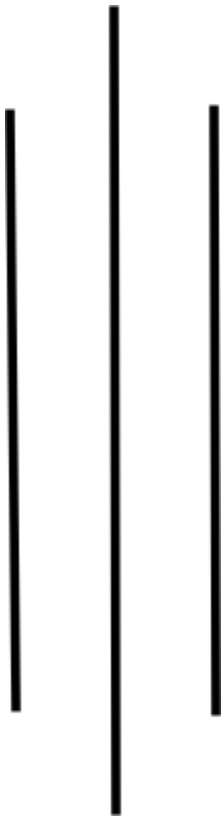
Water Benders

Team: 006-04



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Executive Summary

This final report outlines our investigation into a crucial aspect of drinking water conservation and protection — encouraging a positive shift in consumer behavior to address water pollution and contamination habits. The problem statement encapsulates the challenges faced by various stakeholders, such as water companies, conservation organizations, government agencies, elected officials, and the public.

The primary issue revolves around the inefficient communication of information, highlighting the immediate need for action to counteract water pollution and contamination. Initial research revealed that much of the necessary data is already available, offering an opportunity to educate individuals on best practices for the future. However, building common ground with customers is a time-intensive process, establishing a communication channel between distinct groups and potentially encouraging positive habits.

Further investigation into citizen behavior indicated a disinterest in lengthy reports or sporadic water bill data. The solution involves transforming information into engaging storytelling and presenting it through the appropriate mediums. Unfortunately, due to semester constraints, the research group couldn't delve into communication channels or determine the optimal length and frequency of information dissemination.

Introduction

In the expansive realm of drinking water conservation and protection, our team has undertaken a focused mission to address a critical facet: fostering a positive shift in consumer behavior by tackling the early stages of water pollution and contamination. This endeavor places us at the nexus of a complex web involving numerous stakeholders, including water company executives, the Great Lakes Conservation Coalition (GLCC), the Michigan Department of Environment, Great Lakes, and Energy (EGLE), elected officials, and the general public. The repercussions of contaminated water ripple through various sectors, imposing increased costs on water companies, threatening the reputation of elected officials, and impacting the tourism industry. The scale of this issue is daunting, and the absence of interim solutions exacerbates the challenge. Our investigation zooms in on the intricate feedback loop between water treatment professionals and consumers, highlighting the inefficiencies in disseminating information that may have catastrophic consequences. The health risks associated with contaminated water loom large, necessitating urgent action to prevent heightened operational expenses for water companies and the perpetuation of harmful consumer habits that disrupt our delicate ecosystem.

To contextualize our focus, background research reveals the inherent challenges faced by utility companies, such as limitations in in-house resources and the need for efficient communication strategies. Trust emerges as a linchpin, as people's perception of institutional commitment directly influences their motivation to conserve water. The escalating costs for water companies, as seen in regions like Saudi Arabia, underscore the need for efficient water treatment plants while grappling with high energy consumption. Our affinity wall notes further emphasize the importance of transforming captured data into actionable insights, addressing beliefs through continuous education, leveraging common grade scales for quality communication, and strategically placing water quality grades on reports for enhanced impact. This introduction sets the stage for our comprehensive exploration, where we delve into the intricacies of our investigation and propose strategic recommendations to navigate this complex landscape effectively.

Updated Problem Statement

Our team is dedicated to transforming consumers' perspectives on water, with a primary focus on crucial aspects of water conservation and protection. The objective is to catalyze a positive shift in consumer behavior, particularly by addressing early stages of water pollution and contamination. In collaboration with a diverse range of stakeholders, such as water company executives, outreach staff, the Great Lakes Conservation Coalition (GLCC), the Michigan Department of Environment, Great Lakes, and Energy (EGLE), elected officials, the tourism industry, and the general public, our aim is to emphasize the importance of altering attitudes toward water usage.

The implications of maintaining current habits are substantial: water companies incur rising costs in treating contaminated water, the general public may not fully grasp the impact of their actions, elected officials risk damage to their reputations, and the tourism industry may suffer as the environment loses its appeal. By redirecting attention towards changing consumer perceptions, our goal is to confront these challenges and inspire a collective commitment to preserving water quality.

Recognizing a significant gap between consumers and water companies, we observe that citizens often receive an overwhelming amount of information at once. Without ongoing relationship maintenance, this connection could deteriorate. Ordinary citizens seem less inclined to read reports unless the information is particularly compelling, and there is a risk of losing faith and trust in the government.

Our investigation aims to determine if regular monitoring of water quality is feasible. Bridging the gap between consumers and companies/governments, we intend to deliver information where consumers are actively looking—whether through television breaks or on popular Social Media Platforms. Additionally, we propose assigning a water quality grade to specific reports to enhance understanding and engagement. This multifaceted approach seeks to establish a more seamless and impactful connection between consumers, companies, and governments in the realm of water quality.

