June 2022

“That’s What We Call ‘Aesthetics’”: The Social Construction of Tap Water Mistrust in an Underbounded Community

Abby Vidmar
University of South Florida

“That’s What We Call ‘Aesthetics’”: The Social Construction of Tap Water Mistrust in an Underbounded Community

by

Abby Vidmar

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts
Department of Anthropology
College of Arts and Sciences
University of South Florida

Major Professor: E. Christian Wells, Ph.D.
Tara Deubel, Ph.D.
Heather O’Leary Ph.D.

Date of Approval:
June 21, 2022

Keywords: water insecurity, water infrastructure, risk perception, underbounding, environmental justice

DEDICATION

This thesis is dedicated to the University Area CDC, the residents of the University Area, and city and county water, sanitation and health staff and leaders in the Tampa Bay Area, without whom the completion of this thesis would not be possible.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my committee members, whom I am greatly indebted to, for their immense support and collaboration throughout this process. A very special thanks to Christian Wells; my advisor and chair whose advice, guidance, and humor fueled my work and ignited my desire to advocate for environmental justice, to Tara Deubel; whose knowledge, timely input and thoughtful suggestions pushed me to think about my methodology and research opportunities on a deeper level, to Heather O'Leary; whose meaningful insight challenged me to reveal theoretical connections within my work.

I am beyond grateful for Madeleine Zheng and Nora Awad who were amazing research assistants and friends, who provided excellent insight and contributions to this work. I also wish to thank Eryani Moran-Adames, who was instrumental during research at Harvest Hope Park tabling events, helping in the data collection and Spanish translation.

I gratefully acknowledge the residents of the University Area Community, Sarah Combs, Diana Diaz, Sara Roman, and our partners at the University Area CDC for their enormous support and teamwork in this project, without whom this project would not have been possible. They opened their arms and provided me with the opportunity to navigate the social networks of the University Area.

I also wish to thank all of the city and county water and wastewater engineers, infrastructure and health department staff, and social and political leaders in the Tampa Bay Area, who shared their knowledge, insights, and suggestions. This work would not have been possible without their candor and cooperation.

Lastly, I wish to thank my family and friends, who supported me in all my ups and downs throughout this research process. Your love, encouragement, and guidance helped me get to where I am today and continues to fuel me on my future endeavors.

This research was conducted with the permission of the University of South Florida Institutional Review Board, IRB Study 002686. All names identified in interview excerpts are pseudonyms.

This material is based on work supported by the U.S. National Science Foundation, Grants No. 1937085 and No. 1950458.

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

Recent research on water insecurity in the United States has revealed that underbounded communities — urban disadvantaged unincorporated neighborhoods characterized by high-poverty and high residential density lying just outside the border of an incorporated municipality — often lack consistent access to clean and safe water. In these settings, poor water quality and inadequate infrastructure shape residents' risk perceptions often leading to tap water mistrust. However, little is known about the broader social, political, and economic drivers of water quality in these settings and how such drivers inform the social construction of risk across different stakeholder groups. Using an underbounded African-American/Hispanic neighborhood in the Tampa Bay metropolitan region as a case study, this paper examines how tap water mistrust is socially constructed and how these constructions contrast between neighborhood residents and government officials. Interviews and participant observation with these groups reveal that tap water mistrust emerges from the nexus of inadequate infrastructure, poor housing conditions, affordability challenges, and jurisdictional disconnects. We call for interventions that foreground participatory research, integrate social and cultural context into technical solutions, and prioritize equitability in decision-making

CHAPTER ONE: INTRODUCTION

On January 31, 2022, residents of the Holly Court Apartments in Tampa's University Area Community gathered in the parking lot and shouted, "You can't push us out!" at a rally outside their building. Residents were protesting their eviction for speaking out about poor water quality. This is a common tactic used by landlords in the community to silence residents and sideline protests. One of the protesters was Lavaria, a resident in the building, who, in an interview with a local newspaper, claimed "our babies get UTIs from bathing in contaminated water in the bathroom" (Scott 2020). Other residents have also been speaking out — to the media, to our research team, to anyone who would listen. Residents complained of bodily rashes, burning eyes, and nausea when showering. Delila, a young mother who used to live in the building, told us, "the water… smell[s] like sewage" (interview, June 18, 2021, private residence). Many residents we spoke with, like Delila, repeated the phrase "I just don't trust it," referring to the tap water, and instead rely on bottled water for bathing and cooking. For those who cannot afford to buy water, bathrooms and taps are utilized in a carefully orchestrated network of friends and fast-food restaurants throughout the community.

This was not the first time the residents of Holly Court experienced water problems. In 2018, the Department of Health was pressed to investigate and found excess levels of chlorine and iron (seven times the maximum contaminant level established by the Safe Drinking Water Act, (SDWA 42 U.S.C. §300f et seq. (1974)), the only two chemicals the state would bother to test. These findings prompted a change in management company for the apartment complex, and the problem was reportedly "fixed." Yet, residents we spoke with did not trust the water and

cited additional problems with color, taste, and smell. As Joe, a water engineer who has been with the county for nine years, told us, “You can drink crappy tasting water all day long and it’s not necessarily a health consequence to you… What you smell in the water doesn’t necessarily mean it’s bad for you.” (interview, June 21, 2021, county office). For many residents, to just trust the water, was not — and is still not — a viable solution.

Thesis Organization

My thesis is organized into five chapters. Chapter 1 begins with a short anecdote illustrating the water, sanitation, and housing insecurity challenges that plague residents in the University Area. Chapter 2 provides a brief overview of the literature on water and sanitation challenges in urban communities. In the first section of the chapter discusses the compounded insecurities that residents of disadvantaged unincorporated urban communities (DUUCs) face, by describing what and how DUUCs form, and their unique challenges of water and sanitation. In the second section, I explain the theoretical framework used in this thesis. I explain the anthropological theory of risk perception of environmental risk, specifically water quality and the gap in the literature of a dual perspective from ‘authoritative’ and ‘local’ knowledge holders. Then I delve into the concept of infrastructural violence, the linked nature of it and underbounding, and the encompassing framework of environmental justice overarching the situation of water and sanitation insecurity in disadvantaged unincorporated urban communities.

Chapter 3 provides description and overview of the University Area Community. I detail the interconnected social, health, economic, and environmental challenges that residents face. Then I explain the data collection methods used for this project. A mixed-methods and dual perspective approach was used to understand the perceptions of water and sanitation insecurity amongst stakeholders in the community. I conducted participant observation, rapid assessments,

and semi-structured interviews, and used census information, newspaper articles, environmental reports, and governance documents from water utilities to understand these perceptions. The chapter ends with an open discussion of my positionality and how it impacted my research.

Chapter 4 is organized into sections based on key themes revealed in my research from various stakeholders. These major themes include; the "Aesthetics" of Water Quality or how water quality is perceived by different individuals; Plumbing Past the Curb Stop, or the intertwined housing, water and sanitation nexus and its unique challenges; "We Don't Put in Pipes for Free," the fiscal and monetary barriers to solutions, and Jurisdictional Ping Pong, the political barriers to water, sanitation and housing insecurity in an underbounded unincorporated urban community. Data supporting each sectioned theme is outlined in this chapter.

Chapter 5 concludes in a section titled Pipe Dreams. This section summarizes the findings from this research, outlines recent events at the local and national level that aim to address the water and sewer challenges in the University Area, and concludes by cementing this work in the theoretical and applied anthropological frameworks of risk perception, infrastructural violence, and environmental justice.

CHAPTER TWO: LITERATURE REVIEW

Disadvantaged Unincorporated Urban Communities (DUUCs) WSI Challenges

The University Area Community is like many urban disadvantaged unincorporated communities throughout the United States, where decades of municipal underbounding have led to wide-scale disinvestment in public infrastructure. Underbounding is the process of excluding certain communities, often African American, Hispanic/Latino/a/x, and Native American, from city boundaries, thereby precluding residents from access to municipal water and sewer services (Aiken 1985). Over time, this practice has resulted in unwanted land use in these communities, such as the siting of industries that produce hazardous wastes, which contaminate local soil, water, and air with harmful pollutants (Durst 2018; Stillo and MacDonald Gibson 2017; Mohai et al. 2009; Wells et al. 2020). Contaminating and polluting industries lowers property values in underbounded communities and increases public health hazards (Wells et al. 2020). Groundwater contamination can become a larger public health issue because of the prevalence of private wells in underbounded communities and dramatically increases when well water is not regularly checked (unregulated by entities beyond private owners) after initial construction (Hunter et al. 2021; Munene and Hall 2018). For example, Fizer et al. (2018) studied barriers in private well management in underbounded communities in Wake County, NC and found lack of awareness of well maintenance requirements, and due to high cost of laboratory water quality tests, use sensory information to determine safe water even though some harmful contaminants are odorless and colorless. The UN-WHO Joint Monitoring Programme (2020) found that approximately 10% of the U.S. population relies on well water. Perpetual contamination and

shortage issues are abundant for well water dependents (UN-WHO 2020:4). Unfortunately, these solvable well water issues go unaddressed even though many local health departments have available information resources on their website, in addition to voluntary monitoring, education and training programs. Some property owners, even if they are aware of the services, do not have the funds to repair and maintain wells that are currently in bad condition (Fizer et al. 2018). Notably, underbounding also often results in unsafe or inadequate water and sanitation infrastructure as well as the inability to participate in decision making about utilities' services (Anderson 2010; Wells et al. 2020).

The gap between cities and suburbs or often, disadvantaged underbounded urban communities, are gaining national attention. In California's Central Valley, cities and local water districts controlled by wealthy property owners bypass low-income and unincorporated communities for services and positions in groundwater agencies (Pannu 2012, Dobbin & Lubell 2019). Additionally, unincorporated communities along the U.S.-Mexico border must, "rely on water vending machines and retail water stores, small, decentralized water systems, tanker trucks, nonprofit water corporations and other non-networked means of water supply" (Meehan et al 2020a, 9).

Disparate housing is also tied to water insecurity, revealing racialized wealth gaps. Meehan et al (2020b) call this intersection of housing, social inequality (race and class), and water, the housing-water-nexus. For example, residents in mobile homes face significant barriers to stable and quality water service (Pierce and Jimenez 2015). People experiencing homelessness or inconsistent shelter encounter punitive barriers and access to adequate water and sanitation services (Capone et al. 2020; Meehan et al 2020b). Unstable housing and hydraulic citizenship, the recognition of citizenship/belonging in quality water service (Anand 2017), further illustrate water insecurity's anchor in socioeconomic and political marginalization. Clean water challenges

in disadvantaged underbounded urban communities demonstrate how health is not random, but instead politically decided (Wells & Whiteford 2021).

Risk Perception, Infrastructural Violence, Environmental Justice

While research on water infrastructure in underbounded and other urban communities in the Global North is starting to accelerate (Meehan et al. 2020a,b), much of this literature tends to situate water quality risk as a technoscientific outcome of chemical and biological contamination that prioritizes expert knowledge often over qualitative experiences (Kiessling and Maxwell 2021). As a result, the perceptions of community residents are often not integrated into risk assessments, leaving tap water mistrust as a technical challenge for water scientists and engineers to solve (O'Leary 2018; Brulle and Pellow 2006; Stoffle et al. 1991). Checker (2007), for instance, demonstrates how environmental risk assessments often dismiss the experiences of low-income, people of color, because there is an inability to find 'scientific proof' to show chemicals in their water and soil are the reason for their health problems. Here, we argue that residents' perceptions of water quality are informed by their diverse experiences with not only water but also housing conditions, affordability challenges, and jurisdictional disconnects between governmental and regulatory agencies.

Many studies demonstrate how risk perception of drinking water quality is influenced by a wide range of factors including sensorial information (especially flavor and odor), trust in public utilities and governance, outside information from media coverage, prior experience, socioeconomic status, believed control (of the services), and societal and personal vulnerability (Alameddine, Geeda, and El-Fadelet 2017; Doria 2010; Gutiérrez-Capitán, Brull-Fontsere, and Jimenez-Jorquera 2019; Hu, Morton, and Mahler 2011; Mumbi and Watanabe 2020). Thus,

environmental risk perceptions connect with socio-cultural categories and constructs of health, science, community, and justice (Haenn 2003).

Since risk perception is interconnected to social, economic, and political issues that surround water treatment and its delivery, environmental justice struggles like those experienced in the University Area Community must be considered broadly in an interconnected web of systems of discrimination and "infrastructural violence," or the ways in which infrastructures materialize and channel structural violence (Rodgers and O'Neill 2012; Wells and Whiteford 2022). WatSan risk perception and insecurity are theorized through infrastructural violence which stems from structural violence centered on the detrimental effects of inequitable quality and access of infrastructural services and resources (Rodgers & O'Neill 2012). For example, when access to quality water and sanitation infrastructures are limited or nonexistent, human and environmental health are at risk (Rodgers & O'Neill 2012; Anand et al 2018; Dietz & Meehan 2019; Meehan et al. 2020b; Wells & Whiteford 2021). Environmental justice unveils how socio-economic and political discrimination and manipulation create and exacerbate environmental risk (Brulle & Pellow 2006; Bullard et al. 2008). Race and class disparities produce household water insecurity and increased perception of risk (Meehan et al. 2020). Infrastructural (housing, piping, resources and services) conditions and structural (social, racial, political and economic) systems collide as the "housing-water nexus" where unplumbed homes are more likely to be headed by people of color who have lower income, rent, live in mobile homes, and pay a higher share of their gross income to housing costs (Meehan et al. 2020). In this way, infrastructural violence and underbounding are linked processes of disenfranchisement that create or exacerbate environmental risk and injustice threatening human health and wellbeing (Truelove and Ruszczyk 2022; Brulle and Pellow 2006; Bullard et al. 2008).

This research on risk perception builds upon previous findings of environmental justice, water and sanitation infrastructure, infrastructural violence, and plumbing poverty in the UAC in Tampa, FL (Hinds 2019; Lehigh 2018; Wells et al. 2020). Wells, Wakhungu, Abdel-Mottaleb, Wu, and Zhang (2019) recently developed a geospatial vulnerability framework to identify inequities in water infrastructure in Tampa, FL. They found the highest levels of environmental and social exposure existed in low-income communities of color. Wakhungu (2020) explored the perspectives and reasons behind inequitable WASH services in Sulphur Springs Fl, revealing residents' experiences, and current plans and setbacks in addressing infrastructural violence. Hinds (2019) investigated UAC residents' views of stormwater management, infrastructure, and redevelopment. She found that inadequate infrastructure, climate change, and power dynamics in municipality support fuse to create flooding disasters. Lehigh (2018) explored community engagement and capacity building in the redevelopment of a brownfield site in the UAC. She found that resident engagement in brownfield redevelopment projects enhances environmental and social health establishing skills and resources to instigate positive change for their community. This research leveraged these studies to contribute to a broader understanding of risk perception and infrastructural violence as it is expressed through post-meter and off-network plumbing poverty within the University Area Community.

