strides in cleaning up the lake over the last 30+ years. Removing old logs and sediment, tearing down old factories, it's great. As long as we as a community continue to improve Muskegon Lake and do things to maintain it, our lake will continue to benefit us both economically and for recreation."

Several others left words of thanks to MLWP and AWRI for the work they have done to steward these "new and exciting changes," and particularly the work MLWP has done to "help residents to access the lake." Remarks such as these illustrate that residents recognize the value the AOC restoration has returned to the community in terms of direct economic investments as well as fostering optimism about Muskegon as a place with unfolding possibilities. As one respondent put it, "Muskegon Lake access to fishing, kayaking, boating or just being able to connect to the lake in general is very important."

A dozen respondents submitted written comments concerning shoreline redevelopment. Some of these statements urged expedient action, such as three respondents who were eager to see the Sappi property redeveloped. For example, one person wrote about this site, "There should be a strict timeline for redevelopment, and a penalty for not meeting it." Other respondents raised concerns about losing public areas to access the lakeshore, writing, "I am concerned that the development around the lake will further limit public access to the lake. We need to increase access to the lake for everyone."

However, Muskegon residents do not necessarily see commercial development and public access as mutually exclusive goals. In line with current public-private partnerships being pursued on select development sites, one respondent suggested, "Private corporate owners of lake property should fund public access areas - swimming, fishing areas." Other respondents acknowledged the interlocking nature of ecological, economic, and equity considerations, writing, "I would like to see the recreational aspects maintained. Part of that has to be maintaining the local environment for nature and wildlife, which make the recreational activities worth doing. I am also in favor of some economical development like lakeside bars/restaurants to encourage more community engagement with the lake and downtown areas." Together, these comments suggest that Muskegon residents see a need for balancing development priorities going forward, and favor projects that facilitate place-making experiences connecting residents to their revitalized lake.

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L A K E T O N
MUSKEGON
STATE PARK
MICHIGAN
LAKE
APPROXIMATE MEAN LAKE ELEVATION 177
STATE PARK BOUNDARY & SHORELINE
PENNOCK ROAD
LAKETON OIL FIELD
M S P
Snug Harbor
Devils Kitchen
MUSKEGON STATE PARK
MUSKEGON CORPORATE BOUNDARY
Lights
Coast Guard Sta
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