Process

Scoping the Problem
Problem statement revision:
Our revision was triggered by the feedback from our wonderful GSI, John Rudnik, who correctly recommended that we limit the scope of our research questions in order to allow us to feasibly accomplish our objectives within the time constraints of the course. He also recommended that we improve upon our plan for investigation to provide more information on our key informants as well as data collection methods, which has helped us immensely in terms of finding definition within our problem statement.

Data Collection
We collected the data from various sources:

1. Interview recordings from youtube, which includes
    a. Jon Allan
    b. Noah Urban
    c. Drew Gronewold
    d. Daniel Brown
    e. Evan Pratt

2. Team interview with Eric J. Oswald

    Eric J. Oswald is a highly accomplished professional with a wealth of experience, currently serving as the Director of the Drinking Water and Environmental Health Division (DWEHD) in the Michigan Department of Environment, Great Lakes, and Energy (EGLE). He has made significant contributions to environmental health and water quality through the implementation of stringent regulations and technology improvements.

    We conducted the interview with 3 other groups according to the requirements from EGLE. Teaching team helped us to integrate the protocols, streamline overlapping questions, and organize topically.

Topic of Interview

- The role of technology in improving environmental health initiatives and how these advancements can guide our strategies.
- The feasibility of balancing regulations and advanced technologies to influence consumer behavior regarding water conservation.
- Managing risks associated with technology interventions in water to prevent potential catastrophic outcomes.

3. Resident 1 interview led by David:
   46 year old resident of Plymouth, Michigan. Works as a local salesman for regional business. He has lived here for over 40 years. Has a family of four with extended family who lives throughout Michigan. He is not involved with local water organizations and has owned his house for the last 3 years. Wife works fully remote while raising the children.

Topic of Interview

- How much understanding he had for the basic water cycle.
- Water filtering and conservation daily practices.
- Understanding what does and doesn't work for spreading information.

4. Open source data:
   a. The Environmental Protection Agency (EPA)
   b. World Health Organization (WHO)
   c. US Geological Survey (USGS)
   d. United Nations Water
   e. The National Water Quality Monitoring Council (NWQMC)
   f. Global Water Partnership (GWP)
   g. The Water Data Collaborative
   h. UNESCO
   i. Water.org
   j. Water Residential Assistance Program (WRAP)

To see detail, the link to collected data is provided here.

Affinity Wall Analysis

We constructed the affinity wall based on the research process and topic. The affinity wall's content revolves around fostering a positive shift in consumer behavior concerning water pollution and contamination, particularly focusing on the early stages. The overarching theme emphasizes the importance of not only capturing great data but also exploring effective ways to utilize and communicate that data.

The outline identifies challenges in beliefs, especially post-primary school education gaps, and suggests leveraging common grade scales to communicate water contamination effectively. It acknowledges the information overload citizens face and emphasizes the need for maintaining relationships to prevent the deterioration of interest. Additionally, it recognizes that citizens may be more inclined to engage with captivating stories rather than standard reports.

The affinity wall highlights two key aspects:

Data Collection:
Accurate recording of essential data, including common facts and figures. Navigating challenges in visualizing water management scale, public perception, and communication complexities.

Information Dissemination:
Empowering water conservation through community-driven data representation, effective storytelling, and strategic engagement. Addressing water challenges through communication, technology integration, transformative education, storytelling, science-based decisions, governance, and public engagement.

Findings/Insights

Educational Gaps

Post-primary school education often fails to provide a continuous focus on water conservation, resulting in notable gaps in public awareness. This deficiency is particularly critical as addressing it becomes pivotal for instigating behavioral change among consumers. The recognition of the necessity for ongoing education beyond primary levels is imperative in tackling the water conservation challenge. In this context, abundant opportunities to disseminate knowledge to the public were discussed by various subject matter experts, and the remarks were subsequently collected by our team during the data collection phases.

One suggested method involved experiential learning, as stated by Drew Gronewold (2023) of SEAS at the University of Michigan, who, during his interview, proposed, "Taking students on a field trip to a water treatment facility or a wastewater treatment plan and having them meet the staff and the operators there and hearing about what they do on a day-to-day basis could be extremely impactful for public and private education." This hands-on experience could evidently significantly enhance students' understanding of the water treatment process and foster a deeper appreciation for water conservation.

Furthermore, Dr. Gronewold also emphasized in his interview the critical role of consumer information and public education in mitigating water pollution issues, stating, "Consumer information and public education is critical towards mitigating water pollution problems (Gronewold, 2023)." This underscores the need for targeted efforts to educate the public about the consequences of water pollution and the role individuals play in preventing it.

Lastly, Public Service Announcements (PSAs) were also highlighted as a potent tool for education, with the suggestion that they are "a great way to educate and target various population demographics about the hydrological cycle as well as point source and nonpoint source pollutants (Gronewold, 2023)." Leveraging mass media channels, such as TV and social media,

through engaging and informative PSAs can effectively reach diverse audiences and contribute to raising awareness about water conservation.