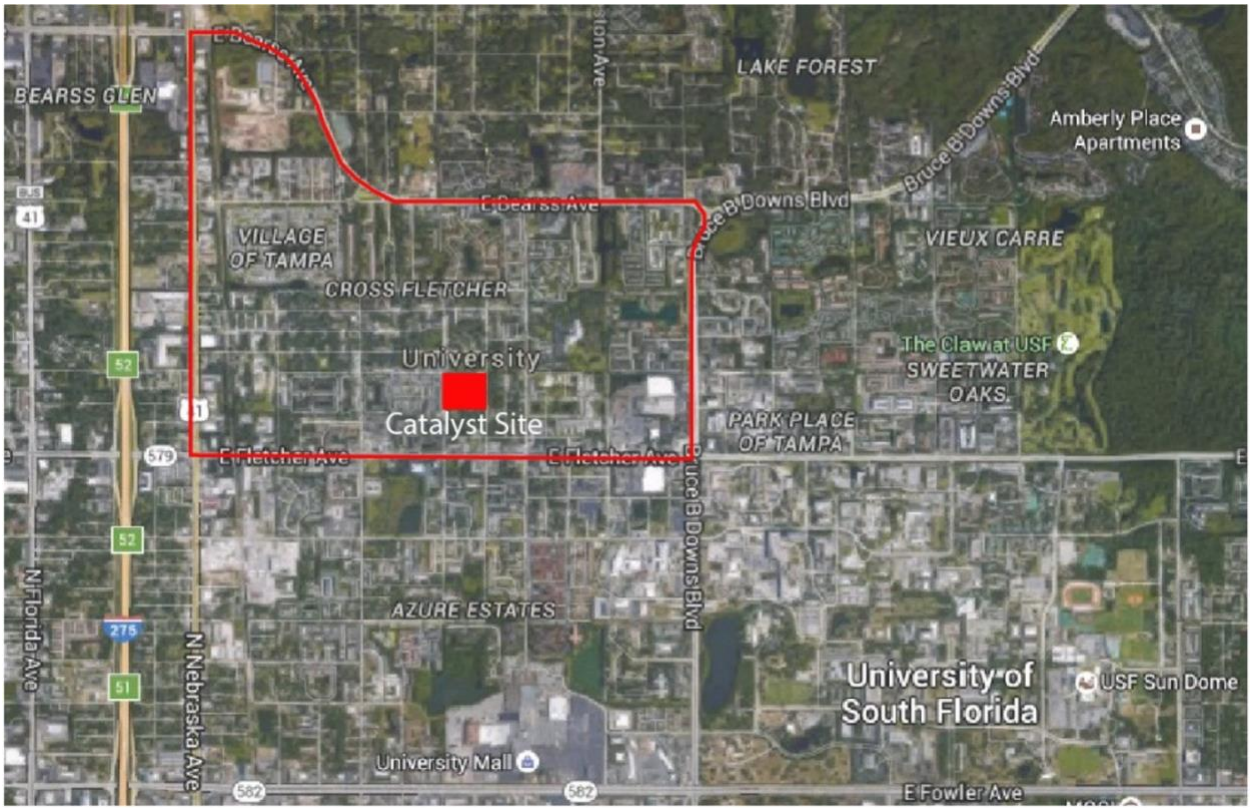


Figure 1. Map of the University Area Community (outlined in red)

CHAPTER THREE: METHODS

Study Area: University Area

People in Tampa use alot of "u" words to describe the University Area Community: unincorporated, underbounded, underserved, under-resourced. Regardless of the term one uses, they all convey the same observation — no municipality has wanted to incorporate the community and provide it with adequate services for people to live safe and healthy lives (see Figure 2). As a result, residents face a multitude of interconnected social, health, economic, and environmental challenges (Hinds 2019; Lehigh, Wells, and Diaz 2020; Wakhungu et al. 2021; Wells et al. 2020). Census data from the American Community Survey (2015-2019) tell part of the story (U.S. Census Bureau 2019). About 79 percent of the 11,894 residents represent historically marginalized groups (50 percent identify as Hispanic and 27 percent as Black), approximately 90 percent of whom are renters. Many residents lack formal education (31 percent have a high school degree), 33 percent are unemployed, and 26 percent fall below the federal poverty level.

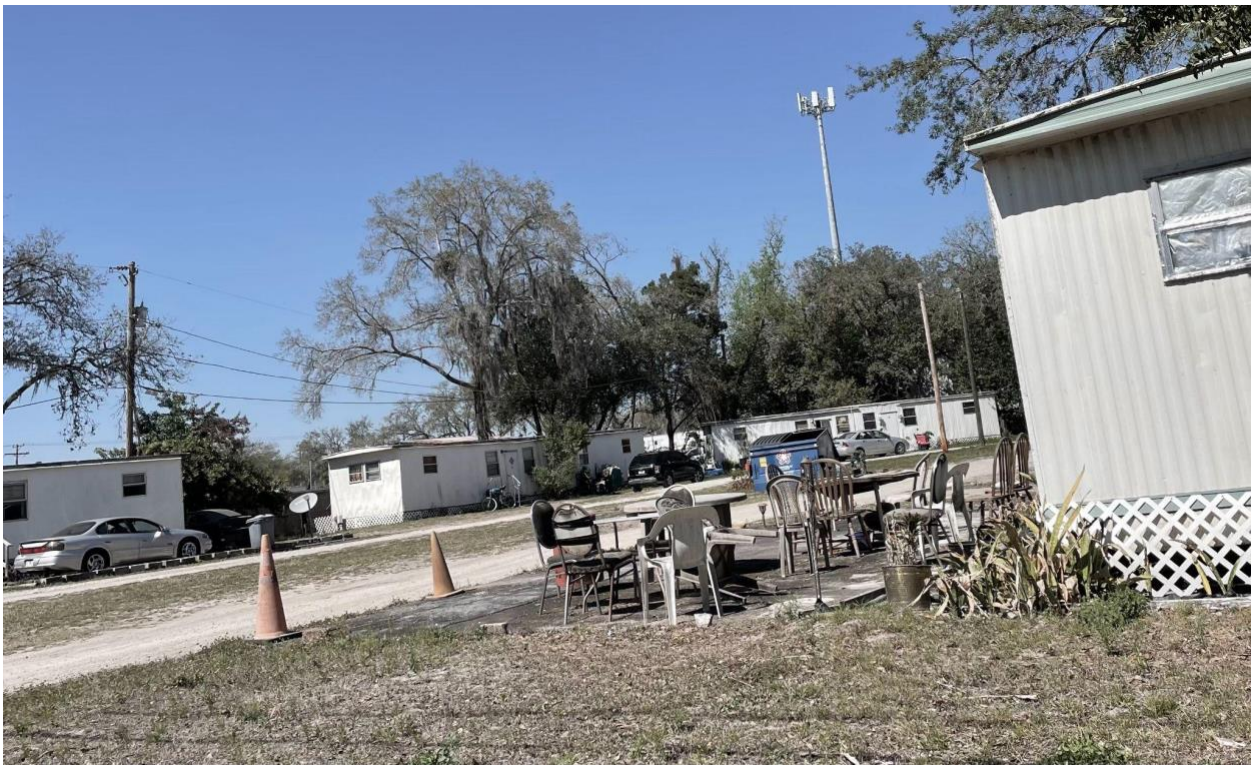


Figure 2. Mobile homes in the University Area

The U.S. EPA's EJScreen tool also reveals that the community ranks at or above the 90th percentile (compared nationally) for hazardous waste proximity, $PM_{2.5}$ (fine particulate matter), air toxics cancer risk, traffic proximity, and wastewater discharge (U.S. Environmental Protection Agency 2022). To culminate the multitude of environmental socioeconomic demographics discussed, the percentage of households below the quality-of-life threshold income (per census block) in the University Area showed that all census blocks range within 90-100.00 (EnviroAtlas, 2022). This means that between 90-100 percent of residents live with an income below the quality-of-life index depending on the census block. In addition to the higher instances of toxic wastes, air quality measures, flooding, and wastewater discharges, large segments of the community are medically underserved (EnviroAtlas, 2022). Lastly, high levels of crime are prevalent throughout the community (FBA Atlas, 2019). For example, total crime is double the national average (index at 202.24), and the assault index is 416.65 percent above the

US average (FBA Atlas, 2019). These different socioeconomic measures compounded by the environmental challenges begin to highlight the experiences of residents (see Figure 3 & 4).

Figure 3. A railroad cuts through the University Area

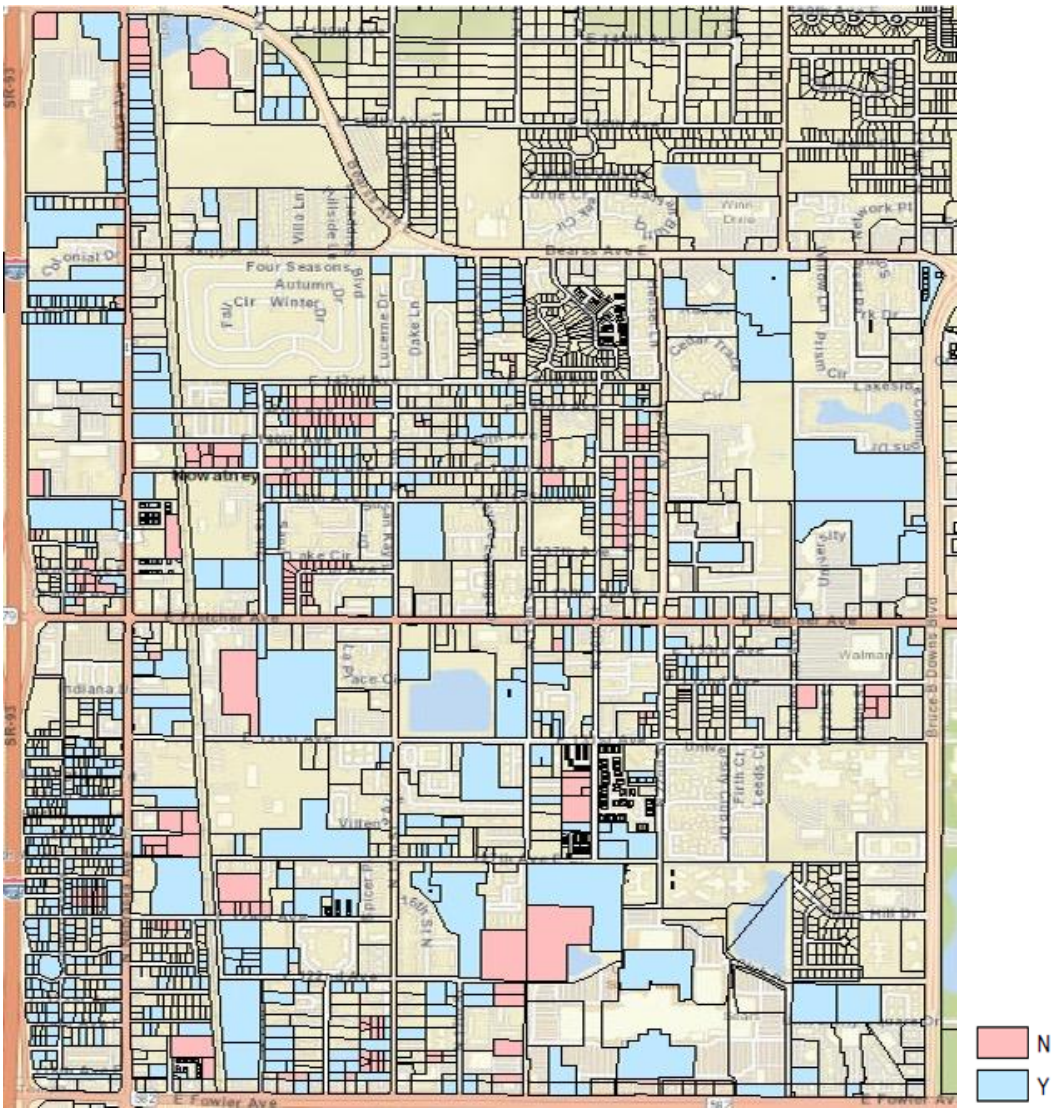


Figure 4. Map of Water Serviced Parcels in the UAC

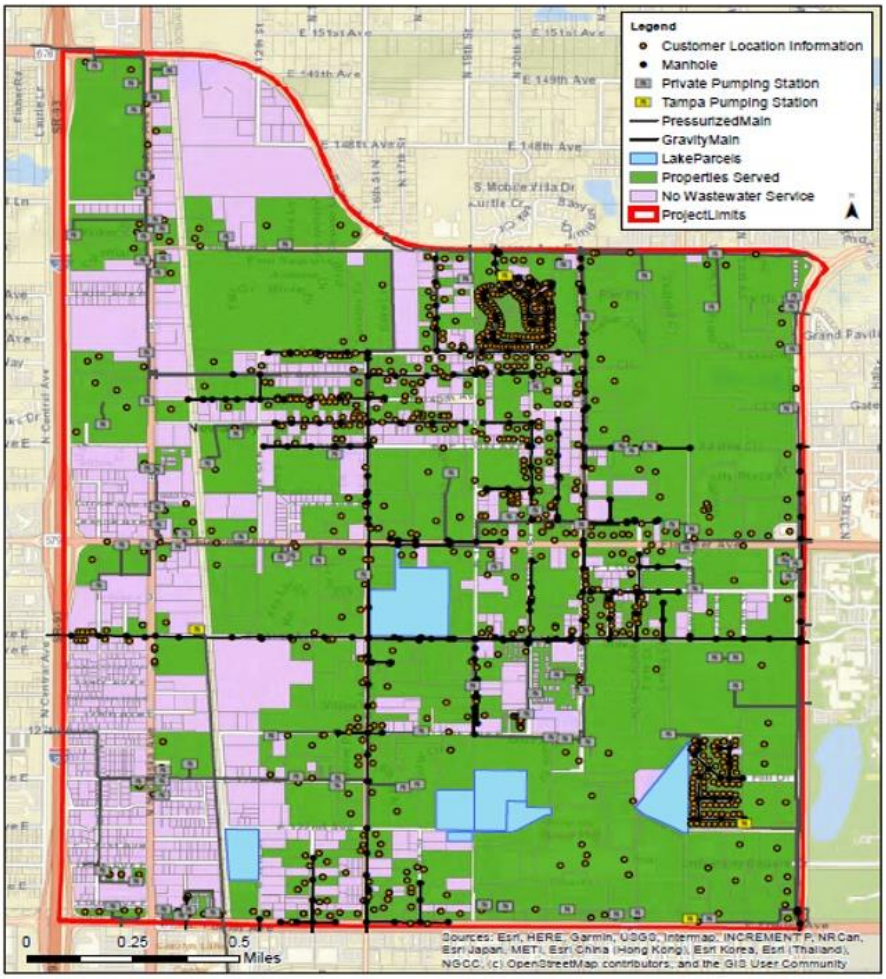


Figure 5. Map of Wastewater Serviced Parcels in the UAC

Of greater concern, however, to residents in this study are basic water and sanitation. Based on ground-truthed maps of water and sewer access in the community that we obtained from the city and county, we estimate that approximately 1,972 (or about 20 percent) residences do not have piped water or sewer access, and instead reply on private drinking water wells (or bottled water) and onsite wastewater treatment, such as septic systems — even though city water and sewer networks are in close proximity (see Figure 5 & 6).

Data Methods

This research was conducted over nine months of fieldwork in the University Area Community where I partnered with the University Area CDC, a community-based nonprofit with deep roots in the community that facilitated our research. I volunteered with their 10-week Block-by-Block program, in which volunteers meet with residents in their homes to learn about their needs and challenges and then provide various resources and forms of support (see Figure 7). These focused interactions with residents resulted in additional contacts through referral sampling. I also attended and participated in the University Area CDC's weekly community garden harvest and many other occasional events and activities where we could interact with community residents (see Figure 8). Finally, contacts with the University Area CDC also helped me meet and speak with key informants in the city and county representing water sector professionals.

