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An Anthropology with Human Waste Management: Non-Humans, The State, and Matters of Care on the Placencia Peninsula, Belize

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An Anthropology *with* Human Waste Management: Non-Humans, The State, and Matters of Care on the Placencia Peninsula, Belize

by

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Dedication

To Don and Kathy.

Acknowledgments

Writing a dissertation is an affecting experience. It is at times thrilling, infectious, anxious, lonesome, boring, frustrating, collaborative, and triumphant. Near the end, I came to identify with Sisyphus pushing the boulder to the top of the mountain each day, only to watch it roll back down. There was a lot of writing and re-writing. It would have been impossible, not to mention meaningless, to attempt such a feat alone. It takes a village to write a dissertation.

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There is no story to tell in anthropology without narrators. The processes and experiences which inform this dissertation come from dozens of people who were kind enough to share a little of their lives with me. Their openness and charity expanded my interior intellectual and ethical life, and I am forever changed by their contributions. As most of the names used in this work are pseudonyms, I will refrain from listing them here. I would like to note however, that they include members of the Placencia Fishing Co-op, Southern Environmental Association (SEA), the Placencia Village Council, The Seine Bight Village Council, The Placencia Chapter of the Belize Tourism Industry Association, CBCL Limited, Belize Water Services, The InterAmerican Development Bank, The Caribbean Development Bank, Fragments of Hope Ltd., as well as peninsula fishers, tour guides, cab drivers, shop owners, and residents.

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And finally, to my friends and family. I’m done now. You can stop asking.

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Abstract

The management of human waste is a seldom studied phenomenon in anthropology. Yet across the globe, in countries both rich and poor, it presents pervasive and difficult to tame problems. This dissertation draws on complimentary theories of management and entanglements to explore the practices and processes of organizing human waste on the Placencia Peninsula, Belize. The results illustrate how problems are conditioned and defined by messy relations between institutions, people, technologies, materials, and ecological life.

Fieldwork and analysis for this work was a culmination of years of interdisciplinary collaboration between other anthropologists and engineers at the University of South Florida. Data collection relied on interviews conducted by these researchers over a five-year period (n=46), as well as original rapid ethnographic assessments on the peninsula, virtual interviews (n=11), and collaboration with engineering colleagues. Data analysis approached management as comprised of three interdependent dimensions – non-humans, social institutions, and matters of care.

The findings highlight contingent relationships between people, human waste infrastructures, state processes, and desirable futures. They emphasize how waste management cannot be understood outside the context of its non-human entanglements (in this case the soil, water, pipes, technologies, and local ecologies). It is within these dynamics that management processes are enacted and understood, even while the specific relations between non-humans are often as speculative as they are empirical. Just as they are entangled with the non-humans of waste management, the social institutions attempting to resolve human waste problems are

equally enmeshed with interpersonal relationships, knowledge practices, and sources of funding. Social trust, the flow of information, and terms of finance each shaped practices as they unfolded, in ways big and small. Finally, matters of care, or the imagined futures which propel action forward, were often dependent on people's social position or their direct relationship with management processes. The politics and ethics of management emerged within these historical and situated relations.

Overall, this work contributes a process-oriented approach to 'thinking through' the practices and problems of human waste management. Being mindful of its crucial material underpinnings, the primacy of relationships and flows of information, and their contingent and emergent political dilemmas, opens a world of possibilities for how management can be enacted. My hope is that this dissertation helps practitioners and future researchers gain new insights about a part of life that has always been, and will always be, with us.

Chapter One: Managing Human Waste

I am changing my daughter's diaper. She squirms as I juggle holding her feet together with one hand, while wielding a wet wipe in the other. On the corner of the dresser, the cover of Taro Gomi's timeless children's book reminds me that "Everyone Poops" (Gomi 1977). It is one of those rare human universals. Generating excreta - urine and feces - is an inevitable part of our mortal experience. Wherever we go we must deal, in some capacity or another, with these bodily excretions[1]. How they are dealt with, or *managed*, is inescapably entangled with endlessly unfolding relationships.

Earlier that morning, like my daughter, I had performed my own small act of corporeality. Unlike her diapered wastes however[2], which were folded into a neat and tidy ball and placed in an odor locking garbage can, mine were deposited in a porcelain toilet and flushed through an underground network of pipes to a municipal treatment plant in Tampa, Florida. In both instances, there are distinct and complex management *practices*, from which different problems emerge.

My daughter's diapers are more than just representations of modern convenience and cleanly childcare. They are also expensive, single-use products reliant on the extraction of cellulose fiber and the manufacturing of oil-based polypropylene. Their circulation is the result of acceptable norms about children's bodily wastes as garbage, collected from the bins in front of

[1] Although as Lea (2001) astutely points out, the expulsion of our wastes is never 'pre cultural', I am only stating the cultural forms around them are a biological inevitability.

[2] References to waste, unless otherwise noted, will always refer to excreta - urine and feces.

my house by public sanitation workers between the quiet hours of 10 am and noon every Monday and Thursday. Her excreta are also among the masses of soiled diapers accounting for 11% of new landfill waste in the US, contributing to hazardous leachate and methane gas emissions (US EPA 2018).

My flush toilet on the other hand, relies on a bathroom with piped water flowing into carefully designed gravity fed sewers and pump stations. From there, they connect to large infrastructures where engineers orchestrate the mechanical separation of solids and liquids and manipulate biochemical processes to remove pathogens. Entangled alongside these practices are ideas of privacy, public health, and governance (Hawkins 2004). Tampa's aging centralized system is also, like so many others across the world, always undergoing problems. Pipes break, storms surges flood the system, power outages and blockages impede the free movement of wastewater - all leading to millions of gallons of untreated sewage spilling into waterways and coastlines (Salman et al. 2019; Wakhungu 2020).