In addition, the importance of reaching out to groups with limited scientific knowledge is underscored, with suggestions for communication through town halls, public media (including newspapers and interviews), and peer-reviewed literature. This multifaceted approach recognizes the diversity in knowledge levels within the community and aims to ensure that water conservation information is accessible to everyone.

In conclusion, the pursuit of continuous education beyond primary levels is crucial for fostering a widespread understanding of water conservation. Leveraging experiential learning, public service announcements, and targeted communication strategies can bridge the gaps in awareness and contribute to a more informed and environmentally conscious society.

Information Overload

Streamlining Data for Effective Communication
In the realm of water quality communication, citizens often grapple with overwhelming amounts of information. The analysis suggests that adopting common grade scales to convey water contamination severity could significantly enhance communication effectiveness. Additionally, the integration of captivating narratives has the potential to improve public engagement. Recognizing the need to present the right amount of data, a crucial step involves breaking down information and crafting it into a coherent story.

Challenges in Existing Data
A prevalent issue with current data lies in its density, often residing in extensive documents that are challenging for the general public to navigate. While some fragments exist, they are not always presented in an accessible manner and may even contain inaccuracies. To address this, attention is drawn to the Neighborhood Vitality Index (NVI), a data collection effort initiated by Data Driven Detroit.

The Neighborhood Vitality Index (NVI)

Noah Urban from Data Driven Detroit highlights the NVI, a seven-year-long data collection initiative designed to gauge residents' sentiments across 23 Detroit neighborhood zones. The NVI examines aspects such as access to clean drinking water, existing water infrastructure, and climate concerns. Despite its pilot phase status, the NVI is poised to become a valuable resource in later stages of project development, illuminating resident perceptions and revealing knowledge gaps within the customer base.

Making Data Digestible

In the interim, the imperative is to break down existing dense data into digestible portions. By categorizing information into common beliefs, research findings, and general questions, these bite-sized portions can be disseminated through various channels, including literature and social media. This approach aligns with the widespread recognition, as identified in our interview with EGLE, that transparency and readability are fundamental values in data communication.

The Path Forward

Enhancing Information Channels

Interviewees, including Noah Urban(2023), emphasize that people are inundated with information at every turn. To positively influence consumer behavior, it is essential to improve the ways in which information is shared—making it not only digestible but also palatable. By observing gaps and effectively communicating measures, organizations can efficiently influence consumer behavior through enhanced information channels.

Breaking down data into manageable categories, such as common beliefs, research findings, and general questions, provides a feasible and digestible approach to presenting information. The Neighborhood Vitality Index, with its rich data on resident perceptions, stands as a promising resource to bridge knowledge gaps and inform more effective communication strategies for water quality concerns.

Communication Challenges

When maintaining a relationship to communicate, there will always be challenges. How they are handled will dictate how much influence each party has. In the case of water conservation and pollution, there is an issue with the flow of communication. According to a resident from Plymouth Michigan, the

water bills offer billing information at the top and water usage at the bottom (Michigan Resident 1, 2023). This shows the priority of information is bill and then awareness of your neighborhood. When asking that resident and another older resident about receiving information about other factors for water, they simply could not recall something other than the Flint crisis. (Michigan Resident 2, 2023) This enforces the idea of communication only occurring when something negative has happened and it makes it to the federal level.

According to Jon Allan (2023) of SEAS, “we spent the first nine months learning to agree”. This experience from Jon demonstrates it takes significant time to bring people together and find common ground when seeking to find a road to work together. Currently, the knowledge is not shared to water customers and that is not helping build the relationship with the public. This would suggest the public is not ready for the storytelling of current problems. They need a base level of understanding to be defined to allow the insights to hold a certain level of significance.

Communication is not going to be where it needs to be with a few flyers or a town hall meeting. It will take months and maybe even years to build a smarter belief system.

One of the other challenges is placing the information where someone needs it to be. Many of the customers simply do not have time or motivation to seek the charts online. They need the information brought front and center. When asking the water customer from Plymouth, MI about sharing a story during a football game break, he responded with, “I would say that is extremely helpful but I don't ever see it happening” (Michigan Resident 1, 2023). This shows there is a huge opportunity for new ways to inform the public about water information.

Outside of new ways to receive information, that same customer expressed confusion when reviewing metrics on a water bill and listening to the news. The information is not presented in a meaningful way. He mentioned he would like better guidelines to what is safe and dangerous for his family. Something similar to a grade scale as the education sector has used for centuries. F to indicate immediate action and C to indicate something is close

to becoming dangerous and customers should slightly review how they are protecting themselves.

Next Steps

Considering the findings, the next steps involve addressing communication challenges, bridging educational gaps, and simplifying information for better public understanding.