Figure 6. Block-by-Block Volunteering

Figure 7. Tabling at Harvest Hope Park

Overall, I conducted 135 hours of participant observation, 28 rapid assessments (brief, structured interviews lasting roughly five minutes), and 24 in-depth semi-structured interviews ranging from 30 minutes to an hour each (some conducted virtually due to the COVID-19 pandemic). Recruitment and eligibility of individual's participation was planned based on factors such as residency in the University Area, association with UACDC or other local nonprofits working directly with community members, and referral sampling. I 'studied-up' to understand perceptions from local political and social leaders, such as city, county and nonprofit officials about household water and sewer quality and security in the UAC (Alba et al. 2014; Nader 1972). To unveil authoritative knowledge, I conducted longer, more formal semi-structured interviews with key informants from the City of Tampa and Hillsborough County water, wastewater, solid waste, and development and infrastructure departments (see Figure 11). Interviews with officials from the Hillsborough County Florida Department of Health and the

Hillsborough Environmental Protection Commission supplemented information from engineers (see Figure 9). I conducted 10 interviews with individuals amongst these departments. Due to COVID-19, several of these interviews were online or over the phone. I also attended various meetings, workshops, rallies, and other public forums, recording our observations through fieldnotes (see Figure 10). Finally, I used secondary data, including census information, newspaper articles, environmental reports, and governance documents from water utilities, to broaden our understanding of water quality challenges and related issues in the community.

Figure 8. Interview at the City of Tampa Department of Solid Waste & Environmental Program Management Office

Figure 9. Town Hall meeting at UACDC about challenges and improvement for the community

Figure 10. Inside the City of Tampa Water Treatment Facility during interviews

Data Analysis

Data from the rapid assessments were examined using descriptive statistics and cross-tabulation analysis to identify key themes and associations. I recorded and transcribed the interviews for thematic analysis using inductive coding to identify recurrent themes (Bernard 2017). I examined the data as a set of texts and coded for themes. Through inductive coding, I discovered themes that repeatedly came up in the collected text data. Through the deductive groupings, 'authoritative' and 'local' knowledge, I was able to identify convergences and overlaps of themes in the data so that coding was a technique to group the data into categories (Bernard 2011). Parent codes included money, affordability, jurisdiction, renter, pipes, backups, bottled water, smell, sewage, chlorine, trust, hook-up, aesthetics, maintenance, landlord/property owner, and flooding. Field notes were thickly described to give context to the multitude of stakeholders' perceptions and experiences of risk related to WatSan infrastructure in the UAC (Geertz 1977). I used grounded theory to further analyze codes to uncover patterns and relationships that elucidate and supported theory on risk perception, infrastructural violence and environmental justice to help understand the findings (Bernard 2011, 459).

The relationships from these codes were compared and ultimately supported with statistical analysis. From the rapid assessment survey responses recorded (n=28), cross-tabulation analysis and correspondence analysis were performed. Descriptive statistics (e.g., frequency bar graphs) revealed patterns amongst the responses to water and sanitation risk perceptions. Fisher's Exact Test was performed to compare variables and determine statistical significance from rapid survey assessment questions. For example, comparing perceptions of quality tap water and reliance on bottled water. Correspondence analysis plots allowed comparison of two sets of variables to understand the strength of the relationships between responses. Also, I conducted a network visualization based on text analysis using the tf-idf

statistic to extract key topics from five interviews with residents of the University Area Community based on their weighted frequencies of occurrence. This allowed us to see the common words and their connections during longer interviews with residents wherein themes came up illustrating several codes conducted in qualitative analysis but also newer connected themes.

Using the findings from this research, I explore the ways and extent to which local understandings of water quality intersect with or diverge from authoritative perceptions of water challenges by "outside experts" (Nader 1972). In the sections that follow, I compare and contrast these perspectives in the broader context of drivers of tap water mistrust, arguing that mistrust can be understood as a social construction (Andrews 2012; Oktem 2016), one that is shared and expressed differently across stakeholder groups. In particular, I examine how social constructions of tap water mistrust are informed by water infrastructure, housing conditions, finances and affordability, and the different ways in which water is governed and managed by the city and the county.

Positionality and Limitations

Throughout this research I collaborated with a mixture of local and non-local Tampa residents. My positionality as an outsider to the community impacted my work. I am a young, white, middle class, graduate student woman not originally from the area. Therefore, I was cognizant of how I interacted and may have been perceived by stakeholders in the community. For example, residents may have responded a certain way because of their perceptions of me. In response, I had tremendous support, feedback, and collaboration with residents, staff, and students from the community, UACDC and USF who helped serve as cultural brokers,

translators and collaborators in this research. Representative and intersectionality sampling was structured into the planning phase and employed as possible but included individuals based on availability and willingness to participate. Future longer-term studies may be conducted to ensure broader representation and intersectionality with research members embedded in the community that may have better opportunity to recruit members less willing to speak to "outsiders."

Additionally, it is important to note that the COVID-19 pandemic likely impacted the amount and quality of interactions, and influenced the level of rapport with participants. To further address these challenges I actively listened, engaged when needed, and maintained respect with each collaborator. Additionally, there has been a significant amount of research, organizations, and resources aimed at residents in this community, but this has overwhelmed it too (Hinds 2019, 45). In response, I maintained respectful boundaries, did not push stakeholders if they were uncomfortable, and followed the research where my collaborators wanted it to go. This is their story, so I did my best to illustrate stakeholders' words and feelings as they were expressed (see Figure 12). This work will be shared with the community and all participants afterward in the form of one or more community presentations at the University Area Community Center.

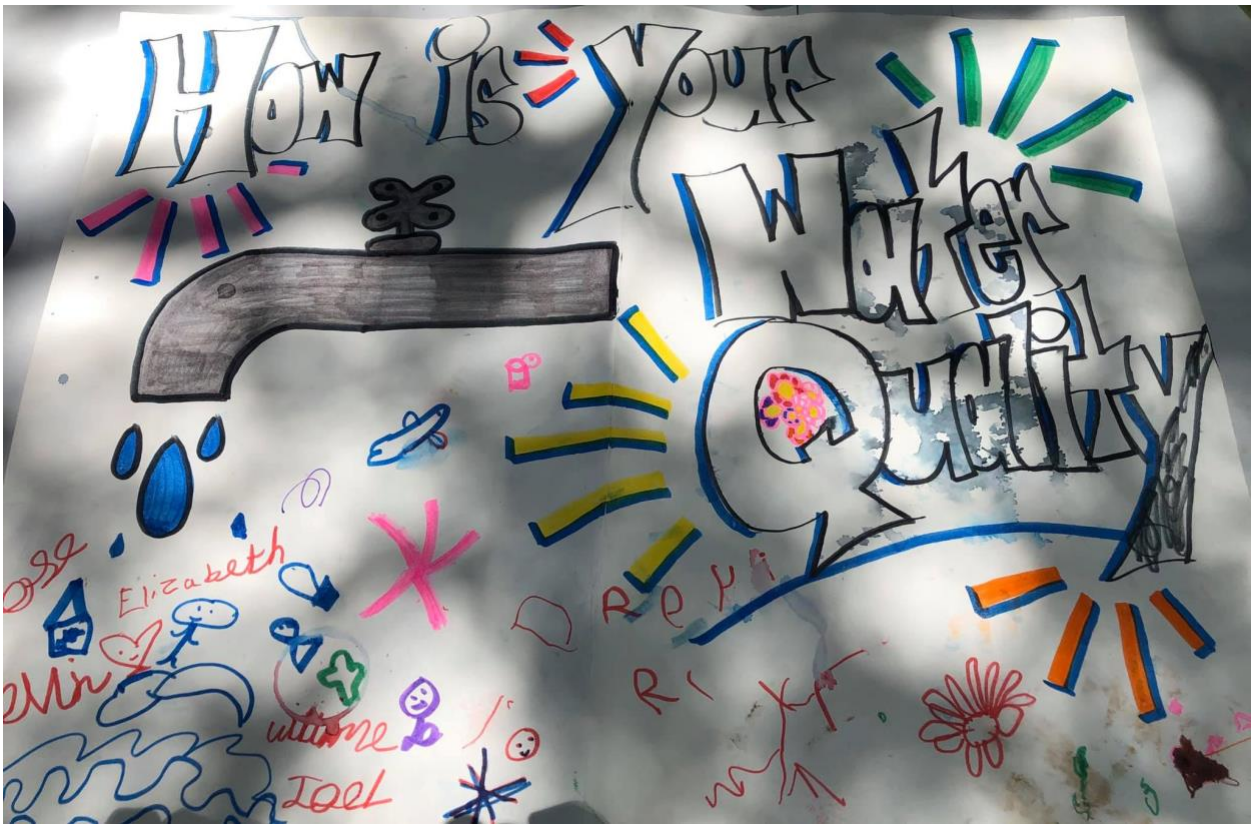


Figure 11. Sign co-created by residents, my research partners and I at Harvest Hope Park and other community events to raise awareness and bring up the conversation about water

CHAPTER FOUR: RESULTS

The "Aesthetics" of Water Quality

To tell me about their water, residents used their senses, with odor, color, and taste as the primary attributes for determining risk (rapid assessment, June 2021, Harvest Hope Park). Whether receiving public or private water, some residents used terms such as "bad," "sewage," and "eggs" to describe the smell and "funny," "bad," and "metal" to describe the taste. Many residents simply remarked, "I just don't trust it" (see Figure 13). Similar to my study, Doria, Pidgeon, and Hunter (2009) found in a cross-national mixed methods survey that water quality is primarily estimated using organoleptics (namely color, odor, and taste) and that risk perception is strongly influenced by these characteristics. As Gutiérrez-Capitán, Brull-Fontsere, and Jimenez-Jorquera (2019) argue, these sensory indicators are not just individual perceptions but biologically based indicators for determining health risks.

On a sweltering summer day, Delila recalls her experiences at Holly Court Apartments. Her memories of living there are full of itchy skin, rashes, smelly water, delinquent landlords, and, with a dismissive shake of her head, she sums it up as, "a medical headache" (interview, June 18, 2021, private residence). Fortunately, with support from the University Area CDC, she and her family were able to move to another property and are much happier. She exclaims that their landlords actually listen and act on their complaints. Still, Delila says, "if it smells like [sewage], don't drink it" (interview, June 18, 2021, private residence). Here, as previous studies suggest (Fragkou and McEvoy 2016; Pierce et al. 2019), prior experience with poor water quality

can influence risk perception and tap water mistrust. These experiences, when combined with other insecurities (e.g., food, housing, transportation) can also inform distrust, systemic mistrust, in other sectors (Alves et al. 2020; Brewis et al. 2019).

Figure 12. Bar chart of description of sensory properties and knowledge of where tap water comes from

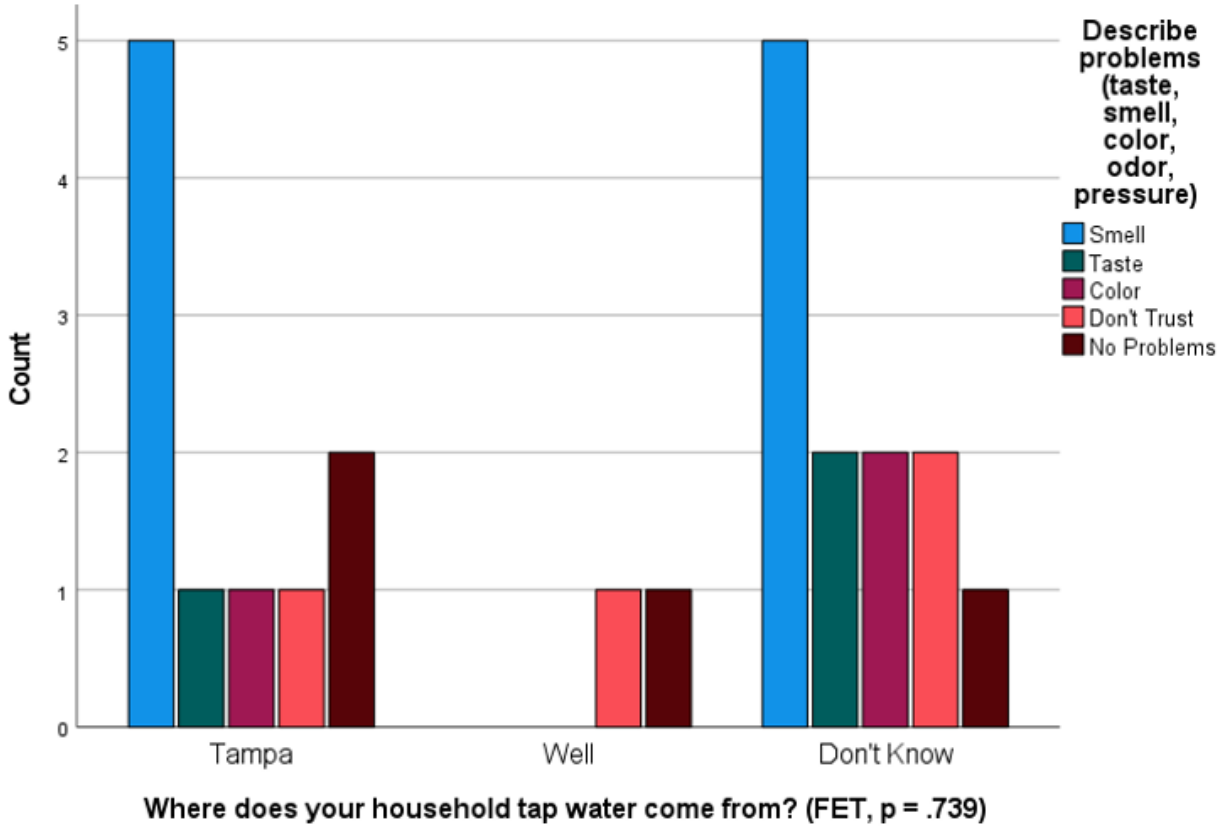


Figure 12. Bar chart of description of sensory properties and knowledge of where tap water comes from

Marta, a Mexican immigrant who founded a local nonprofit describes how some of the residents she works with do not trust their tap water and instead rely on bottled water because of their experiences “back home” in Mexico (see Figure 14). When asked if she thought residents would ever drink their tap water if they believed it was safe, she said “no” and explained, “It’s because we’re not used to it, no… they’re comfortable just buying bottles of water, having

bottles of water at home... That's not going to change just like that. Because we're so used to buying water in Mexico (interview, July 12, 2021, virtual). Marta's conversation reveals how the social, cultural, and political layers involved in tap water mistrust vary and often are carried with people as they move to new places. Fragkou and McEvoy (2016), for instance, found in their study in two Latin American cities that prior experiences with poor water quality and long-standing distrust of water utilities and government services increase perceptions of risk, and are embedded into every day decisions involving water, resulting in reliance on bottled water. In the U.S., Javidi and Pierce (2018) found that Hispanic households were the largest population to perceive their water as unsafe.