Changing diapers and flushing toilets are only two methods along a continuum of contemporary and historical strategies. For at least 5,000 years people all over the world have experimented with different infrastructural practices for managing people's wastes (Halperin, Le Moine, and Pérez Zambrano 2019; Hequn and Yufengyun 2018; Lofrano and Brown 2010). Over the millennia, management configurations have proliferated in response to changing desires for convenience, increasing population densities, conceptions of public and ecological health, universal human rights, and technological interdependence (Antoniou et al. 2016; Matsui, Kanehara, and Kanehara 2003; Prabaharyaka 2020; Vuorinen, Juuti, and Katko 2007).

Management configurations have also encountered new problems as they resolve existing ones, as evidenced by my own household. The history of contemporary human waste

management is brimming with stories of invention and reconfiguration under changing conditions (Arnesen 2001; Dubber and Gill 2014; Kuribayashi and Nakamura 1980; Swanson et al. 2004; Venkatesh 2013). The fix and fiddle nature of managing waste echoes organizational theorist Russell Ackoff's maxim: "problems are abstracted from systems of problems, or messes….managers do not solve problems, they manage messes" (Ackoff 1979:100). Thinking through these messes – of materials, of institutions, of ethics - to better understand why particular practices and problems in human waste management emerge, is the central aim of this dissertation.

Waste management has become a particular concern on the Placencia Peninsula in southern Belize. The narrow strip of land is home to four small communities undergoing rapid tourism development at different rates, with different capacities for human waste management. They are also uniquely located in a country that is both a coastal Central American nation and considered a Caribbean Island. The sparsely populated but highly diverse country has, like others in the Caribbean, been under appreciated as a locale for cultural anthropology (Mintz 1996; Thomas and Slocum 2008). Human waste management in the region has also been all but ignored by the social sciences more broadly. A circumstance in urgent need of change.

Placencia is experiencing a common Caribbean phenomenon. Tens of millions of tourists come to the region to take in the beautiful weather, invigorating cultures, and natural wonders. Their arrivals coincide with rapid infrastructure development - resorts, condos, shops, restaurants, roads, water supplies, cruise ship ports, airports, and power grids. Managing the influx of human waste, particularly after it has been deposited into a bathroom, garners much less attention. Consequently, in the most tourism dependent region in the world, where nearly

70% of the population live along and depend on coastlines, as much as 85% of human waste enters the sea untreated (Cashman 2014).

The lingering questions are, what problems does this present and how can these small island states[3] marshal the resources and capacities to address them? When it comes to human waste management, the Caribbean is once again an "Open Frontier" for anthropological inquiry (Trouillot 1992). The Placencia case is intended as a "sensitizing instance", to foreground and reveal the material and social complexities of managing waste in a seldom studied location (Mol and Law 2002). To do so, this research will explore ways of thinking about contemporary technoscientific waste management practices and processes as opposed to entities or meta-discourses. It is my hope that the following dissertation helps practitioners and researchers, to borrow the phrase from German Philosopher Hannah Arendt, "think what we are doing" (Arendt 1958:4).

Setting the Scene in Placencia, Belize

"If you look up *life* in the dictionary, it just says *change*", Jeff offered as I mulled over the local developments in tourism. It was the dozenth time he had done so in a week. Sometimes he straightened his posture and lifted his chin, orating "Merriam Webster's dictionary defines life as…" satirizing any pretenses of control.

It is hard to deny the truthiness[4] of his sentiment. His wife, a local restaurant icon, passed the month before. Now he was helping Aayisha, one of her daughters, with the daunting task of reinventing her mother's recipes. They disagree over the new menu. Aayisha, a Creole Belizean,

[3] While Belize is partially landlocked, it is considered an island within many intergovernmental bodies (e.g., UN SIDS, Caricom)

[4] "Truthiness" was coined by comedian Stephen Colbert and indicates the feeling that something is figuratively true even though it isn't literally true.

wants to serve traditional food like stew chicken with red beans and rice. Jeff, a long time American ex-pat, argues they should serve tourist-friendly fare like biscuits and gravy.

Their small wood-frame shack and its steel drum BBQ sit just a few feet from high tide at the southernmost tip of the Placencia Peninsula, a 17-mile sandbar extending out from the south coast of Belize. Most of their customers are tourists grabbing an early breakfast before going on day trips to one of the many small islands peppering the coast. The shack's small service window faces north, towards a peninsula undergoing changes of its own.

Every year more tourists come. Over the past decade the number of visitors staying overnight in Belize has more than doubled, a trend with no end in sight. In 2018 Belize was the fastest-growing tourism destination in the Caribbean (BTB 2018). Up and down the coast local and foreign investors and entrepreneurs are converting homes to vacation rentals, erecting condominiums and hotels, and searching for ways to provide memorable services.

Figure 1. *View towards the north from the southern tip of the peninsula. Photo by Victor Faux*

Aayisha and Jeff are trying to drum up business by building a small U-shaped patio for customers to sit and picnic on the beach. They are completing it piecemeal as money comes in, the thin exterior still waiting for another coat of paint. Projects always come with surprises.

I spent my first day in Placencia on the patio prying into Aayisha's rum punch recipe. She silently smirked at my guesses, refusing to give anything away. After a couple of hours chatting with tour guides waiting for arrivals at the nearby pier, the punch, and the gentle slapping of the tide on the beach, took its toll on me. I needed a bathroom.

In addition to the growing need for public toilets, existing treatment infrastructures are often leaky, undersized, or inadequately built for the peninsula. Most toilets are attached to either a septic tank or a soak pit. In either case, treating waste eventually relies on layers of earth, and the microorganisms living there, to filter out excess nutrients. Placencia's high-water table and porous soil can be an unforgiving environment for that process.