The emphasis is on making information accessible and engaging for the target audience. As Jon Allan (2023) mentioned, changing behavior with water is not like selling iphones but water is not as engaging. With addressing the communication challenge, there will need to be a deliberate effort to research the appropriate channels, frequency and quantity of information to present.

The first step is to raise awareness with basic water knowledge that data currently exists. Bandwidth and financial constraints may be the largest issues. When researching the communication for water cycles awareness, something at the federal level would be worthwhile. Water is not just a Michigan issue. This could be a larger effort to spread information to a larger audience.

Within the next 5 years is where the exciting solutions can be found. As artificial intelligence continues to improve there is light at the end of the tunnel. Similarly, virtual reality experiences are just starting to make some headway. This immersive technology could be placed within museums or other art exhibits to allow people to have an experience that will be unforgettable.

Conclusion

This comprehensive investigation has shed light on critical challenges and potential solutions surrounding water conservation and protection, making it evident that the path to success heavily hinges on effective communication with consumers and stakeholders. The heart of the problem revolves around information overload and educational gaps, inhibiting a crucial shift in consumer behavior.

Fostering communication between distinct groups is a meticulous but essential task. It's about crafting clear, engaging narratives presented through suitable media platforms. Meeting consumers where they are and educating them on best practices for water conservation and pollution can directly influence their habits, thus benefiting our ecosystem and the stakeholders involved.

The evidence suggests that hands-on experiences, public service announcements, and information accessible even to those with limited scientific knowledge can make a positive difference. Additionally, deploying a common grade scale for water quality and optimizing the data presentation on water bills could lead to an increased public understanding and engagement.

However, the journey to a more water-conscious society is a long one, requiring the collective efforts of water companies, government agencies, conservation organizations, and the public. Although our research couldn't delve deeply into specific communication channels within a constrained period, it sets a foundation for future endeavors, emphasizing the need to raise awareness and improve communication strategies.

The future looks promising as we anticipate advances in artificial intelligence and immersive technologies like virtual reality that could offer unique, unforgettable educational experiences. Overcoming these hurdles would mean achieving our desired goal - a more water-conscious society dedicated to preserving our vital water resources. Furthermore, this model can be broadened to a nationwide context, ensuring that all citizens have access to resources and information necessary to safeguard their water sources. We

hope that our findings inspire further investigations and innovative strategies to enhance water conservation efforts.

References

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Oswald, Eric J. (2023). Personal communication [Interview].

Pratt, E. (2023). Personal communication [Interview].

Urban, N. (2023). Personal communication [Interview].

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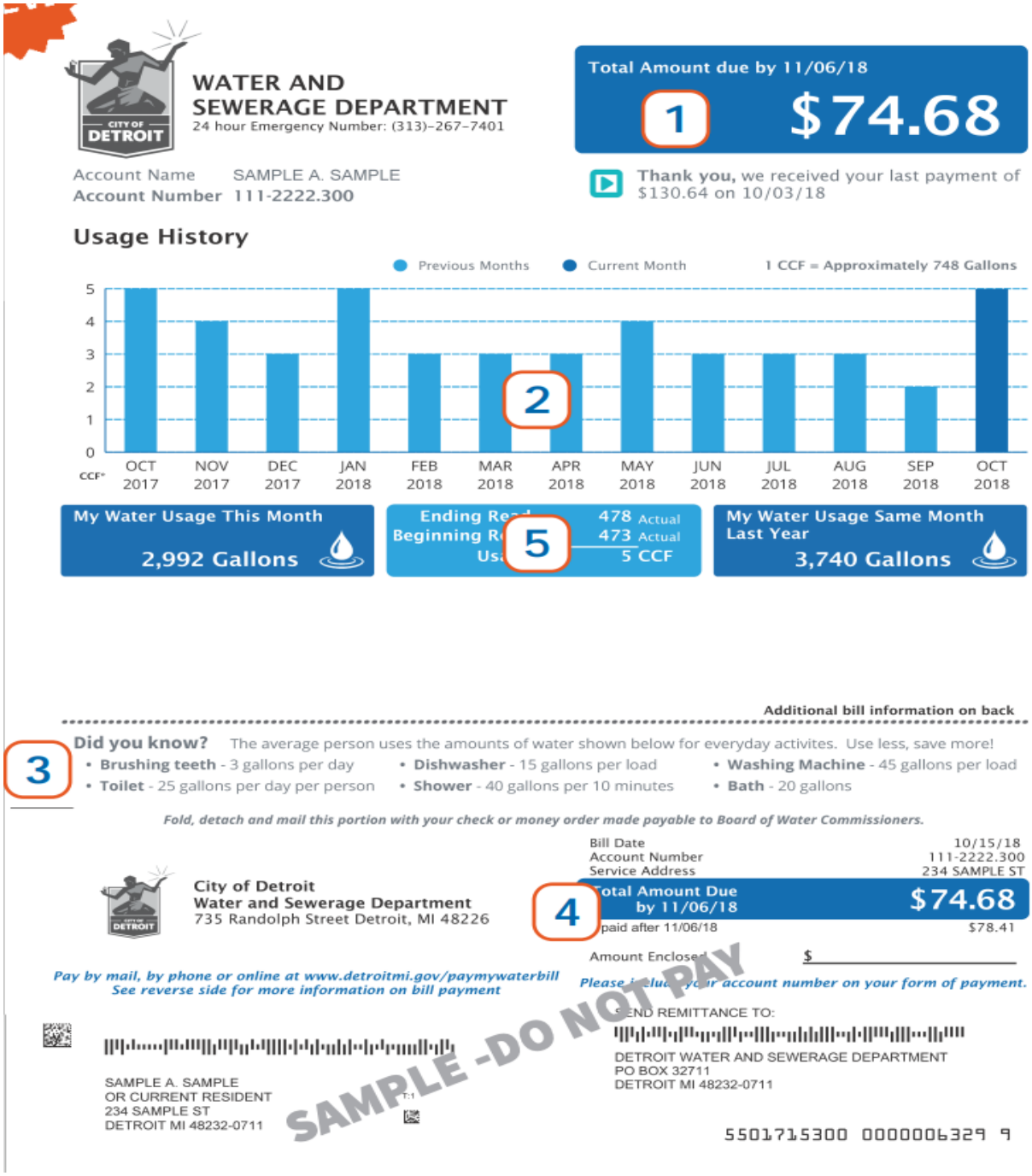
Appendices