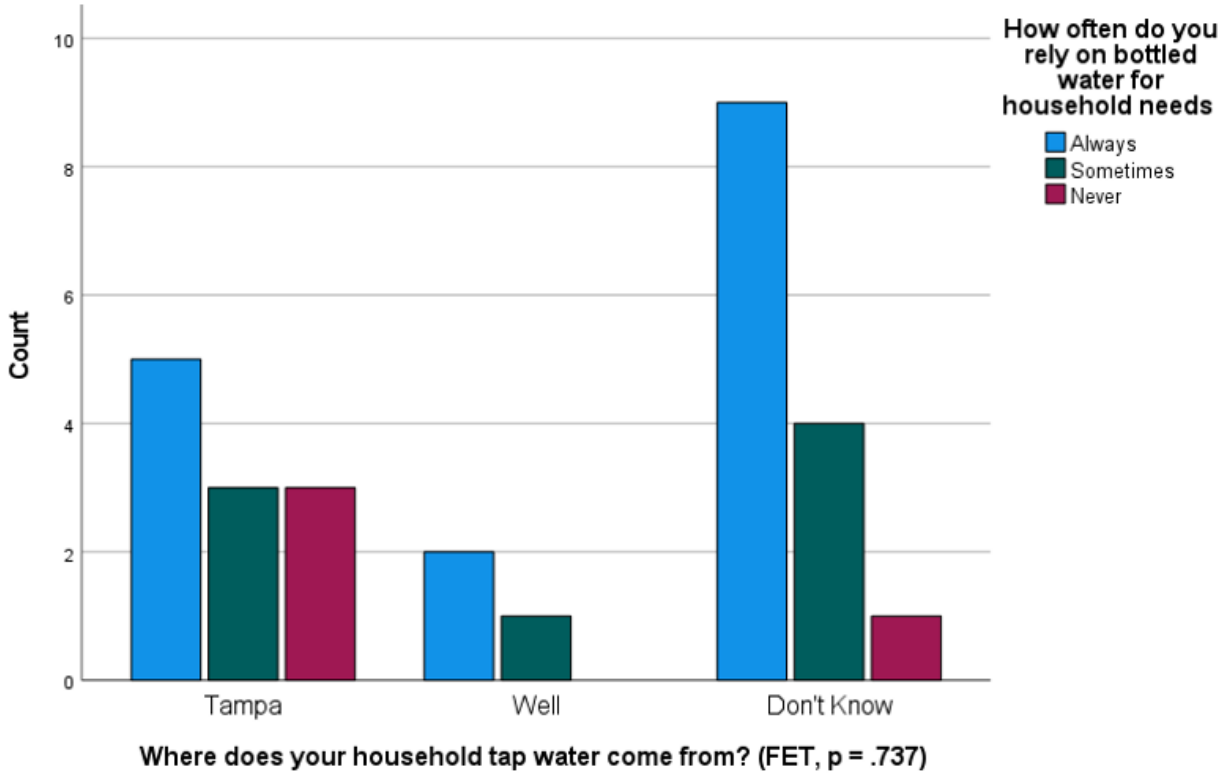


Figure 13. Bar chart of residents who said they rely on bottled water and knowledge of where their tap water comes from

Like Marta, for many residents of the University Area Community, tap water mistrust has resulted in reliance on bottled water. Our rapid assessments suggest that this relationship, between tap water mistrust and bottled water use, is statistically significant (Fisher's Exact Test, p=0.05, n=23) among the residents we spoke with (see Figure 15 & 16). When household tap water was rated as excellent, residents almost never used bottled water, but when residents rated their water as satisfactory, fair, or poor, they almost always used bottled water. For example, Rachel, a former resident described her situation: "It smells. It was really bad. So you can't drink it, so you're forced to buy bottled water. Sometimes you don't want to bathe in it, but you have no other choice" (interview, June 29, 2021, virtual). While buying bottled water makes Rachel, Marta, and other residents "feel safe," numerous studies have documented the detrimental health and economic consequences from reliance on bottled water (Doria 2010; Parag and Roberts 2009; Stoler et al. 2020). Alternative sources of water are typically more expensive than tap (Javidi and Pierce 2018; Parag and Roberts 2009; Stoler et al. 2020) and may be less healthy (Rosinger and Young 2020).

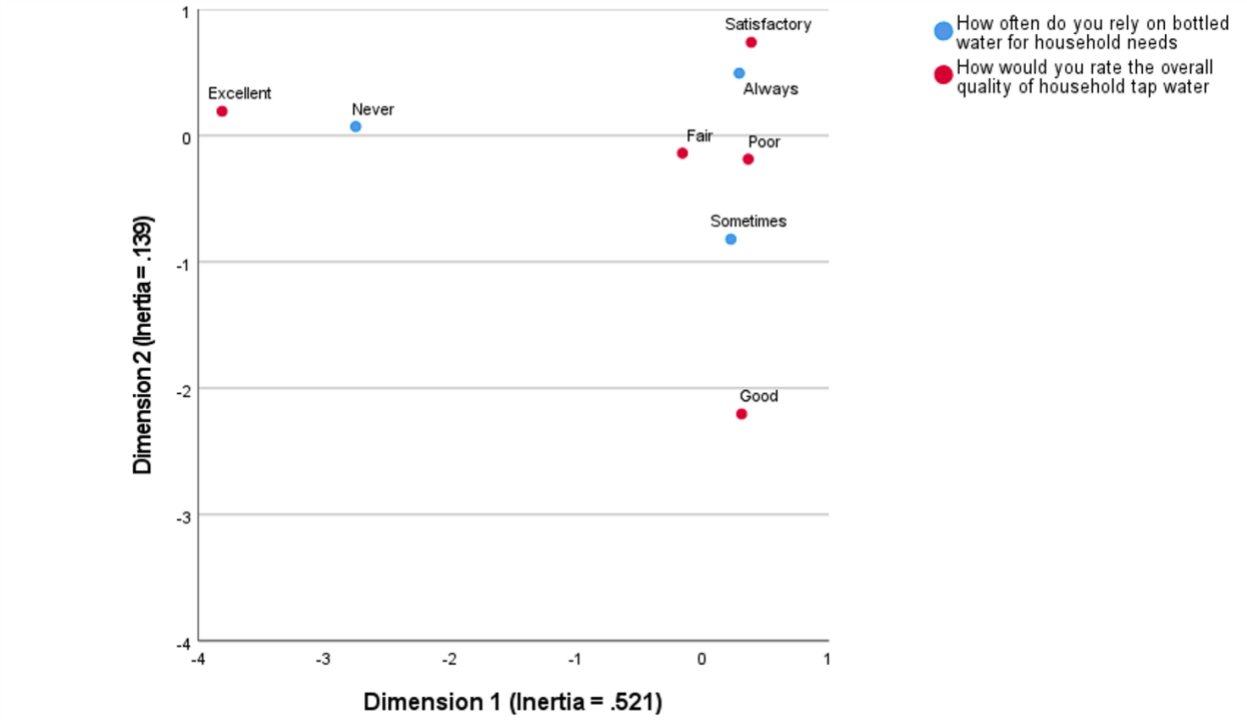


Figure 14. Correspondence analysis plot (n=23). Total inertia = .660; Fisher's Exact Test, p=0.05.

The tap water mistrust and perceptions of water quality I found speaking with residents suggest a shared cultural model of understanding about the relationship between water, contamination, and health. During interviews with city and county officials, I shared this model and the perceptions I was hearing from residents about their water. I explained that risk perceptions of water quality by residents centered on sensory details (smell, taste, appearance, color, turbidity, and so on), with a common expression "our water smells like sewage." City and county officials reacted to these comments with some degree of skepticism. Mark, a county water resources engineer remarked, "There's a difference between contaminated and just, 'I don't like the water.' That's what we call aesthetics. That's not a public health issue" (interview, June 7, 2021, virtual). In another interview, Ian, a city water engineer, further explained that the presence of hydrogen sulfide often found in private wells affects the taste and smell of the water (e.g., like rotten eggs), but it does not pose a threat to public health unless found in high

concentrations (interview, June 11, 2021, virtual). As Spackman and Burlingame's (2018:365) research on the "sensory politics" of early water quality regulation illustrates, when organoleptic characteristics became an individual matter of taste (or "aesthetics") rather than scientific judgment, subjective experiences became marginalized. Over time, technocrats came to view perceptions as complaints of personal and public disapproval until further analysis could verify "actual" hazards. As a result, "consumers' sensory aesthetic knowledge remains circumscribed in its ability to act" (Spackman and Burlingame 2018:367). Yet, empirical testing and sensing toxicity are uneven practices, such that the ways in which inconsistencies between these two approaches are interpreted must be understood politically.

This research suggests that water quality aesthetics are an important part of the social construction of tap water mistrust (see Figure 17). At the same time, lack of trust between water consumers and water governance is also a critical factor (Doria, Pidgeon, and Hunter 2009; Grupper, Schreiber, and Sorice 2021; Grupper et al. 2021; Johnson and Scicchitano 2005; Leahy and Anderson 2008). As this research suggests, officials often do not trust residents' perceptions of their water if it is only based on sensory details without scientific testing, i.e., 'expert' evaluation (Checker 2007; Haenn 2003; Keissling and Maxwell 2021). On the other hand, in the University Area Community, there is widespread distrust of water and officials who espouse that water is safe and clean even though it has been tested. A notable example brought up by some residents I spoke with is the Flint water crisis, which demonstrated that municipal services, 'experts,' and 'testing' are not always trustworthy as residents' experiences are devalued or dismissed (Pieper, Tang, and Edwards 2017; Sobeck et al. 2020). As Fragkou and McEvoy (2016) argue, investment in water infrastructure is only as effective as the trust residents have in their governance system. Thus, if interventions are not connected with sociocultural

understandings and decision-making, the “epidemic of tap water distrust and disuse” will continue despite expensive investments in water infrastructure services (Montoya et al. 2021; Wells, Lehigh, and Vidmar 2021).

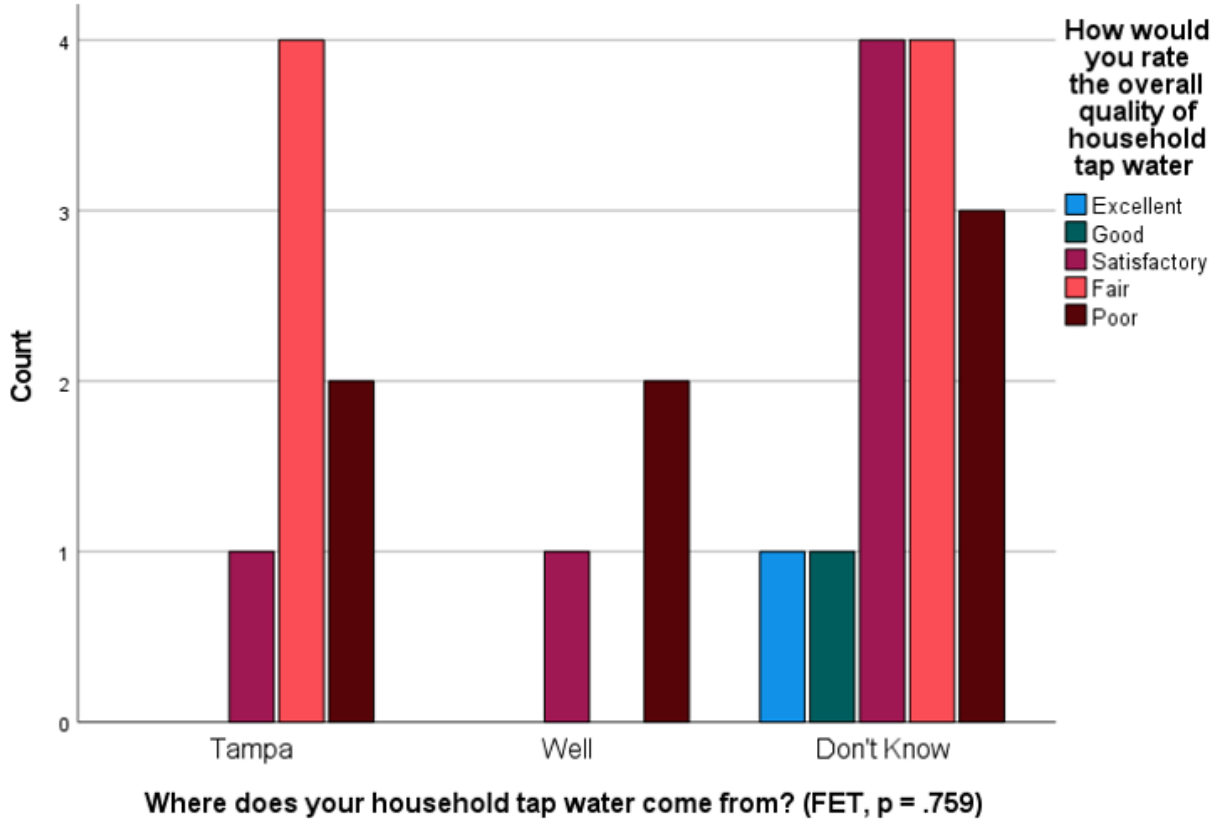


Figure 15. Bar chart of residents ratings of tap water and knowledge of where their water comes from.

Plumbing Past the Curb Stop

Tap water mistrust is sometimes tied to housing insecurity (Doria, Pidgeon, and Hunter 2009), where aging or deteriorating water infrastructure results in water quality challenges “past the curb stop” (Meehan et al. 2020b; Jepson 2014; Rosinger et al. 2020). For example, Deitz and Meehan (2019) found residents in mobile homes have consistent water service challenges related to connections, fittings, and plumbing that compromise access, pressure, reliability, and quality. These challenges heighten perception of risk, especially when compounded with insecurity of

housing status (Meehan et al. 2020b; Pierce and Jimenez 2015; Pierce et al. 2019). Several residents I talked with live in mobile home parks within the community. Jerry, for example, distrusts his tap water, even though it is piped water provided by the city, because of the old, deteriorating pipes he knows were not replaced when they added the connection (fieldnotes, February 15, 2022, Harvest Hope Park). On a call with Laura, another resident of the mobile home park, she told me about significant flooding and sewage overflows yearly in her mobile home, which she believes compromises her water quality (virtual interview, June 2021).

Apartment units in the University Area Community also have plumbing problems. Gloria, a mother of two and frequent visitor to the community garden, has lived in the neighborhood for only a few years but hopes to move out soon because of the many housing infrastructure and landlord problems she and her family face. With a sigh, Gloria describes a litany of plumbing challenges: foundation issues, corrosion, red rings in the bathtub, backups, pests, sewage overflow and flooding in the yard, and tap water that is white, powdery and smells like chlorine (interview, July 21, 2021, virtual). She knows her family has water and sewer service provided by the city and believes that a lot of their problems are caused by the pipes in her home. She explains, "Our grey water does not drain to the city. It just drains into the yard. We would not even complain about something like this to them because larger, more impactful things go unaddressed for months and months or indefinitely" (interview, July 21, 2021, virtual). As Meehan et al. (2020b) found, rental status is often correlated with residents feeling disempowered to ask for help due to fear of eviction, an increase in rent, and/or a lack of maintenance from the property owners. The rapid assessments support this finding in the University Area Community when we asked respondents to describe plumbing problems and the quality of their plumbing service (Fisher's Exact Test, $p<.001$, n=21) (see Figure 18). Respondents reported aging or inadequate plumbing infrastructure was the cause of many

challenges, including slow drains and sewer backups. While Gloria has water and sewer service from the city, she does not trust it.