The peninsula's sandy substrate allows effluent, or nutrient-rich partially treated waste, to quickly sift through and mix with groundwater that is oftentimes less than a foot below the surface. Heavy rains and storms can raise the high-water table even higher, leading to pooling around septic tanks or latrines, sometimes causing them to overflow or back up.

The high-water table can also be hard on treatment infrastructure. Especially since many were built with bonded cement cinder blocks prone to leaks after years of being submersed under water. Beyond environmental challenges, systems designed for single families and a few tourists struggle to accommodate the increase in visitors. The need for larger systems is dampening residents' ability to participate in the burgeoning tourism economy. Entrepreneurs are finding themselves frequently pumping out their septic tanks to avoid unpleasant odors for guests and unable to afford new treatment solutions.

The result of all the failing or undersized systems is an ebb and flow of wastewater and groundwater, an underground network of nutrients and bacteria traveling through the peninsula and out to the shoreline (Haberstroh 2017). The state of waste management, coupled with the flood of people coming to Placencia, has provoked fears about water quality for many residents. The peninsula is surrounded by a mangrove lagoon to the west and the Caribbean Sea to the east. Each containing sensitive ecosystems, on which many livelihoods depend, vulnerable to the impacts of wastewater inputs.

The wheels of infrastructure development began slowly winding around these issues over 20 years ago. In 2001, Hurricane Iris, a category IV, cut through Placencia bringing 15 ft storm surges saturating the peninsula and flooding the streets with the contents of its wastewater systems. The impact of Iris inspired a hotelier in Placencia Village, the primary town for tourism activity on the peninsula, to contact Engineers Without Borders (EWB) via her son who was living in the United States. EWB members made site visits, conducted research, and consulted with the Placencia Village leadership over the next several years. In 2006, they produced a proposal for a centralized system expected to cost approximately five million US dollars (Fedak 2006). The proposal faced a few hurdles. It was not uniformly popular amongst residents nor were members of the other towns along the peninsula consulted. Plus, the costs of the project were out of reach for the Placencia Village community councils and water boards.

The plan laid dormant for four years until the Belize government applied to participate in a regional wastewater development program called CReW in 2010 (CReW 2014). CReW had devised a revolving loan program, which combined with grant funds, was designed to use revenue from the Placencia system to fund wastewater developments elsewhere in Belize. The federal government tasked the national water utility, Belize Water Services, to implement the

project. In turn they contracted consultancies – from the US and England - to determine the feasibility and ultimate design of the system.

The project has gone through several stages over the years. When consultants analyzed the feasibility of the EWB design they found it would need to be modified, with the cost coming in at least two to three times what the original design suggested. Plus, by the time the utility gained access to the funds, the land for the initial EWB treatment plant was no longer available. Determining a new site became a politically fraught task after the re-design predictably chose the cheapest land option.

When the government revealed the plan, many residents across the peninsula protested, bussing three hours to the capital to contest the siting of the plant in the poorest community on the peninsula. A second proposed site was met with equal resistance by aquaculture operations on the opposite side of the lagoon. That site risked the health and eco-sustainability certifications of their shrimp farms (Wells et al. 2019).

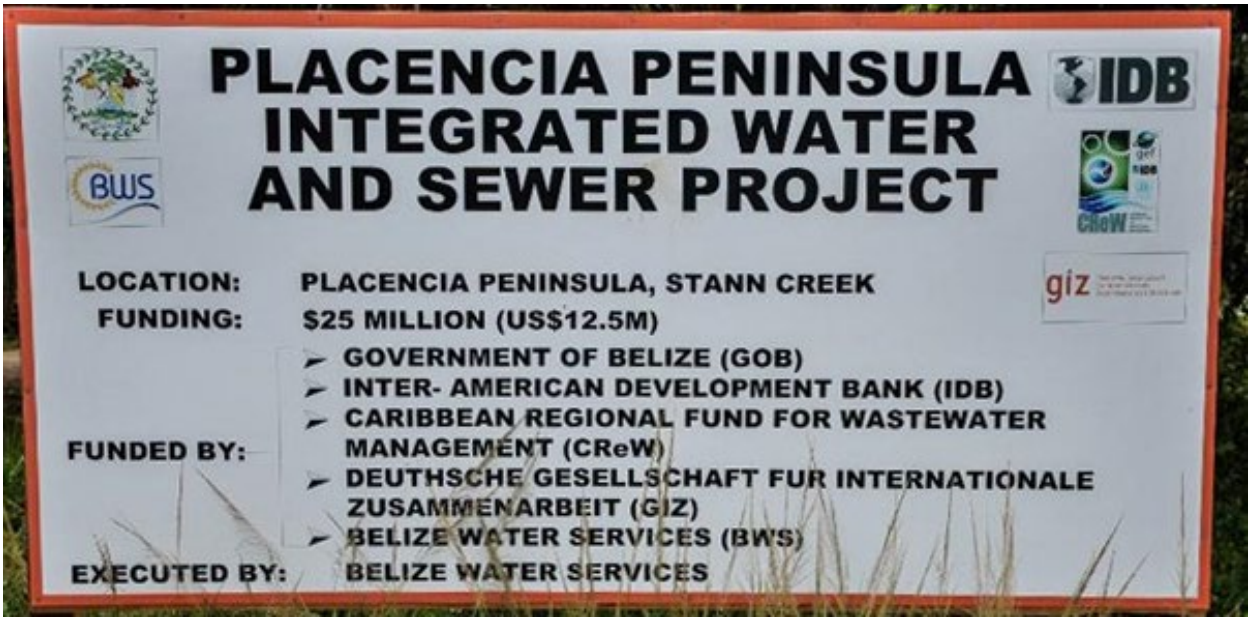


Figure 2. *Sign for the centralized sewer project. Photo by EC Wells.*

Community disagreements about the placement and necessity of such a large-scale project stalled development and eventually the IADB funding opportunity expired. Since then, a few uncertainties about the project have persisted. To clarify issues with community leaders, the utility has hired another consultancy to conduct yet another round of studies to better understand the specific technical dynamics of wastewater on the peninsula and calculate risks. More money was sought elsewhere to finance a complex analysis of the relationships between local hydrology, nutrients, and development.