Appendix A

Example of Michigan Water Bill



Appendix B
Resident Protocol

Introduction

Hello, our team name is Water Benders and we are all graduate students in the University of Michigan, Master of Science in Information. My class group is currently conducting research for the conservation and protection of water in Michigan. The goal of this study is to improve communication between water authorities and citizens to allow better water practices.

We would also like to assure you that no proprietary information will be revealed publicly. This study is voluntary, and you can decline to participate or withdraw your participation at any time, for any reason. This will take about 30 minutes.

We would now like to ask for your permission to record the interview.

Overarching Question

How can we effectively enhance the communication and data visualization strategies on water conservation for citizens in Michigan?

Key Questions

Section 1: Awareness and Perception

1. **How aware are you of the current issues related to water pollution and contamination?**
2. **Do you believe that the quality of water you consume directly affects your health and well-being?**
3. **When is the last time you have received some information about water quality changes?**

Section 2: Personal Engagement

4. **How often do you consider the source and quality of your water before usage or consumption?**
5. **Are there any steps you currently take to ensure the water you consume is safe and not contaminated?**
6. **Can you describe any changes in behavior or habits you might make if you were more informed about water quality issues?**

Section 3: Willingness to Participate in Water Conservation and Protection Programs

7. **Would you be interested in learning more about how to contribute to water conservation efforts?**
8. **How willing are you to participate in programs or initiatives aimed at protecting water resources?**
9. **Do you feel that you have a role to play in maintaining water quality, and if so, in what ways?**

Section 4: Views on the Sustainability Practices of Water Providers

10. **Would you be willing to pay a slightly higher fee if it ensured better water quality and the sustainability of water resources?**

Conclusion

Thank you very much for participating in our interview today. Your insights as a local citizen have provided invaluable contributions that will significantly inform our research on enhancing water conservation communication practices in Michigan. We deeply appreciate your time and the information shared, and want to assure you again that all data will be handled confidentially and used solely for our research purposes in compliance with the University of Michigan's ethical guidelines. Your involvement is crucial as we strive to improve communication between water authorities and citizens, aiming at better water practices in our state. Please feel free to contact us should you wish to share any additional information in the future. Thank you once again for your significant contribution to our study.

Appendix C

SME Protocol - Amanda Grimm, Great Lakes Commission

1. What are some key challenges and obstacles that you believe are currently impeding effective communication and data visualization in promoting water conservation to Michigan's citizens?
2. How do you measure the effectiveness of your current communication strategies?
3. What are the common misconceptions or misunderstandings by the public about Michigan's water issues based on your experience?
4. Are there any other environmental issues tied to water conservation that might need better visualization for the public?
5. What can be done to improve the use of data visualization in communicating Michigan's water issues?
6. What tools or resources do you rely on for creating effective data visualizations?
7. What role can digital platforms or social media play in communicating water conservation insights?
8. If there was another medium to communicate these issues, what would it be and why?
9. Are there any specific groups or demographics that you believe are especially important to reach when communicating about water conservation?
10. If there was a state-wide meeting on water conservation, what are the three most important insights you would share?