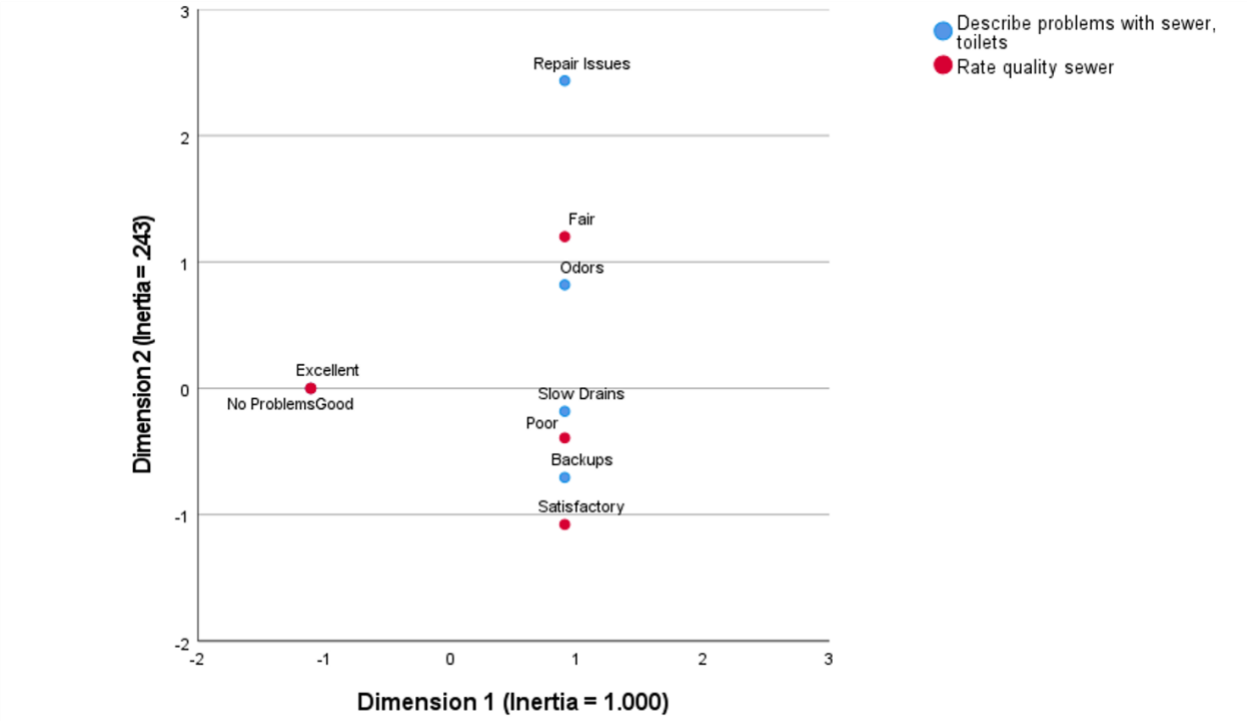


Figure 16. Correspondence analysis plot (n-21). Total inertia = 1.294; Fisher's Exact Test, $p<0.001$

Gloria further tells me that she knows a water test would not pass in her house, no matter what city officials say about the quality of their water or her sewer, and that she can only call maintenance with permission from their landlord. It is an added fee so she avoids it unless it is "life or death." Gloria's feelings of insecurity and heightened perception of risk is the layering of water, sanitation, and housing infrastructure challenges created and exacerbated by socioeconomic inequities (Meehan et al. 2020b; Pierce and Jimenez 2015; Pierce et al. 2019; Wells and Whiteford 2022). The thematic analysis of the interviews revealed interconnected challenges related to the household-water-sanitation nexus including the themes of "trapped" and housing, place and mold, water and smell, paying rent, low-income, jobs, and government and money (see Figure 19). Similar to Checker's (2007) findings, Gloria's personal experiences

living in her residence, as a low-income person of color, feeling powerless to her landlord's wishes are enough "truth" for her, as she put it, of the inadequate and unsafe conditions that the water utility will be "unable to fix." As Gloria laments, "you just kind of take it as it is," and hope to find and afford a new place (interview, July 21, 2021, virtual).

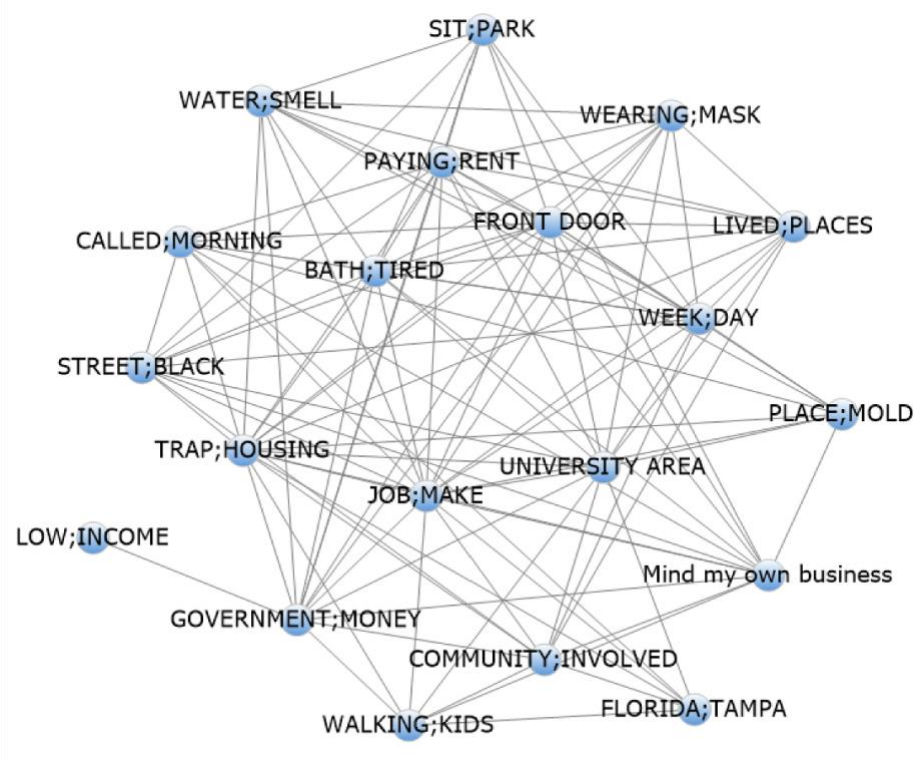


Figure 17. Network visualization based on a text link analysis using the tf-idf statistic to extract key topics from five interviews with residents of the UAC based on their weighted frequencies of occurrence and connectedness

When I spoke with city and county water managers about situations like that of Gloria, they agreed that housing insecurity is connected with water and sanitation insecurity. While they empathize with residents like Gloria, they emphasized their limited capacity to help "after the curb stop" or "after the meter." For example, Ian explained that water quality is guaranteed only up to the meter because after that it is private property and the responsibility of the property owner (interview, June 11, 2021, virtual). He noted that his job is water and that housing infrastructure challenges are "outside of their area." As Gloria knows, however, if it is not a "life

or death" situation; she will receive no help. So, whose responsibility is it? We went to the Department of Health to ask. There, we spoke with Margaret, who works with county residents on water issues, and she confirmed that piping infrastructure can be a major contributor to water quality, especially if residents perform DIY fixes using different materials or pipes that do not fit correctly. She also noted that water heaters in apartments and townhomes can produce poor water quality if not cleaned and maintained regularly. She explained that most rental properties keep their water temperature low because they do not want to get sued if people are injured by hot water, but "if your temperature is too low in your water heater, it just builds up sulfur and iron bacteria. So it smells nasty coming up. So it's got to be high enough to kill that… the inside of water heaters are absolutely the most disgusting bacteria-laden pits" (interview, June 25, 2021, county office). She continues that most rental units (if small) would have their own water heater, however larger units will have a boiler that gets to a high enough temperature. However, she tells me that these are challenges that the property owner should oversee (see Figure 20 & 21). The housing-water nexus is entrenched in managerial and policy gaps such as this (Durst 2018; Meehan et al. 2020b).

LIBRARY COPY PLEASE RETURN

Opflow

ISSN 0149-8029 Vol. 16 No. 7 July 1990

A monthly publication of the American Water Works Association

Phew! My Hot Water Smells Like Rotten Eggs

David J. Hack
Project Engineer
Marshall Engineering and Surveying
Columbia, Mo.

Taste and odor problems can affect hot or cold water, but hot water problems usually bring complaints of smells like rotten eggs.

The rotten egg odor is caused by hydrogen sulfide (H2S) gas. The odor is repulsive, but the gas is not usually harmful at the low concentrations that occur in a household water system. This is not a problem of health but aesthetics. It is unpleasant to take a shower, wash clothes, or cook with water that smells like decay.

Chemical Causes

Rotten-egg odors result from a chemical process that involves three primary components:

- sulfur (S),
- electrons, and
- bacteria.

Sulfur. Sulfur often appears in water as sulfate ions (SO_4^{-2}), which are quite stable. However, sulfate can convert to sulfides (S) and hydrogen sulfide gas by the gain of eight electrons (negative charges). The gain of negative charges is called a reduction reaction.

Electrons. The sulfate-reduction reaction requires energy. Electrons are the energy source. Excess electrons may occur in water as the result of the decay of organic matter or the corrosion of metals. Sulfate may convert to the less stable sulfur form of sulfide in the presence of excess electrons, but this conversion is not entered into easily. A catalyst is required to speed up the reaction if it is to take place at a rate sufficient to cause the nuisance odor.

Bacteria. The nonpathogenic, sulfate-reducing bacteria, *Desulfovibrio desulfuricans*, produces enzymes that have the power to accelerate the sulfate-reduction reaction. However, the sulfate-reducing bacteria lack the ability to reduce the sulfates to sulfides without the external energy source provided by the excess free electrons.

All three components of the reaction: the sulfates, the sulfate-reducing bacteria, and the excess electrons must be present for hydrogen sulfide to be produced. The rate of the H2S gas production is determined by how active each component is.

Time. An influencing factor is the length of time that the water is in contact with the reaction. Even at a very low reaction rate, the H2S may build in concentration to objectionable levels given enough time.

If you can substantially reduce any one of the four factors, you can control the odor problem.

H2S in Groundwater

Sulfates occur in most groundwater environments at sufficient levels to form objectionable concentrations of H2S gas. The sulfate-reducing bacteria will grow almost anywhere the other reaction components exist. The water may be in the ground for a near infinite period of time. Therefore, this leaves the availability of electrons as the principle controlling factor for the occurrence of hydrogen sulfide in groundwater. Shallow wells tend to be susceptible to surface water contamination, which may have a high concentration of organics. As a result, shallow wells and private household wells may have a greater problem with the rotten egg odor.

Deep wells that are cased and sealed to state specifications have few organics. In addition, they may lack the nutrients needed to support the bacteria that feed on the few organics available.

(continued on pug 7)

Figure 1 Bacterial action in water heater.

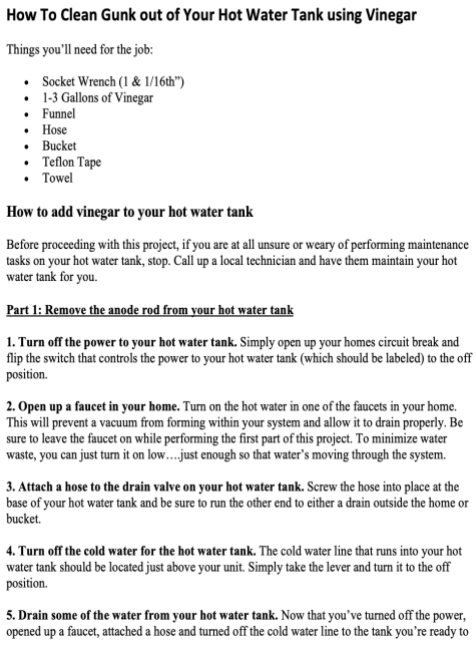
Cold Hot

Magnesium Anode

Sulfate-Reducing Bacteria

Distribution System **Symposium.. .. see pages 3-6**

Figure 18. Snapshot of a pamphlet county Department of Health official shared about reasons for a "rotten egg smell" in water



How To Clean Gunk out of Your Hot Water Tank using Vinegar

Things you'll need for the job:

- Socket Wrench (1 & 1/16th")
- 1-3 Gallons of Vinegar
- Funnel
- Hose
- Bucket
- Teflon Tape
- Towel

How to add vinegar to your hot water tank

Before proceeding with this project, if you are at all unsure or weary of performing maintenance tasks on your hot water tank, stop. Call up a local technician and have them maintain your hot water tank for you.

Part 1: Remove the anode rod from your hot water tank

1. Turn off the power to your hot water tank. Simply open up your homes circuit break and flip the switch that controls the power to your hot water tank (which should be labeled) to the off position.

2. Open up a faucet in your home. Turn on the hot water in one of the faucets in your home. This will prevent a vacuum from forming within your system and allow it to drain properly. Be sure to leave the faucet on while performing the first part of this project. To minimize water waste, you can just turn it on low….just enough so that water's moving through the system.

3. Attach a hose to the drain valve on your hot water tank. Screw the hose into place at the base of your hot water tank and be sure to run the other end to either a drain outside the home or bucket.

4. Turn off the cold water for the hot water tank. The cold water line that runs into your hot water tank should be located just above your unit. Simply take the lever and turn it to the off position.

5. Drain some of the water from your hot water tank. Now that you've turned off the power, opened up a faucet, attached a hose and turned off the cold water line to the tank you're ready to

Figure 19. Snapshot of Pamphlet Department of Health official shared about cleaning hot water tank

As Margaret indicated, many of my interlocutors take matters into their own hands when it comes to plumbing problems with "DIY fixes." Several residents discussed what they or their

neighbors have done to fix piping and plumbing when maintenance is slow or inaccessible. Tom, a longtime resident in the community since 1989, exclaimed, “our water rots everything! Plastic, metal, you name it” (interview, June 18, 2021, private residence). He went on to describe how his neighbors did not have hot water for three months and had continual backups in their bathtub, but their landlord did nothing. With a look of exasperation, Tom remembers watching his neighbor dig and fix the bathtub completely himself. In some ways, residents must find ways to harness their own agency but often, as Wakhungu (2020:44) found in another Tampa neighborhood, landlord neglect typically results in little agency for residents to change their living conditions. Residents, fearful of being evicted or unable to hire a maintenance person, must figure out how to fix their infrastructure issues themselves, live with the deterioration, or move if they can afford it. In the rapid assessments, some residents who rated their plumbing quality as poor (due to backups and slow drains) said they sometimes had to rely on neighbors or local businesses for bathroom needs (rapid assessment, June 25, 2021, Harvest Hope Park) (see Figure 22 & 23).