Implementation is another looming source of uncertainty. Construction is not only expensive but complicated given the long and narrow peninsula. The centralized system will require tearing up the only road to lay pipes that will have to connect across multiple property lines and accommodate hook ups from a mix of infrastructure types. The project would presumably also include provisions for homes with no bathroom at all, of which there are many. As the problems have become more well understood, the demands and costs of the project have increased. The utility is struggling to secure enough funds to build it.

Finally, in the years since the initial proposal, tourism investment on the peninsula has laid some community tensions bare. What is the future vision an enlarged sanitation system enables? While tourism is a dominant pressure, and financial justification, for increasing wastewater treatment capacities, how much tourism should be accommodated and by whom are contentious questions. And how well regulated will these developments be?

For many residents improving wastewater is a necessity for encouraging foreign investment and economic opportunities. For others, rapid tourism growth – with its haphazard land clearing, real estate inflation, resource consumption, and uneven economics - is incompatible with the stability of the peninsula, regardless of improving wastewater treatment

capacity (Vitous and Zarger 2020). Residents and the state alike are greeted with multiplying problems as they address human waste challenges in Placencia.

After returning from the bush behind the bar, I wondered what Jeff and Aayisha thought of the proposed system. Despite the controversy a few years ago, they only vaguely remembered it. Stalled projects are a part of life in Placencia. A truism evidenced by the abandoned concrete skeletons of multi-story hotels and condominiums strung across the north of the Peninsula. Besides, they have bigger concerns. The state had recently announced they were going to ban buildings within six feet of the shoreline, meaning they may demand the shack be torn down or moved. They are pushing ahead optimistically. Change indeed.

Social Problems in Human Waste Management

The events unfolding on the Placencia peninsula are mirrored in places far beyond the Belizean coast. Communities all over the world are grappling with shortfalls in human waste management amidst the whirlwinds of economic development and population growth (George 2008; Black and Fawcett 2010). The consequences of these shortfalls can be far reaching. Human waste has the potential to disrupt social life, introduce new and deadly health risks, and destabilize ecologies (Whiteford et al. 2016; Zhang et al. 2016). The exact problems posed by its management depend on the situations people find themselves in.

Perhaps the most pressing concern is *public health*. In 2008 I made the mistake of going for an afternoon swim after a heavy rain while living in Barbados as a sea turtle researcher. To see into the usually clear waters I had to dive three feet below a hazy brown sludge. People immediately rushed to the shoreline and called me in. I was marinating in the south coast of Barbados's collective sewage. Luckily, I did not get ill, but millions of people across the globe

do (Shuval 2003). Human wastes contain pathogens from the bodies that produced them as well as high concentrations of nutrients, which enable the rapid growth of even more macroalgae. An afternoon swim or morning bath in waters inundated with untreated human waste can put you at risk for gastrointestinal, respiratory, dermatological, and other infectious diseases (Fuhrimann et al. 2016; González-Saldía et al. 2019; Henrickson et al. 2001).

Swimming is only one avenue of disease from human wastes. When excreta come into contact with drinking water supplies, people are exposed to diseases like diarrhea, hepatitis, giardia, and typhoid (Borchardt et al. 2003; Kumie and Ali 2005; Valli 2002; Wolf et al. 2014). Similarly, the nutrients from human waste can enrich stagnant waters, making them ideal breeding grounds for mosquitoes spreading viruses like malaria, dengue, and zika (Boisson et al. 2016; Hotez et al. 2008). Without access to adequate care, these illnesses can lead to long term health consequences or become fatal, with some estimates attributing 5% of unnecessary deaths in low-income countries to poor sanitation (IHME 2017). At least one global study suggests inadequate waste treatment might be a greater predictor of mortality than access to water infrastructures (Ellis and Schoenberger 2017).

The same watery pathways by which untreated wastes become a public health issue are also transformed by its presence, leading to *ecological health* concerns. The majority of the world's excreta end up in aquatic bodies like rivers, lakes, and coastlines (Jewitt 2011). The degree to which it is a cause for concern depends on the volume of waste relative to the size and movement of the body of water. When the amount of waste is comparatively small, dense aquatic food webs can absorb them with limited disturbance. As the old adage in waste management goes, "the solution to pollution is dilution" (Rockefeller 1998). In large and consistent quantities relative to their end point however, the effects can be devastating.

Human waste's high concentration of nutrients and organic carbon introduces a glut of feed for algae and bacteria. As the nonflowering plants and single celled organisms feast, their populations grow exponentially, depleting oxygen supplies, competing for space, and blocking sunlight from reaching the waters below (D'Angelo and Wiedenmann 2014; Lapointe, Herren, and Paule 2017). The flora and fauna beneath the surface slowly suffocate and die, devastating the food web (Altieri et al. 2017). The net effect is upended livelihoods, diminished ecosystem resilience, and a severe reduction in the biological richness of life (Banaszak 2021; Isaza et al. 2021; Lapointe et al. 2019; Sánchez et al. 2013).

Problems of human waste management are, of course, also entwined with the politics of social life. Perceptions of *citizenship,* or inclusion in everyday social performances, are often reflected through participation in management practices. When the ability to use a flushing toilet, a staple in many urban cores, is unequal, the bathroom can represent a sense of social belonging, of being a moral citizen through the responsible management of waste (Helgegren et al. 2018; Morales 2016). The use of a private space can also serve, by distinction, as the basis for someone becoming a "public" person (Appadurai 2001; Chalfin 2014). In specific rural contexts this dynamic can become inverted however, where social relations make open defecation preferential to toilet access (Coffey and Spears 2017; Thys et al. 2015).