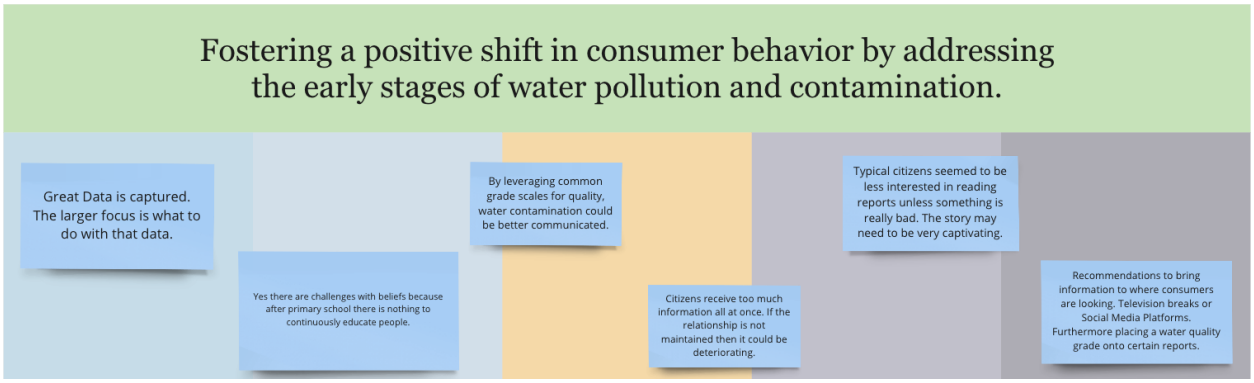
Appendix D

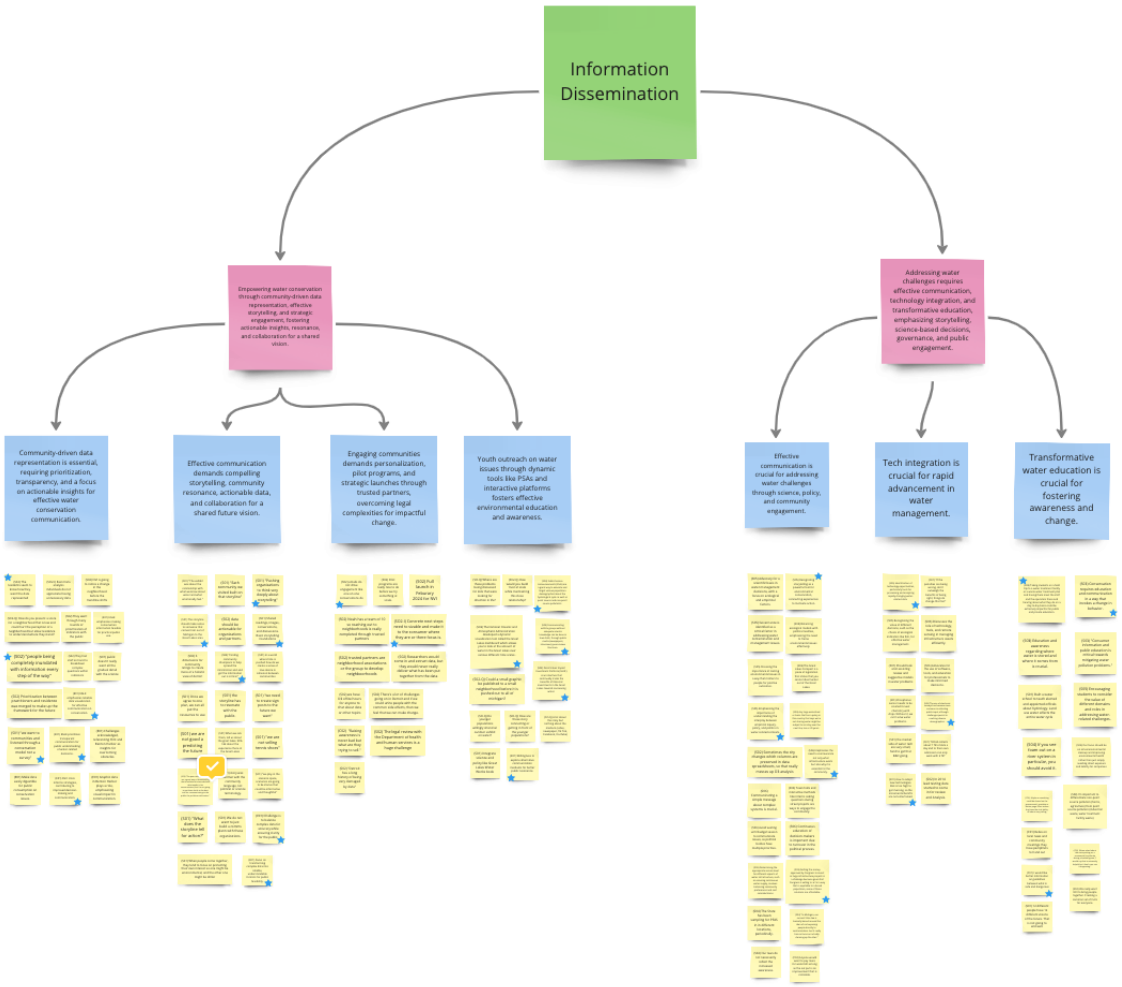
SME Protocol - Eric J. Oswald, EGLE

1. When it comes to communicating with the broader public about water quality and conservation, how does transparency relate to the decisions that EGLE makes?
2. What are some key challenges and obstacles that you believe are currently impeding effective communication in promoting water conservation to Michigan's citizens?
3. How do you (or how does EGLE) think about data visualization when it comes to communicating about conservation-related issues?