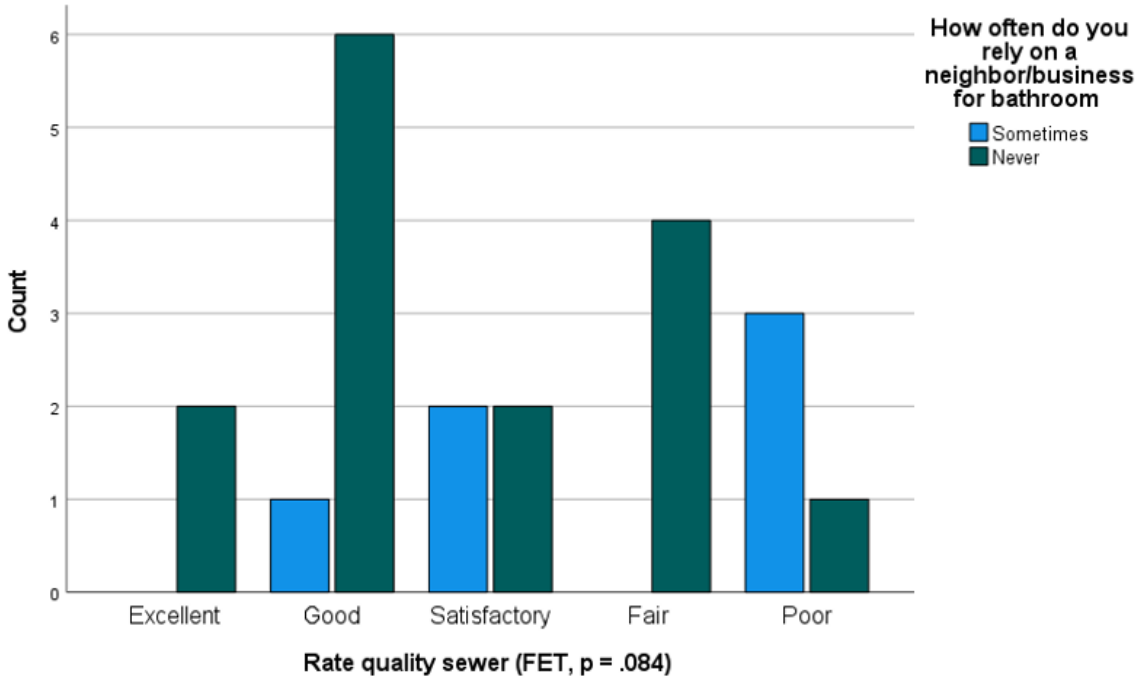


Figure 20. Bar chart of sewer quality ratings and reliance on a neighbor/business for a bathroom

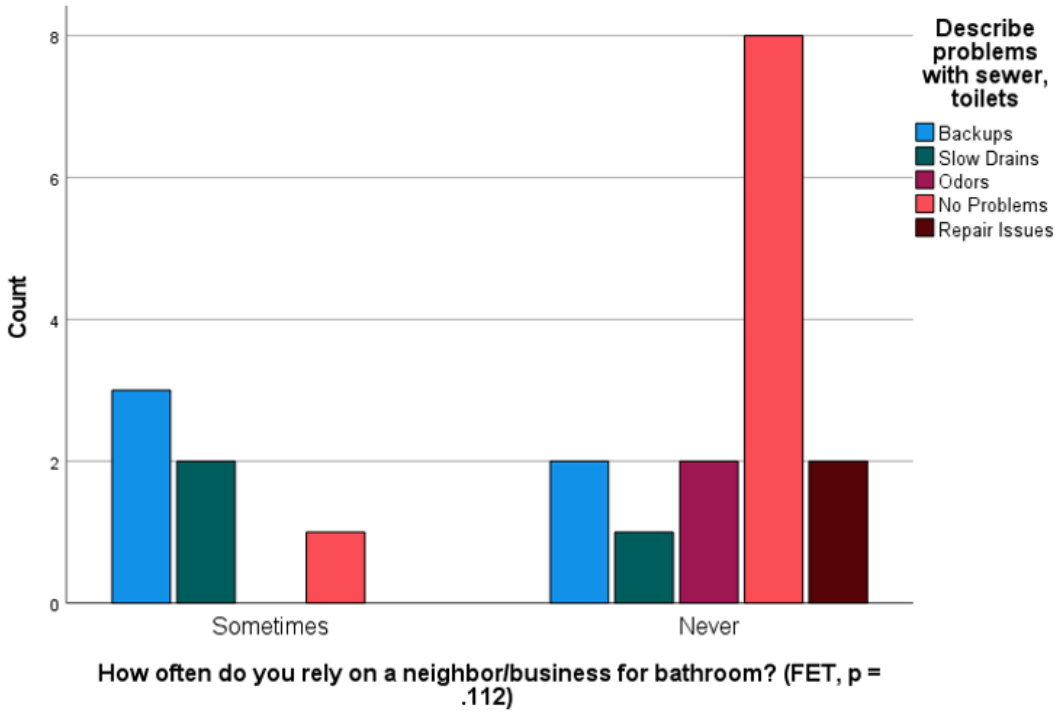


Figure 21. Bar chart of reliance on neighbor/business bathroom and description of problems

The kinds of challenges Tom listed can be exacerbated when inadequate household infrastructure experiences flooding. Charles, an employee at the University Area CDC and resident in the community, described a time when his apartment flooded so badly that he called maintenance. Knowing that "it would take forever," he utilized his own skills and knowledge of plumbing to fix it (interview, June 25, 2021, Harvest Hope Park). He acknowledges, however, that a resident without access or awareness to resources would have great difficulty responding. In a separate study, Hinds (2019) investigated residents' views of stormwater management, infrastructure, and redevelopment in the University Area Community. She found that inadequate infrastructure, climate change, and power dynamics in local government intersect to create flooding disasters. Here, the interplay of inadequate housing, high rates of renting, infrastructure decline, dependence on and fear of landlords, and past-the-curb-stop challenges discourage involvement from water or sanitation officials (Johnson and Scicchitano 2005; Meehan et al. 2020b).

"We Don't Put in Pipes for Free"

Throughout this research, residents' thick descriptions of water quality problems were mixed with their desires for solutions to obtain clean and safe water (Geertz 1973). Residents relying on private drinking water wells hoped connections to piped water from the city would solve their problems. Delila, for example, believes the infrastructure in the community needs to be completely revamped, especially the housing and plumbing infrastructure. She argued that there are enough online reviews of the bad infrastructure of the apartments and homes that the city and county need to get together and fix all the pipes underground and get people connected. Delila explained, "I think what they really need to do is to get down into these [pipes] with cameras and see exactly what's down there, how much corrosion there is, and how open the tube

is actually because all that corrosion" (interview, July 18, 2021, private residence). Delila understands that the issues in some of the residences are past-the-curb-stop problems, and that access to city services might not solve the issues. However, Delila was adamant that connections need to be made because of her negative experiences living with private well water. Other residents I spoke with reiterated this desire (fieldnotes, June-August 2021, Harvest Hope Park).

I asked Mark, our county water resources interlocutor, about the possibility of connecting residents on well water and septic tanks to city/county services. His response was immediate, "We don't put in pipes for free. So if there's a bunch of septic tanks out there and they want to hook up to us, they have to pay the impact fee and if we have to extend the pipe, then they have to pay for that too. And that's the same with water, and that's pretty expensive. So that's probably the biggest problem with getting people off septic tanks and wells, is affordability" (interview, June 7, 2021, virtual). Mark understands and is highly attuned to the expense of connections, as some residents fear. However, he also believes that all residents do not want or should not want to be on private well water or have septic tanks. Several residents and employees at local nonprofits we spoke with were also worried about costs of connections but explained that municipal or centralized services were not always the desire in the first place (fieldnotes, August 2021, Harvest Hope Park). For example, Elaine, who has lived in her residence in the community for many years, maintained a septic tank until a few years ago when the city required her to transition to city sewer or be fined (fieldnotes, February 15, 2022, Harvest Hope Park). Elaine reluctantly connected to city sewer, even though it increased her bill significantly. She is on private well water, and wants to continue because she maintains it, gets it tested yearly and is happy with it. However, she noted that the city water line is across the street and found it unusual that the city did not ask her to transition to city water when they required the wastewater connection. Elaine's situation highlights the mosaic of lines, utilities, and

services differentially distributed throughout the community and how these interact differently to produce tap water mistrust.

I spoke with Ian, the city water engineer, about Elaine's situation. Ian reiterated the lack of funding and feasibility of providing universal centralized services, "We do have water mains in the area. So what we want to try to do is find a solution where we can get the connection made. [But] … there's a huge, huge cost with that, especially if you have to extend water mains or collection pipes for wastewater, to get it to the property, there's a cost to that" (interview, February 20, 2022, virtual). Joe, from the county's water resources division, explained that unincorporated communities like the University Area Community that are in the city's water service area are on regular maintenance schedules but not on the city's (or the county's) capital improvement plan for extending water mains (interview, June 21, 2021, county office). Thus, residents are in limbo between the city and county in terms of priorities for water infrastructure improvements.

According to Hutton and Chase (2016), these economic factors and competing priorities by government officials, are typical barriers to improvements whether at the public, private, or individual household level. Sinharoy, Pittluck, and Clasen (2019) describe how lower taxation in unincorporated areas can limit infrastructure investments. As Joe explains, "The reality is that the city's first obligation is to its residents inside the city limits. So, if money is tight, and resources are limited, the city is going to choose to serve its citizenry first. So, people outside the city limits, even though they're in the inter-local [water service] area, even though they're their customers, yeah, they're going to take the backseat. And that's just a reality" (interview, June 21, 2021, county office). This dilemma emerges from selective annexation covenants of the community that continue to prevent access to safe water for some residents (Anderson 2010; Jepson and Vandewalle 2016; Lockhart, Wood, and MacDonald Gibson 2020). Anand's (2017)

concept of 'hydraulic citizenship,' the recognition of belonging in quality water service, is out of reach for residents living in unincorporated areas like the University Area Community, further illustrating the socioeconomic and political marginalization of residents.

Jurisdictional Ping Pong: A Game of Mistrust

This research found that an important factor in constructing notions of tap water mistrust is uncertainty about where one's water comes from. Half (n=14/28) of the residents we spoke with in the rapid assessment did not know the source of their water (see Figure 24). This is not altogether uncommon for unincorporated communities. Doria (2010), for example, found public knowledge of water sources limited, and surveys by Oliver (1999) found only half of respondents accurately guessed where their tap water comes from. Residents in the University Area Community who did know where their water comes from had varying uses for their tap. For example, 10 residents believed they are on city water, only two of which admitted to drinking from the tap; the rest use bottled water (rapid assessment, July 10, 2021, Harvest Hope Park). Kayla, an employee of the University Area CDC and former resident of the area, recently moved away from the community to another residence and said she loves her "new water," but does not know where it comes from (fieldnotes, June 4, 2021, Harvest Hope Park). Kayla did not drink or like the water in her apartment in the University Area Community and seemed more trusting of the water in her new apartment because she lives outside the community. She jokingly said when she invites family and friends over to her new place, they rave about how good her water tastes (fieldnotes, June 4, 2021, Harvest Hope Park). For Kayla, source did not matter, rather, general trust living outside the community was reason to drink from the tap. Kayla's reasoning fits squarely with research by Doria, Pidgeon, and Hunter (2009), who found that tap

water avoidance is linked to household water insecurity challenges including access, affordability, adequacy, quality, taste, and risk perception.

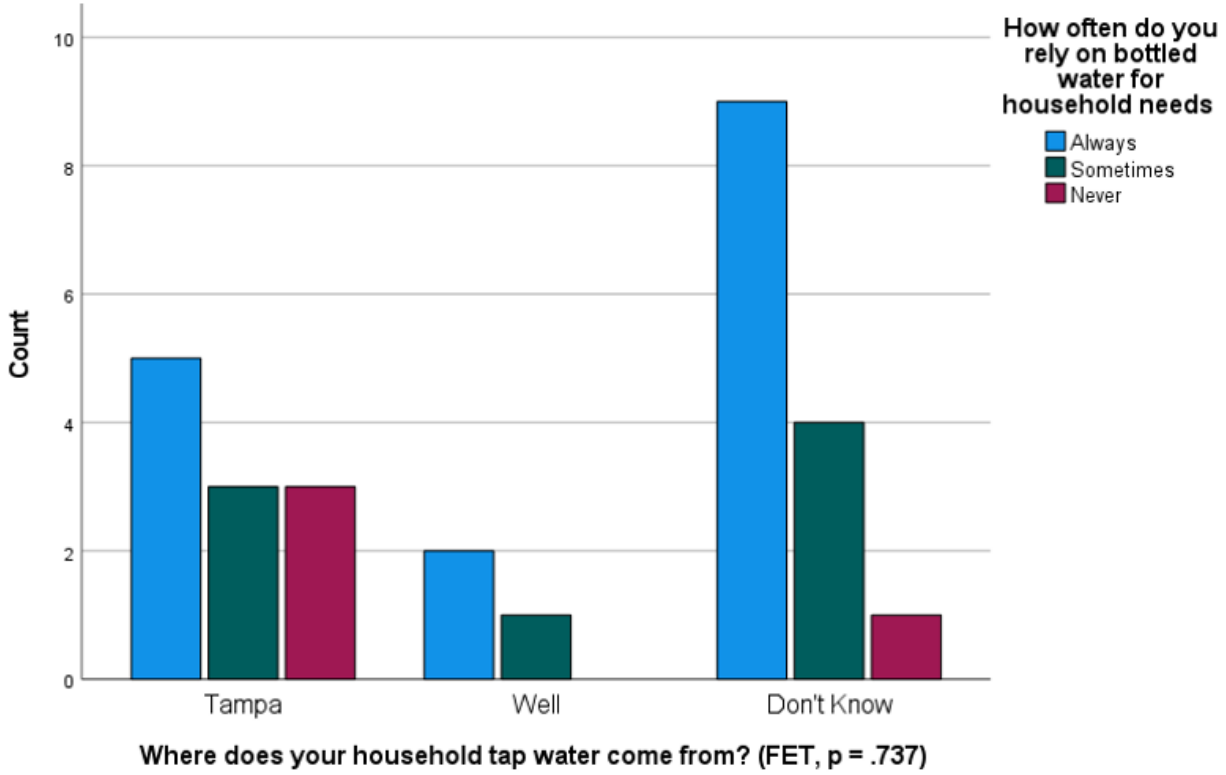


Figure 22. Bar chart of reliance on bottled water and knowledge of where water comes from

The lack of awareness of tap water source from our rapid assessments seemingly contradicts the assumption by some water managers we spoke with, that residents who know they are on centralized systems trust their water, drink it, and consider it the best option to mitigate risk. For example, in a conversation with Jack, a resident in the community for five years, said he receives city water but complains that the water bill is much too high and he does not even drink the tap (rapid assessment, June 18, 2021, Harvest Hope Park). Jack explained that he always uses bottled water for drinking and cooking and only the tap for cleaning and watering his plants because he does not trust it. He loves where he lives, but has suspicions about the pond

in his complex, which has turned him against his water. As Doria (2010) found, context cues such as experiences with taps, water pipes, bottles, characteristics of water consumption locale, and suspicion of contaminants within the community influence risk perception and trust in services. Jack's description of his water use and habits is an example of how perceived risk, even without organoleptic complaints, creates preventative, risk averse behavior (Doria 2010). Many studies have found that vulnerable populations are more likely to live in and near places with heightened contamination and water insecurity and so context cues become an important part of constructing tap water mistrust (Brulle and Pellow 2006; Deitz and Meehan 2019; Javidi and Pierce 2018).