The relationship between public life and toilets is particularly powerful for women and girls. A safe place to use the bathroom can be the difference between being able to participate in education and the workforce or being vulnerable to violence and alienation (Corburn and Hildebrand 2015; Pearson and Mcphedran 2008; Scorgie et al. 2016; Sommer et al. 2014). For many communities experiencing rapid growth, living with a combination of these issues is part of everyday life. Left unresolved, these processes can converge into social and economic burdens

undermining the opportunities, and underutilizing the talents, bringing people to urbanizing areas (Hernández-Sancho et al. 2015; Hulton 2012).

The will to manage waste problems has struggled to keep pace with humanity's exponential growth. In fact, most people rely on sanitation practices that leave their waste's untreated (WHO and UNICEF 2020). A reality that cannot be simply reduced to national economics. High income countries throughout the world are also plagued by these persistent challenges (Maxcy-Brown et al. 2021; Murray 2020; Naden et al. 2016; Roller et al. 2019; Sidhu et al. 2013).

Since the last quarter of the 20th century the push to resolve sanitation troubles has been globalized. Intergovernmental organizations, development banks, states, and nonprofit organizations have attempted to ameliorate risks posed by poorly managed waste. Since the 1980's, the United Nations, for instance, has set three decades long benchmarks for improving global sanitation. The most recent, 2015's Sustainable Development Goal six (SDG 6), seeks to ensure universal access to safely managed sanitation by 2030. Each of the UN's sanitation benchmarks have failed to be realized however, and not by trivial amounts (World Health Organization 1991; 2017)[5]. Current estimates suggest the rate of infrastructure development would need to quadruple to reach the SDG 6 deadline (WHO and UNICEF 2020).

There have been many lessons learned from the dynamics of these failed ambitions, although they do not point to easy or uniform solutions. Despite the push for investment, managing waste still garners significantly less political and financial support than other infrastructure development projects (Mara 2003; WWAP 2017; Mariwah 2018). Additionally,

[5] It should be noted that while the UN has consistently missed their sanitation targets, the cumulative failure of these ambitious is in part because they moved the goal post at each iteration (e.g., from providing a facility, to providing treatment, to provide safe management, etc.).

addressing waste management problems involves more than the mere transfer of technology, as communities often have their own idiosyncratic tensions about what a desirable solution might be (Fuchs and Mihelcic 2011; Kooy and Harris 2012; Libby, Wells, and Mihelcic 2020; Naughton et al. 2018; Workman et al. 2021). For instance, areas experiencing rapid growth often contain a mix of existing treatment strategies and economic capacities, making uniform top-down interventions difficult (Domínguez Aguilar and García De Fuentes 2016; Lawhon et al. 2018). Bottom-up solutions run into similar hurdles when attempting to bring them to scale (Chambers 2009; Prouty, Mohebbi, and Zhang 2018).

Sanitation interventions also come with their own power relations over how problems are defined and how change is enacted. Due to the diffuse consequences of collective human waste, its management can quickly become a conflicted public issue, where the distribution of wealth, risk, and preferred solutions vary (Dewey 1927; Pfaffenberger 1992a). This can lead to situations in which governmental discourses and designs are at odds with the needs and conceptions of particular constituents. Official discourses emphasizing economic growth and public health can be met with resistance if sections of the public are not convinced they will personally benefit, or worse, fear they will suffer (Downs and Larson 2007; Jenkins and Sugden 2006; Mara et al. 2010; Nawab and Nyborg 2009).

Consequently, the role of the state and development organizations in human waste management is often a contentious one, with conflict running in many directions. In unequal settings excluded communities may petition their government for access to adequate sanitation on legal and moral grounds (Appadurai 2001; Flowers 2020; McFarlane and Silver 2017; Wells et al. 2022) or, alternatively, communities may resist the extension of government into local sanitation management (Ratner and Rivera 2004; Wells et al. 2019). Citizens may protest the

state's mishandling of waste (Alley 2002; Hawkins 2006) or find themselves beleaguered by development and state institutions intent on shaming them into using a particular technological and management strategy (Bateman and Engel 2018; Doron and Raja 2015; Engel and Susilo 2014).

In the absence of state or privately funded interventions during periods of growth, people are left to their own creativity and existing markets. In these circumstances, management covers a range of small-scale options including people who collect chamber pots in the middle of the night in Ghana (van der Geest 2002), mobile urinals in India (George 2008), custom household treatment systems in Belize (Prouty, Mohebbi, and Zhang 2018) or "flying toilets" in Kampala, Uganda, which is the practice of bagging feces and throwing them into canals and refuse piles (Terreni Brown 2019).

What a mess human waste management is! Its crisscrossing problems illustrate how embedded it is in social and political life (Reno 2015). Its possibilities are entangled with the material qualities of waste, perceptions of how it should be managed, and the distribution of power and responsibility. To follow along these many processes, this research proposes an anthropology "*with"* as opposed to one "*of*" human waste management.

The distinction between these prepositions points to separate research commitments. Anthropologies *"of"* take a traditionally comparative approach, in which a phenomenon is understood within the context of an academic object or entity (e.g., religion, the state, development, etc.). Alternatively, an anthropology *"with"* jettisons this obligation in favor of

attending to and joining in on the social and material processes and relations of managing waste, to explore possibilities as the world unfolds (Ingold 2014; 2017)[6].

An Anthropology *with* Human Waste Management

Exploring human waste challenges presents a familiar, yet intractable, anthropological dilemma. When waste management's potential problems and practices are so diffuse and pluralistic, how do you decide what to attend to? Which processes should be highlighted over others? There is no natural end to thinking through the material and social relations giving waste management presence in the world. To borrow from anthropologist Gregory Bateson's ecological thinking, "what can be studied is always a relationship or infinite regress of relationships. Never a "thing." (Bateson 1972:246; see also Whitehead 1929).