4. If there was another medium to communicate these issues, what would it be and why?
5. How have EGLE's communication strategies developed over time?
6. How do you measure the effectiveness of your current communication strategies?

Appendix E

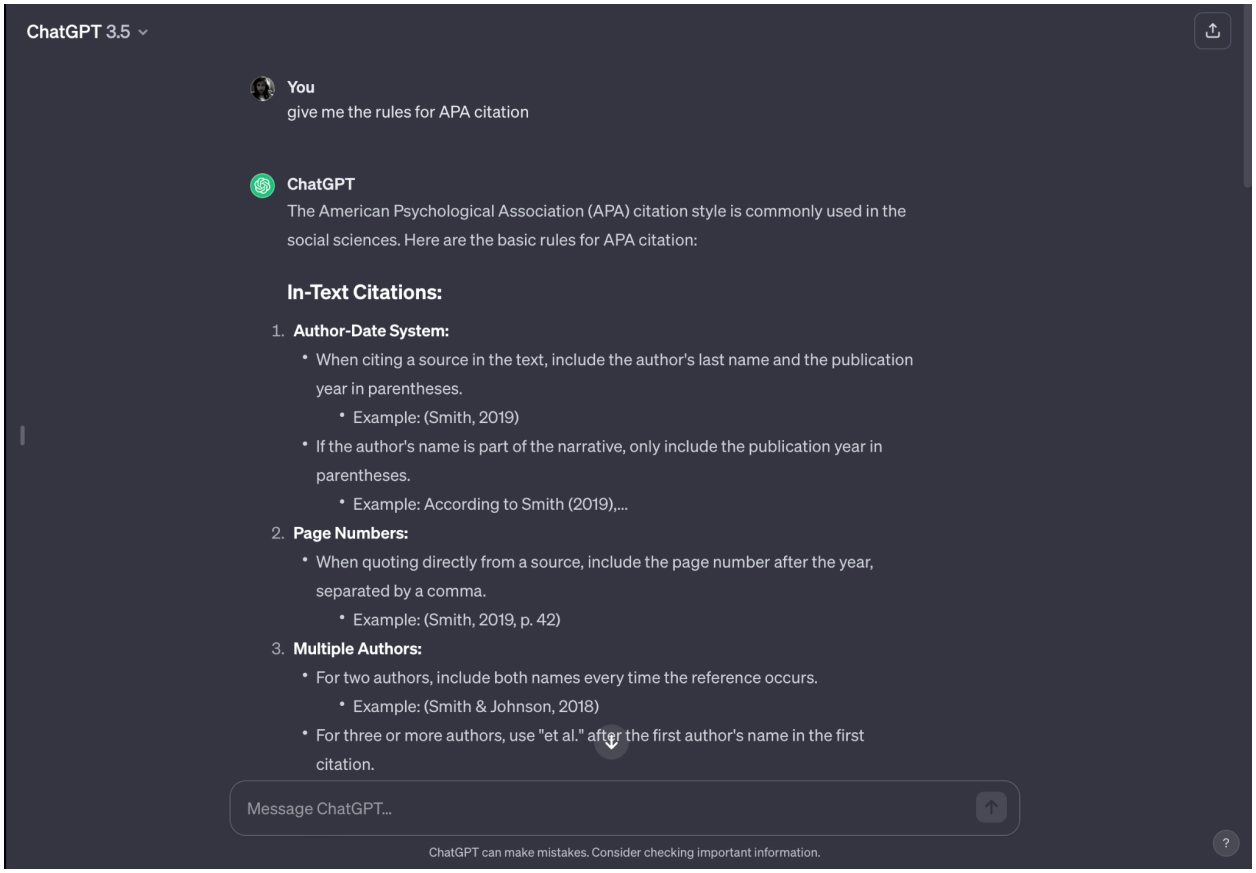
[Affinity Wall]





Appendix F

Generative AI - ChatGPT



Throughout the assignment, ChatGPT was utilized for brainstorming and polishing text for creating this concise final report.