As an unincorporated community, the University Area Community is the court of a "ping pong game" of jurisdictional responsibility and authority between the city and county water and wastewater departments. The county's water and wastewater utilities have an urban service area prescribed by state statutes, which is outside most of the city limits but does not cover the entire county. The city of Tampa has their own utility service area that provides water and sewer inside city limits but, through an interlocal agreement with the county, the University Area Community is located in their service area. As the engineer Joe stated, "so while it's [University Area Community] technically outside the city limits, it's in their service area by agreement" (interview, June 21, 2021, county office). As a result, water and wastewater lines have become interspersed unevenly across the community, some of which are not even utilized. Moreover, there has been a lack of desire by either utility, city or county, to completely service the community even though it is close to municipal lines. The resulting mosaic of city, county, and private water and wastewater connections and systems is not just hydrologic, as Workman et al. (2021) argue, but rather is politically decided. The legal and political agreements over who has

jurisdiction and who does not are used as an excuse to "ping pong" responsibility back and forth when problems are reported.

However, officials from the city and county argue that it is not just political will and action that perpetuates the University Area Community's water problems. Officials I spoke with describe the challenges with fiscal feasibility of figuring out where, who, and how residents can obtain municipal water services. Mark from the county explains, "We can't go in there and serve them anyway. It's the city. And the city's got pipelines and stuff in there that cost a bunch of money… we have an interlocal agreement that defines those boundaries and what services can and can't, what you can and can't do, so that's an interlocal agreement between the city of Tampa and our board... and it doesn't matter who owns it, it's a lot of money to put the pipes in, and so who's gonna pay for those pipes, the people that are there can't" (interview, June 7, 2021, virtual). Yet, as Workman et al. (2021:5) argue, water provision is "sociotechnical," not just an engineering problem but also a governmental choice. For example, Durst (2018) found that fiscal or economic considerations are generally not associated with underbounding patterns and annexation decisions. Ian from the city's water utility is worried about the risk of non-payment, "So I think it's going to be important to think through, how are the bills going to get paid after this? Is that really a reasonable expectation, after we make these connections, right?" (interview, June 11, 2021, virtual). As Sinharoy, Pittluck, and Clasen (2019) note, fears of cost recovery and the perception that informal settlements will be unable to pay for the services and long-term maintenance have been found in multiple studies.

CHAPTER FIVE: CONCLUSION

Pipe Dreams

Residents' experiences with water, perceptions of risk, and behavior contrast in the University Area Community. The factors underlying tap water mistrust also vary, but emphasize sensory details or "aesthetics," housing infrastructure challenges, affordability, and governance. These factors reveal the ways in which risk is a social construction, expressed and experienced differently by community residents (Checker 2007; Oktem 2016). In contrast, I found that water utilities employees rely on more techno-scientific approaches to risk in water management, where risk is perceived as empirically identifiable and measurable (Spackman and Burlingame 2018; Wedgworth et al. 2014). Here, "experts" calculate risk as a probability to inform decision-making, alongside solutions calculated to enhance efficiency and economic feasibility (Kiessling and Maxwell 2021; Wells et al. 2019). In the University Area Community, these divergent understandings have led to significant differences in perceptions of risk and trust between stakeholders. If left unaddressed, different understandings of risk can complicate communication (Lehigh, Wells, and Diaz 2020) and jeopardize the sustainability of interventions (Montaya et al. 2021; Wells, Lehigh, and Vidmar 2021; Wells and Whiteford 2022).

Several potential interventions to water challenges are emerging for the University Area Community. The City of Tampa has launched a new initiative, Progressive Infrastructure Plan to Ensure Sustainability (PIPES) to transform the water and wastewater infrastructure in the city. PIPES is a $2.9 billion funding plan to renew and replace deteriorating infrastructure. However, the University Area Community was not one of the neighborhoods prioritized for the project. At

the same time, the county is currently developing its own plan, the Infrastructure Development Plan (IDP), focused on water and transportation, which includes the University Area Community. Neither plan, however, has elicited the opinions of community residents, who feel distrustful that their situations will improve and uncertain about the future. Moreover, willingness to pay for improvements will not just be for the city or county to decide but will also involve property owners and renters.

At the conclusion of this research, a new project emerged to tie both of these efforts together — the University Area Sewer and Water Connection Program, which aims to address water and sanitation insecurity in the community. This $5-million-dollar project was approved by the board of county commissioners and will be funded by the county's American Rescue Plan funds. This program will involve the use of vouchers to offset or completely cover costs for water and wastewater connections for property owners. While some residents see this as a major win for water quality improvement, other residents are concerned about affordability of recurring costs and about the potential for gentrification and displacement. Moreover, residents are well aware that even if they receive clean and safe water from the city, what happens after the curb stop with local plumbing can compromise these efforts. There are no provisions in the plan to assist property owners or renters with onsite infrastructure. Interventions such as the county's plan, therefore, require a more holistic perspective that takes into account residents' experiences and perceptions and understands tap water mistrust more broadly.

This research demonstrates how ethnographic research can contribute to broader understandings of tap water mistrust and risk perception surrounding water quality. As an applied anthropologist, I can use this fine-grained and context-sensitive information to advocate for local change and also to advocate for how risk assessments for water quality are approached more broadly. Following suggestions by O'Leary (2018), Brulle and Pellow (2006), Checker

(2007), I can work more collaboratively with environmental scientists and water managers to include the voices, perceptions, and desires of community residents who hold valuable knowledge about their experiences and practices that can reduce these exposures. In the University Area Community, for example, residents can use assessment scales to track long-term trends in water quality challenges and provide water managers with specific and localized onsite data, thereby sharing control of the risk assessment process (Heany et al. 2011; Roque et al. 2022). Additionally, I am working with colleagues to bring household user-friendly water testing devices (ROSALIND) to residents so that they can determine if and what contaminants are in their water.

Finally, this research shows how tap water mistrust is constructed socially and culturally and, as such, is subject to power differences between stakeholder groups. This insight can be useful for developing or expanding theories of environmental justice and infrastructural violence (Rodgers and O'Neill 2012; Wells and Whiteford 2022). For example, the environmental justice literature demonstrates how race and class disparities produce household water insecurity and increased risk perception where infrastructural conditions (housing, piping, resources, and services) and structural systems (social, racial, political and economic) intersect to perpetuate infrastructural violence (Bullard et al. 2008; Stillo and Macdonald Gibson 2018; Stillo et al. 2019; Wakhungu et al. 2021). Anthropological approaches to risk perception and the social construction of water quality, then, are pertinent to refocus water insecurity on the power relations that drive physical geographies of inequity (Meehan et al. 2020b; Whiteford et al. 2016; Workman et al. 2021).

REFERENCES

Aiken, Charles S.

1985 New Settlement Patterns of Rural Blacks in the American South. Geographical Review 75(4):383-404.

Alameddine, Ibrahim, Geeda Jawhari, and Mutasem El-Fadel

2017 Social Perception of Public Water Supply Network and Groundwater Quality in an Urban Setting Facing Saltwater Intrusion and Water Shortages. Environmental Management 59(4):571-583.

Alves, K., Andrade, E.P., Savioli, J.P. *et al.*

2020. Water scarcity in Brazil: part 2—uncertainty assessment in regionalized characterization factors. *Int J Life Cycle Assess* 25, 2359–2379. https://doi.org/10.1007/s11367-020-01739-3

Alba, Rossella, Alex Bolding, and Raphaelle Ducrot

2014. The art of allocating water through licenses and taxes. State power and water resources management in Mozambique. IV IESE conference paper submission, p.1-14. https://library.wur.nl/WebQuery/wurpubs/fulltext/352459

Alves, Kilvia de Freitas, Edilene P. Andrade, Jose P. Savioli, Amandine V. Pastor, Maria C. Brito de Figueiredo, and Cassia M.L. Ugaya

2020 Water Scarcity in Brazil: Part 2—Uncertainty Assessment in Regionalized Characterization Factors. The International Journal of Life Cycle Assessment 25:2359-2379.

Anand, Nikhil

2017 Hydraulic City: Water and the Infrastructures of Citizenship in Mumbai. Durham, NC: Duke University Press.

Anderson, Michelle W.

2010 Mapped Out of Local Democracy. Stanford Law Review 62:931-1003.

Andrews, Tom

2012 What Is Social Constructionism? Grounded Theory Review 11(1):39-46.

Attari, S. Z., K. Poinsatte-Jones, and K. Hinton.

2017. Perceptions of water systems. *Judgment and Decision Making 12(3)*:314-327.

Balazs, Carolina, et al.

2011. Social disparities in nitrate-contaminated drinking water in California's San Joaquin Valley. Environmental Health Perspectives 119(9):1272-1278.

Bernard, H. Russell
2017 Research Methods in Anthropology: Qualitative and Quantitative Approaches. 6th ed. Lanham, MD: Roman and Littlefield.

Brewis, Alexandra, Cassandra Workman, Amber Wutich, Wendy Jepson, Sera Young, and the Household Water Insecurity Experiences – Research Coordination Network (HWISE-RCN)
2019 Household Water Insecurity is Strongly Associated with Food Insecurity: Evidence from 27 Sites in Low- and Middle-income Countries. American Journal of Human Biology 32(1):e23309.

Brown, Glenn R.
1998. An Examination of Homeless Men, Day Labor, and the University West Community. MA thesis, University of South Florida, Tampa.

Brulle, Robert J. and David N. Pellow
2006 Environmental Justice: Human Health and Environmental Inequalities. Annual Review of Public Health 27:103-124.

Bullard, Robert D., Paul Mohai, Robin Saha, and Beverly Wright
2008 Toxic Wastes and Race at Twenty: Why Race Still Matters after All of These Years. Environmental Law 38(2):371-412.

Capone et al.

2020. Water and Sanitation in Urban America, 2017-2019. *American Journal of Public Health 110,* 1567-1572. https://doi.org/10.2105/AJPH.2020.305833

Cardno.

2017. University Area Community Brownfields Environmental Inventory. Report submitted to the University Area Community Development Corporation, Hillsborough County, Florida.

Checker, Melissa

2007 “But I Know It’s True”: Environmental Risk Assessment, Justice, and Anthropology. Human Organization 66(2):112-124.

Deitz, Shiloh, and Katie Meehan

2019 Plumbing Poverty: Mapping Hot Spots of Racial and Geographic Inequality in U.S. Household Water Insecurity. Annals of the American Association of Geographers 109(4):1092-1109.

Desai, Renu

2018. Urban planning, water provisioning, and infrastructural violence at public housing resettlement sites in Ahmedabad, India. *Water Alternatives 11(1)*:86.

Dobbin, K. B., & Lubell, M.

2019. Collaborative governance and environmental justice: Disadvantaged community representation in California sustainable groundwater management. Policy Studies Journal. https://doi.org/10.1111/psj.12375

Doria, Miguel de Franca

2010 Factors Influencing Public Perception of Drinking Water Quality. Water Policy 12:1-19.

Doria, Miguel de Franca, Nick Pidgeon, and Paul. R. Hunter

2009 Perceptions of Drinking Water Quality and Risk and Its Effect on Behaviour: A Cross-national Study. Science of the Total Environment 407(21):5455-5464.

Douglas, Mary

1992. Risk and Blame: Essays in Cultural Theory. London, Routledge. https://doi.org/10.4324/9780203430866

Douglas, M. and Wildavsky, A.

1982. *Risk and Culture: An Essay on Selection of Technological and Environmental Dangers*, Berkeley: California University Press.

Durst, Noah J.

2018 Racial Gerrymandering of Municipal Borders: Direct Democracy, Participatory Democracy, and Voting Rights in the United States. Annals of the American Association of Geographers 108(4):938–954.

EJSCREEN (2022). *Environmental Protection Agency.* Interactive map.

https://www.epa.gov/ejscreen

Fizer, C.; Bruine de Bruin, W.; Stillo, F.; Gibson, J.M.

2018. Barriers to Managing Private Well and Septic Systems in Underserved Communities: Mental Models of Homeowner Decision-Making. *Journal of Environmental Health, 81(5):*8-15.

Fragkou, Maria C., and Jamie McEvoy

2016 Trust Matters: Why Augmenting Water Supplies via Desalination May Not Overcome Perceptual Water Scarcity. Desalination 397:1-8.

Geertz, Clifford.

1973. Thick Description: Toward an Interpretive Theory of Culture. In The Interpretation of Cultures: Selected Essays. New York: Basic Books. Inc., Publishers. 1-30.

Geertz, Clifford.

1977. The Interpretation of Cultures: Selected Essays. New York: Basic Books, Inc., Publishers. 1-30.

Grupper, Madeline A., Madeline E. Schreiber, and Michael G. Sorice
2021 How Perceptions of Trust, Risk, Tap Water Quality, and Salience Characterize Drinking Water Choices. Hydrology (8)49:1-17.

Grupper, Madeline A., Michael G. Sorice, Marc J. Stern, and Madeline E. Schreiber
2021 Evaluating Determinants of Social Trust in Water Utilities: Implications for Building Resilient Water Systems. Ecology and Society 26(4):Article 41.

Gutiérrez-Capitán, Manuel, Marta Brull-Fontsere, and Cecilia Jimenez-Jorquera
2019 Organoleptic Analysis of Drinking Water Using an Electric Tongue Based on Electrochemical Microsensors. Sensors 19(1435):1-16.

Haenn, Nora
2003 Risking Environmental Justice: Culture, Conservation, and Governance at Calakmul, Mexico. *In* Social Injustice in Latin America. Susan Eckstein and Timothy Wickham-Crawley, eds. Pp. 81-102. New York: Routledge.

Heaney, Christopher, Sacoby Wilson, Omega Wilson, John Cooper, Natasha Bumpass, and Marilyn Snipes
2011 Use of Community-owned and -managed Research to Assess the Vulnerability of Water and Sewer Services in Marginalized and Underserved Environmental Justice Communities. Journal of Environmental Health 74(1):8-17.

Hinds, Kris-An

2019 Perceptions of Infrastructure, Flood Management, and Environmental Redevelopment in the University Area, Hillsborough County, Florida. M.A. thesis, University of South Florida, Tampa.

Hu, Zhihua, Lois Wright Morton, and Robert L. Mahler

2011 Bottled Water: United States Consumers and Their Perceptions of Water Quality. International Journal of Environmental Research and Public Health 8(2):565-578

Hutton Guy, and Claire Chase

2016 The Knowledge Base for Achieving the Sustainable Development Goal Targets on Water Supply, Sanitation and Hygiene. International Journal of Environmental Research and Public Health 13(536):1-35.

Javidi, Ariana, and Gregory Pierce

2018 U.S. Households' Perception of Drinking Water as Unsafe and its Consequences: Examining Alternative Choices to the Tap. Water Resources Research 54(9):6100-6113.

Jepson, Wendy

2014 Measuring 'No-Win' Waterscapes: Experience-based Scales and Classification Approaches to Assess Household Water Security in Colonias on the US-Mexico Border. Geoforum 51:107-120.

Jepson, Wendy, and Emily Vandewalle

2016 Household Water Insecurity in the Global North: A Study of Rural and Periurban Settlements on the Texas-Mexico Border. The Professional Geographer 68(1):66-81.

Johnson, Renée J., and Mike James Scicchitano

2005 Uncertainty, Risk, Trust, and Information: Public Perceptions of Environmental Issues and Willingness to Take Action. Policy Studies Journal 28(3):633-647.

Kiessling, Brittany, and Keely Maxwell

2021 Conceptualizing and Capturing Outcomes of Environmental Cleanup at Contaminated Sites. Environment and Society: Advances in Research 12(1):164-180.