Anxieties about scale are embedded in anthropological theory. Even the boundaries of its core concepts, people and culture, are disciplinary inventions (Clifford and Marcus 1986; de Sardan 2015; Strathern 1991; Wagner 1975). Anthropologists have experimented with various forms of scalar thinking to understand its influence on theory, including geography (e.g., Appadurai 1990; Wells, Davis-Salazar, and Moreno-Cortes 2014), knowledge practices (e.g., Ong and Collier 2005; Strathern 2003; Tsing 2005), temporality (e.g., Ingold 1993; Rabinow 2008; Smith 1962) , and political power (e.g., Mintz 1977; Wolf 2001; Workman 2019).

These experiments, amongst many others, highlight how inevitable problems of scale are in anthropological research. The boundaries created through scalar thinking determine the divisions by which phenomena are understood and compared. In the context of human waste

[6] Ingold frames "with" vs "of" in terms of ethnography vs participant observation. However, there is nothing implicitly comparative about ethnography. His point of process-oriented research that is both empirical and speculative is well taken however and inspired this research approach.

management, relations are a constantly unfolding set of diverse processes, adjusting themselves through space and time. Anthropologists and other social scientists engaged in processual theories have convincingly suggested bounding the study of practices by the immediate social and material relationships that draw them together (Hinchliffe 1996; Jensen 2014; Latour 2005; Law and Mol 2001). It is for this reason the title of this dissertation includes the word *management*.

An anthropology of management refers to "a social process, involving negotiation and construction of meaning to get things done", although it is also constrained by, and potentially transforming, the context it is operating within (Linstead 1997:87). As an ongoing activity there is no 'essence' to management, it is enacted by a changing cast of actors, with different practices and perspectives through various points in time. Therefore, the scale of research is not drawn around the study of a community, or managers, or institutions; it is drawn around the active processes of management (Czarniawska 2004; Hernes 2007).

But what exactly is included within these processes? Certainly, they could be bounded by *social institutions,* ranging from an informal collection of households to public or private utilities, non-governmental organizations, state institutions, community action groups, domain experts, financiers, and bureaucrats. Management processes might also be expanded to include artifacts like documents, computer models, and regulatory frameworks which inform and mediate relationships. The negotiations and construction of meanings between and among these institutions, however, are directly related to the organization of bodily excretions as substances with physical and biological properties. The influence of materials and other life forms in the performance of everyday life is inescapable (Ingold 2011a; Latour 1998:14; Miller 2005).

Excreta has a smell and texture and is made up of chemicals and pathogens. Its management inevitably features inorganic and organic substances. Those substances may interact with technologies like toilets, pipes, and electricity, as well as materials like water, soil, and other chemicals. The bacteria and chemical properties of waste may further create new processes along with other living organisms. Regardless of the configuration of these elements, management concerns and treatment processes rely on the properties and behaviors of *non-human* contributors.

The sum of organizational and non-human relations does not equate to the total of human waste management, however. Even if their dynamics are comprehensively described, in painstaking detail, one nagging question remains. What is all this management for? Human ethics and aspirations are the engines of action in management. But in pluralistic societies, they are hardly uniform. So far, I have invested quite heavily in the use of the word "problem" in relation to human waste management. It is not intended as a model of "deficit thinking" in which the world as-is is presented against my preferred utopianism (e.g., Lambrinidou 2018).

Problems in my conception are inevitable, contested, and time bound. They are also the force that produces a "public" who express different concerns regarding the effects of human waste management (Dewey 1927). These *matters of care*, or the situated articulations of political and moral aims, are what animate social problems (de la Bellacasa 2011; Martin, Myers, and Viseu 2015). Tensions which make management practices comprised not only of organizational and non-human dimensions, but philosophical and ethical perspectives as well.

Organized this way, three interrelated and overlapping focal points emerge when thinking through the problem of scale in an anthropology with human waste management: managing waste is entangled with 1) non-humans - the pipes, toilets, water, and surrounding environments,

etc., 2) social/political institutions - individuals, community groups, governmental agencies, etc., and 3) matters of care - or the landscape of motivations that direct human behavior.

The aim of this project is a pragmatic and applied understanding of the diverse practices and problems in waste management in Placencia, Belize through the following questions: [R:1] How and why do non-human aspects of waste management, and the ecologies they are enmeshed in, shape potential solutions on the Placencia Peninsula? [R:2] How and why do waste management's social institutions on the peninsula –e.g., local and national governance, consulting experts, and development finance – make sense of problems and collaborate towards solutions? And finally, [R:3] How do matters of care, and the speculative futures they engender, produce discourses around waste management problems?

Dissertation Outline

This dissertation is about human waste management. It is about how practices emerge and are conditioned through messy relations between institutions, people, technologies, materials, and ecological life. It is principally a "minor science" (Deleuze and Guattari 1980:284), much more interested in exploring methods, or rather ways of thinking about, complex and emergent socio material phenomenon than critiquing or advancing a development narrative. The outline of the work is as follows:

Chapter two (*Theory*) makes a case for what should be attended to when studying human waste management. This chapter extends current, predominantly symbolic, anthropological approaches to thinking about human waste to include the many material and institutional relations giving definition to its management. The result is an examination of theoretical tensions

related to non-humans, social institutions, and matters of care. These tensions serve as the analytical outline for the case study.

Chapter three (*Methods*) outlines the circumstances through which knowledge about human waste management was accrued, how my relationships in Placencia emerged and were sustained over time, and how data was constructed and analyzed. Borrowing from Donna Haraway's conception of 'diffraction' as an alternative to reflection, the chapter presents my personal journey through the research process as interwoven within its methodologies.