Appendix G
Data Collection

Team 006-04 / Anupama Bhatta | David Cox | Shaoze Yang

Narrative Overview:
Our data collection spreadsheet is organized with dedicated sections for each of the ten data sources, providing information about their sources, data types, access methods, and update frequencies. It includes specific codes or identifiers to facilitate tracking and retrieval. The data sources are divided into three main categories: government agencies, international organizations, and non-profit/community initiatives. These sources collectively offer a broad spectrum of data related to water quality, pollution levels, and sanitation, allowing for a comprehensive analysis of the topic from various perspectives.

To prepare the data for the upcoming affinity diagram assignment, I will first categorize and sort the collected data based on common themes and key variables. This initial organization will enable me to identify connections and patterns within the data. The affinity diagram will then serve as a visual tool to represent these relationships and insights, making it easier to spot trends and groupings that will inform my project. This approach will help us gain a deeper understanding of water quality and pollution issues both domestically and internationally.

Data Source	Identification Details	Source Type	Specific Source Note	Collection Date	Key Themes/Topics	Quotes/Extracts	Citations of Scholarly articles/ Press Releases/Social Media Posts/datasets	Notes
The Environmental Protection Agency (EPA)	EPA-01	Dataset	https://sdwis.epa.gov/ords/	2023 Quarter 3	Enhancing Public Water System Transparency and Accessibility through Data-driven Reporting	query the SDWIS Fed Data Warehouse, for example, the detail of water system, which includes the city it serves, the Number of Facilities, Number of violation	URL of Dataset	Provides extensive data on the pollution level in drinking water across the US. You can find specific data on the Safe Drinking Water Information System (SDWIS).
World Health Organization (WHO)	WHO-02	Report	https://who.foundation/	2023 October	Raise people's awareness of water safety and health problem	"The Health Emergencies Alliance mobilizes for Türkiye and Syria" "A Climate and Health Diagnosis: Five Takeaways"		Offers global data on water quality and sanitation, including pollution levels.
US Geological Survey (USGS)	USGS-03	Photo	https://www.usgs.gov/	2022	Understanding the Global Water Cycle and Human Impacts on Water Distribution and Quality	"The Water Cycle" "The Natural Water Cycle"		Information on water quality and pollutants in US bodies of water.
United Nations Water	UNW-04	Desk Research	https://www.unwater.org/bethechange/	2023 October	List of small themes to better communicate towards the citizen	"Take part in local cleanups" "Don't let it run" "Be Curious" "Stop Dumping waste/chemicals"		This database provides international data on water pollution and sanitation.
The National Water Quality Monitoring Council (NWQMC)	NWQMC-05	Photo	https://www.youtube.com/watch?v=DPSmwdl44sM	Sept 16th 2015	How scientist and government should curate their information for citizen attention.	"Conceptual diagrams can simplify complex processes" Simple drawings could create common beliefs accross language and culture barriers.		Offers information on water quality in different areas of the US.
Global Water Partnership (GWP)	GWP-06	Photo	https://iwrmactionhub.org/learn/iwrm-tools/information-gathering-and-sharing-networks	2021	This resource discusses the journey from collecting data to presenting it for future influence on human behavior.	"connecting data to users; incentivizing users to incorporate data into the decision-making process; and influencing them to value data."		This international network provides datasets on water resources, including pollution.
The Water Data Collaborative	WDC-07	Artifact	https://www.waterdatacollaborative.org/mainstem-network	2023	The WDC's Mainstem Network wants bring all facets of community-focused water quality monitoring under one umbrella from study design to data management.	"Discover the impact that community-led water quality programs can have."		Community-based water quality monitoring data.
UNESCO	UNESCO-08	Artifact	https://en.unesco.org/waterqualitymonitor	2023	The UNESCO World Water Quality Portal showcases and demonstrates the potential of remote sensing and satellite Earth Observation to improve water quality monitoring towards sustainable water resources management.	"monitor the trend and evolution of water quality and pollution, and assess anthropogenic and climate change impacts on water resources"		Scientific programmes and policies fostered as platforms for development and cooperation.
Water.org	WO-09	Report	https://water.org/our-impact/all-stories/to-when-flowers-bloom/	2016	Promoting access to safe water and sanitation facilities, and empowering communities through financial solutions, education, and partnerships to address the challenges of water contamination in underserved areas.	"Long-term, affordable access to safe water at home empowers families to explore their income-generating potential."		Sustainable water and sanitation solutions to improve access to clean water and sanitation facilities, and promote hygiene and education
Water Residential Assistance Program (WRAP)	WRAP-10	Report	https://www.waynemetro.org/wp-content/uploads/2023-Wayne-Metro-Community-Needs-Assessment.pdf	February 2023	Two-year program that provides funding to eligible, low-income households to assist with water bills, water conservation, and self-sufficiency initiatives.	"From my initial appointment with Wayne Metro, I felt at ease and received assistance to pay my back rent within a short period of time."		Envisions thriving communities where all people have hope and opportunities to realize their full potential.