Leahy, Jessica E., and Dorothy H. Anderson

2008 Trust Factors in Community-water Resource Management Agency Relationships. Landscape and Urban Planning 87(2):100-107.

Lehigh, Gabrielle R., E. Christian Wells, and Diana Diaz

2020 Evidence-informed Strategies for Promoting Equitability in Brownfields Redevelopment. Journal of Environmental Management 261(1):110150.

Lockhart, Sydney, Erica Wood, and Jacqueline MacDonald Gibson
2020 Impacts of Exclusion from Municipal Water Service on Water Availability: A Case Study. New Solutions: A Journal of Environmental and Occupational Health Policy 30(2): 127-137.

Meehan, Katie, Wendy Jepson, Leila M. Harris, Amber Wutich, Melissa Beresford, Amanda Fencl, Jonathan London, Gregory Pierce, Lucero Radonic, E. Christian Wells, Nicole J. Wilson, Ellis Adjei Adams, Rachel Arsenault, Alexandra Brewis, Victoria Harrington, Yanna Lambrinidou, Deborah McGregor, Robert Patrick, Benjamin Pauli, Amber L. Pearson, Sameer Shah, Dacotah Splichalova, Cassandra Workman, and Sera Young
2020a Exposing the Myths of Household Water Insecurity in the Global North: A Critical Review. WIREs Water 7(6):e1486.

Meehan, Katie, Jason R. Jurjevich, Nicholas M. J. W. Chun, and Justin Sherrill
2020b Geographies of Insecure Water Access and the Housing-Water Nexus in US Cities. The Proceedings of the National Academy of Sciences 117(46):28700-28707.

Mohai, Paul, Paula M. Lantz, Jeffery Morenoff, James S. House, and Richard P. Mero
2009 Racial and Socioeconomic Disparities in Residential Proximity to Polluting Industrial Facilities: Evidence from the Americans' Changing Lives Study. American Journal of Public Health 99(Suppl 3):S649-S656.

Montoya, Lupita D., Lorelay M. Mendoza, Christine Prouty, Maya Trotz, and Matthew E. Verbyla

2021 Environmental Engineering for the 21st Century: Increasing Diversity and Community Participation to Achieve Environmental and Social Justice. Environmental Engineering Science 38(5):288-297.

Mumbi Anne W., and Tsunemi Watanabe

2020 Differences in Risk Perception of Water Quality and Its Influencing Factors between Lay People and Factory Workers for Water Management in River Sosiani, Eldoret Municipality Kenya. Water 12(8):1-25.

Nader, Laura

1972 Up the Anthropologist: Perspectives Gained from "Studying Up." In Reinventing Anthropology. Dell H. Hymes, ed. Pp. 284-311. New York: Random House.

Oktem, Onur

2016 The Social Construction of Water Management and Political Culture. *In* Water Politics and Political Culture. Onur Oktem, ed. Pp. 15-32. Berlin: Springer International.

O'Leary, Heather.

2018. Pluralizing science for inclusive water governance: an engaged ethnographic approach to WaSH data collection in Delhi, India. Case Studies in the Environment 2(1):1-9.

Oliver, Miguel De

1999 Attitudes and Inaction: A Case Study of the Manifest Demographics of Urban Water Conservation. Environment and Behavior 31(3):372-394.

Pannu, C.

2012. Drinking water and exclusion: A case study from California's Central Valley. California Law Review, 1, 223–268. https:// doi.org/10.15779/Z38B133

Parag, Yael, and J. Timmons Roberts

2009 Battle Against the Bottles: Building, Claiming, and Regaining Tap-water Trustworthiness. Society & Natural Resources 22(7):625-636.

Pieper, Kelsey J., Min Tang, and Marc A. Edwards

2017 Flint Water Crisis Caused by Interrupted Corrosion Control: Investigating “Ground Zero” Home. Environmental Science & Technology 51(4):2007-2014.

Pierce, Gregory, and Silvia Jimenez

2015 Unreliable Water Access in U.S. Mobile homes: Evidence from the American Housing Survey. Housing Policy Debate 25(4):739-753.

Pierce, Gregory, Silvia R. Gonzalez, Peter Roquemore, and Rebecca Ferdman

2019 Sources of and Solutions to Mistrust of Tap Water Originating between Treatment and the Tap: Lessons from Los Angeles County. Science of the Total Environment 694:133646.

Rodgers, Dennis, and Bruce O'Neil

2012 Infrastructural Violence: Introduction to the Special Issue. Ethnography 13(4):401-412.

Roque, Anais, Amber Wutich, Barbara Quimby, Sarah Porter, Madeleine Zheng, Mohammed J. Hossain, and Alexandra Brewis

2022 Participatory Approaches in Water Research: A Review. WIREs Water 9(2):e1577.

Rosinger, Asher Y., and Sera L. Young

2020 In-home Tap Water Consumption Trends Changed Among U.S. Children, but Not Adults, between 2007 and 2016. Water Resources Research 56(7):1-13.

Rosinger, Asher Y., Alexandra Brewis, Amber Wutich, Wendy Jepson Chad Staddon, Justin Stoler, Sera L. Young, and the Household Water Insecurity Experiences – Research Coordination Network (HWISE-RCN)

2020 Water Borrowing is Consistently Practiced Globally and is Associated with Water-related System Failures across Diverse Environments. Global Environmental Change 64:102148.

Scott, Larissa

2020 University Area CDC Says Contaminated Water Gave Children UTIs, Flooding Caused Ringworm. ABC Action News, WFTS Tampa Bay. Retrieved [April, 11, 2022] from https://www.census.gov/programs-surveys/acs.https://www.abcactionnews.com/news/region-hillsborough/university-area-cdc-says-contaminated-water-gave-children-utis-flooding-caused-ringworm.

Sinharoy, Sheela S., Rachel Pittluck, and Thomas Clasen

2019 Review of Drivers and Barriers of Water and Sanitation Policies for Urban Informal Settlements in Low-income and Middle-income Countries. Utilities Policy 60:100957.

Sobeck, Joanne, Joanne Smith-Darden, Megan Hicks, Poco Kernsmith, Paul E. Kilgore, Lara Treemore-Spears, and Shawn McElmurry

2020 Stress, Coping, Resilience and Trust during the Flint Water Crisis, Behavioral Medicine, 46(3-4):202-216.

Spackman, Christy, and Gary A. Burlingame

2018 Sensory Politics: The Tug-of-war between Potability and Palatability in Municipal Water Production. Social Studies of Science 48(3):350-371.

Stillo, Frank, and Jacqueline MacDonald Gibson

2017 Exposure to Contaminated Drinking Water and Health Disparities in North Carolina. American Journal of Public Health 107(1):180-185.

2018 Racial Disparities in Access to Municipal Water Supplies in the American South: Impacts on Children's Health. International Public Health Journal 10(3):309-323.

Stillo, Frank, Wändi Bruine de Bruin, Catherine Zimmer, and Jacqueline MacDonald Gibson
2019 Well Water Testing in African-American Communities without Municipal Infrastructure: Beliefs Driving Decisions. Science of the Total Environment 686:1220-1228.

Stoffle, Richard W., Michael Traugott, John V. Stone, Paula D. McIntyre, F.V. Jensen, and C.C. Davidson
1991 Risk Perception Mapping: Using Ethnography to Define the Locally Affected Population for a Low-level Radioactive Waste Storage Facility in Michigan. American Anthropologist 93(3):611-635.

Stoler, Justin, Amber L. Pearson, Chad Staddon, Amber Wutich, Elizabeth Mack, Alexandra Brewis, and Ahser Y. Rosinger
2020 Cash Water Expenditures are Associated with Household Water Insecurity, Food Insecurity, and Perceived Stress in Study Sites across 20 Low- and Middle-income Countries. Science of the Total Environment 716:135881.

Truelove, Yaffa and Ruszczyk, Hanna A.
2022. Bodies as urban infrastructure: Gender, intimate infrastructures and slow infrastructural violence. Political geography, 92, p. 102492.

UN-WHO Joint Monitoring Programme.

2020. WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP, washdata.org).

U.S. Census Bureau

2019 2015-2019 American Community Survey. Retrieved [April, 11, 2022] from https://www.census.gov/programs-surveys/acs.

U.S. Environmental Protection Agency

2022 EJScreen. Retrieved [April, 11, 2022], from https://www.epa.gov/ejscreen.

Wakhungu, Mathews J.

2020 An Ethnography of WaSH Infrastructures and Governance in Sulphur Springs, Florida. Ph.D. dissertation, University of South Florida, Tampa.

Wakhungu, Mathews J., Noha Abdel-Mottaleb, E. Christian Wells, and Qiong Zhang

2021 Geospatial Vulnerability Framework for Identifying Water Infrastructure Inequalities. Journal of Environmental Engineering 147(9):04021034.

Wedgworth, Jessica C., Joe Brown, Pauline Johnson, Julie B. Olson, Mark Elliott, Rick Forehand, and Christine E. Stauber
2014 Associations between Perceptions of Drinking Water Service Delivery and Measured Drinking Water Quality in Rural Alabama. International Journal of Environmental Research and Public Health 11(7):7376-7392.

Wells, E. Christian, Gabrielle R. Lehigh, Sarah Combs, and Miles Ballogg
2020 Diversity Improves Design: Sustainable Place-making in a Suburban Tampa Bay Brownfield Neighborhood. *In* Case Studies in Suburban Sustainability. Sandra J. Garren and Robert Brinkmann, eds. Pp. 131-149. Gainesville: University Press of Florida.

Wells, E. Christian, Gabrielle R. Lehigh, and Abby M. Vidmar
2021 Stakeholder Engagement for Sustainable Communities. *In* The Palgrave Handbook of Global Sustainability. Robert Brinkmann, ed. Pp. 1-13. London: Palgrave Macmillan.

Wells, E. Christian., W. Alex Webb, Christine M. Prouty, Rebecca K. Zarger, Maya A. Trotz, Linda M. Whiteford, and James R. Mihelcic
2019 Wastewater Technopolitics on the Southern Coast of Belize. Economic Anthropology 6(2):277-290.

Wells, E. Christian, and Linda M. Whiteford

2022 The Medical Anthropology of Water and Sanitation. *In* A Companion to Medical Anthropology, 2nd ed., Merrill Singer, Pamela I. Erickson, and César E. Abadía-Barrero, eds. Pp. Oxford, UK: Wiley-Blackwell.

Whiteford, Linda, Maryann R. Cairns, Rebecca K. Zarger, and Gina Larsen

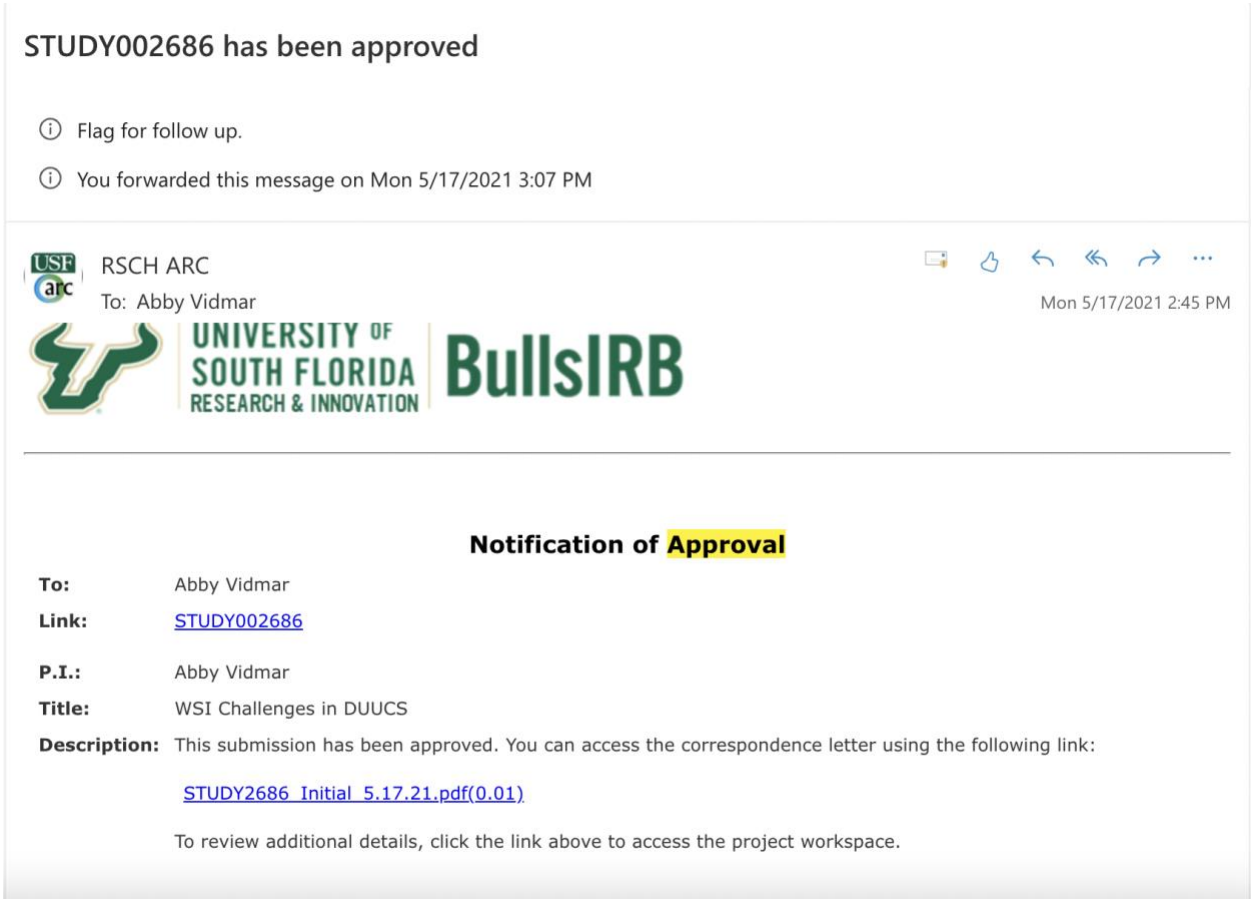
2016 Water, Environment, and Health: The Political Ecology of Water. *In* A Companion to Environmental Health: Anthropological Perspectives. Merrill Singer, ed. Pp. 219-235. Sussex, UK: John Wiley.

Workman, Cassandra L., Maryann R. Cairns, Francis L. de los Reyes III, and Matthew E. Verbyla

2021 Global Water, Sanitation, and Hygiene Approaches: Anthropological Contributions and Future Directions for Engineering. Environmental Engineering Science 38(5):1-16.

APPENDICES

Appendix A: USF IRB Approval



STUDY002686 has been approved

Flag for follow up.

You forwarded this message on Mon 5/17/2021 3:07 PM

RSCH ARC

To: Abby Vidmar

Mon 5/17/2021 2:45 PM

UNIVERSITY OF SOUTH FLORIDA RESEARCH & INNOVATION | BullsIRB

Notification of Approval

To: Abby Vidmar

Link: STUDY002686

P.I.: Abby Vidmar

Title: WSI Challenges in DUUCS

Description: This submission has been approved. You can access the correspondence letter using the following link:

STUDY2686_Initial_5.17.21.pdf(0.01)

To review additional details, click the link above to access the project workspace.