Chapter four (*Site Description*) introduces the Placencia Peninsula as the case study site. This chapter provides context for human waste management by recounting the history of Placencia and Belize more generally, including an overview of economic, infrastructural, and organizational changes in the recent past.

Chapters five (*Non-Humans),* six (*Social Institutions),* and Seven (*Matters of Care)* each present an ethnographic account emphasizing a different analytical scale in the practices of human waste management in Placencia.

Chapter eight (*Discussion & Conclusion)* combines and explores the insights from the previous three chapters through a re-review of the literature. I then discuss the limitations of the study, identify some practical solutions related to the case study, and presents concluding remarks.

Chapter Two: Thinking Shit Through

Human waste is not a popular topic. Not in politics, not around the dinner table, and not in anthropology. Except for the archaeological study of fossilized feces, known as coprology, the discipline has mostly been content to "not know" about collective excretory habits (van der Geest 2007a). Consequently, the field's contributions to human waste management *practices* are slight (Hyun et al. 2019; Workman et al. 2021).

Anthropology's most influential theory on excreta is Mary Douglas's notion of *matter-out-of-place* from her work "Purity and Danger" (1966). In it, she illustrates how cultures construct and manage concepts of dirt and pollution to create order in an otherwise disordered world. Within her framework, bodily excretions must first be viewed as something out-of-place within an organized system *before* they can be seen as unclean: "dirt is a by-product of a systematic ordering and classification of matter" (1966:36)[7]. Which is to say, waste is less disgusting in a sewer pipe than it is near food.

Exploring human waste as a process of classification and order reveals a kaleidoscope of possible interpretations. Excrement is at turns disgusting and embarrassing (Bubandt 1998; Durham 2011; Glazer 2017; Jewitt 2011; van der Geest 1998), a source of pollution and emblematic of the social contract (Alley 2002; Hawkins 2006; Winkler and Flowers 2017), an untapped resource for a hopeful future (Mihelcic, Fry, and Shaw 2011; Thompson and Beck

[7] Douglas's symbolic structuralism drew from sociologist Emile Durkheim's notion of "Total Social Facts" (Durkheim 1895), and anthropologist Evans-Pritchard's description of political practice being dispersed throughout the public rather than specific entities of governance (Evans-Pritchard 1940).

2017; Verbyla et al. 2016), a tool of warfare (Mayor 2009:81), or even sexual stimulation (Peakman 2013).

Interpretations of waste are also "socialized" in their world, that is, there can be considerable distinction between the bodily excretions of a loved one compared to a stranger, for instance (van der Geest 2007b; van der Geest and Zaman 2021). In many communities, a person's status is reflected in how they manage their wastes relative to others; signifying citizenship, wealth, shame, and/or social distinction (Appadurai 2001; Al-Mohammad 2007; Doron and Raja 2015; Pickering and Wiseman 2019; Srinivas 2002). People have transgressed, retained, and reimagined the symbolic boundaries around waste in the expression of religious rites (Bourke 1891; Neis 2012), public performances (Dick McGeough 2011), art (Verrips 2017; Werner 2017), and literature (Cortez 2009; Lea 2001; van der Geest 2018).

The anthropology of waste does well to highlight the diverse webs of meaning attributed to excreta as well as how social dynamics get caught up in them. Human wastes, however, are also substances with a physical presence in the world, enmeshed in material relations conditioning their symbolism (Miller 2010; Tilley 2007). Further, their material properties are managed by people and organizations situated in complex evolving environments (Suchman 2007; Weick 2009). A few anthropologists have extended Douglas's aphorism to include these dynamics.

In a study of an off-the-grid community in Hawaii for instance, Lucy Pickering details how composting toilets were a key feature of the groups' agricultural lifestyle. Converting their wastes into communal fertilizer had become a unifying practice undergirding social relations. For them, the concept of state operated centralized sewers were *relations-out-of-place* rather than just *matter* (Pickering 2010). Similarly, anthropologies of human waste infrastructures have

emphasized how its physical relations – toilets, pipes, sewers, treatment systems – give definition to waste management concepts such as accountability and public participation (Chalfin 2014; Gururani 2019; van der Geest and Obirih-Opareh 2002; Wells, Wakhungu, and Webb 2021).

What might a process-oriented anthropology with human waste contribute to this literature? By turning attention to the many diverse management practices, and their relationship to social problems, this chapter extends the strictly symbolic and relational to the *entangled*. Entanglements imagine the degree to which the relations comprising management activities are interdependent, and as a result introduces a few theoretical tensions in anthropology.

How do the material dimensions of waste management influence the direction and understanding of its management? How and why do social institutions arise and negotiate around waste management? How do waste management's materialism, social institutions, and symbolism converge in discourses around social problems? In short, how can we *think shit through*[8]?

Entanglements

Management is a process of ongoing negotiations (Handel 2003). The many and evolving negotiations amongst the realism of materials, the socialization of their management, and the symbolism they take on can be thought of as *entanglements*. An entanglements, much like its companion term *relation*, is a common metaphor in anthropologists' work, albeit one used in a variety of contexts with nuanced interpretations (e.g., de Castro 2014; Harman 2014; Latour 2004a; Strathern 1993; Strathern 2018a; Thomas 1991). Holding in common is the assertion that humans and what are often referred to as *non-humans* (things, materials, biotas) are mutually

[8] The use of the word "shit" is a common tactic to emphasize excreta's materialism (e.g. Black and Fawcett 2010; Morales, Harris, and Öberg 2014; Workman et al. 2021).

constitutive in producing processes in the world. There is not a fixed nature resisting or acquiescing human desires; rather people and non-humans are always co-conditioning each other.

How things come to be mutually constitutive varies depending on where the researcher places their attention (Ingold 2017). For physicist-philosopher Karan Barad, epistemology is at stake within an entanglement. She argues the world is only knowable through entanglements, where nothing- neither entity nor idea - has a stable identity without an entanglement to animate it (Barad 2007). Alternatively, scholars more concerned with ontology maintain a separate view of entities but decenter the role of humans in producing processes.

These scholars envision various space-time relations - networks (Latour 1991; Law 1999), assemblages (Deleuze and Guattari 1980; Ogden et al. 2013), sociotechnical systems (Hughes 1981; Trist 1981), communities of practice (Lave and Wenger 1991), meshworks (Ingold 2015), and situated actions (Suchman 2007), to name a few - within which interactions between various types of humans and non-humans take place. In these conceptions, agency is not inherent in any person or object but emerges from the complex composition of parts. While some argue humans and non-humans contain symmetrical agency in these relations (Haraway 2016; Latour 2004a), it is more convincing, and politically realistic, to articulate agency as distributed throughout a process depending on the dynamics of the particular lifeworld (e.g., Bennett 2010; Ingold 2011a).

From different processes we can imagine different forms of distributed agency. For instance, management refers to human directed action that is both responsive and proactive in relation to an end goal. Human agency is constrained by the aspirations of management goals and the ability to manipulate the materials of waste management – waste, pipes, water, etc.

Therefore the entanglement of relations occur within the confines of a disciplined human agency and a captured material agency (Pickering 1995).

In the context of this research, entanglements are the unit of observation. It draws its boundaries around the interdependent relations – material, biological, ideational, behavioral – comprising waste management as a disciplined activity. Encapsulated within this framework is a pragmatist anthropology, wherein there is "a real world in which our lives take place, albeit a world which does not exist in any ontologically pre-structured way in and of itself but is rather "structured" through human purposive participation in world involving practices" (Pihlström 1998:239; also see Figueiredo 2022; Gori 2017; Kelly and Cordeiro 2020).

Implicitly, entanglements are sustained by a sense of dependency. To claim something is entangled is to say that a process would not exist without the contribution of all the different components. If one component were to change then so would the entanglement, at least qualitatively. The mutual dependency of parts bears meaningfully on management because pre-existing entanglements are integrated into wider practices and social institutions (Hodder 2012; Weick 1969)[9].

The expectations of management, and the knowledge about how it is performed, are prefaced on existing social and material relationships providing the practical infrastructure framing responses and creative future action. These practical infrastructures should not be confused with determinism, however. They are merely historical. They do not make practices inevitable or immune to reconfiguration. But they do require maintenance and consistent participation to achieve their aspirations, which in a way, "entraps us in their care" (Hodder 2012:220).

[9] While Weick's work predates the concept of an entanglements in social science - he refers to organizational sensemaking within a history of technological, organizational, and knowledge relationships.

It is at the level of care, of maintaining management practices or imagining new ones, that the pragmatic metaphysic of human and non-human relations become entangled with ethics (Pihlström 2009). Because agency is distributed, and existing relations are inherited, management entanglements are inherently political. The desirability and effect of a practice varies depending on a person's position and concerns (e.g., Roberts 2017). Further, the construction of new entanglements is often a herculean effort, requiring time, resources, technical expertise, and political persuasion (Harvey and Knox 2015; Latour 1993).

Conflicts can then be framed in two ways. As either a request for the inclusion of individuals or considerations within entanglements of practice, or as a debate between "which situated set of entanglements should dominate over others" (Hodder 2012:214). Exploring the entanglements of management is to re-imagine how to think through these political realities (e.g. Ingold 2011b; Latour 2017).

The remainder of this chapter explores three different focal scales in waste management: non-humans, social institutions, and matters of care. These scales are overlapping and non-hierarchical. They represent a shift in focus, not a clean delineation. Each one adds to a denser understanding of the richness of management entanglements. In this regard, no singular aspect is "causal" in the traditional sense of the physical sciences[10]. The technical aspects of management inspire and are motivated by matters of care, which are defined and configured within the context of social institutions (e.g., Hamlin 1988).

[10] The appeal to a non-hierarchical understanding of relations, sometimes referred to as a 'flat ontology', is derived from the metaphysics of Gilles Deleuze (Deleuze and Guattari 1980).

Non-Humans in Human Waste Management

Defecating and urinating are firstly embodied experiences. We interpret physical sensations – pressure, fullness, gurgling - as the inevitable release of fluids and matter accompanied by social expectations of what to do about them (Lea 1999). Following along the creation and afterlife of excrement reveals the degree to which these embodied experiences are never entirely self-contained (Scheper-Hughes and Lock 1987).

Human waste exemplifies the porous boundaries and micro-to-macroscopic entanglements between the world "out there" and the sovereign "self" (Benezra, DeStefano, and Gordon 2012; Gilbert, Sapp, and Tauber 2012). The food we consume only become discardable wastes through a relational world of air, water, acids, enzymes, and symbiotic microbes (Abrahamsson 2014). Under scrutiny, human waste collapses the bridge between what is often framed as either "human" or "natural" into a singular whole (van der Geest 2007b).

Excreta are teeming with the stuff of the "natural" world. Once outside our bodies, their material properties articulate with the expanding and contracting flows and rhythms of diverse ecological processes (Mihelcic and Zimmerman 2014). Our waste's inevitable deconstruction and incorporation into other lifeworlds makes considering non-human relations essential to understanding management practices (Higgin 2016).

Like its social symbolism, however, there are no "inherent" considerations of the non-human relations of human waste. Management actions are a consequence of knowledge about particular practices (Blosch 2001), which is always partial and technologically mediated (Latour 2004c; Stengers 2010). Further, what is often considered an *object* within these processes, is in fact a collection of materials *objectified* through human practices and perception (Miller 2005).

Consequently, key dynamics have a tendency to shift under our feet as new entanglements emerge (Ingold 2008; Van Assche, Duineveld, Beunen, et al. 2022).

For instance, it would be imprecise to say "human waste" is managed. It is what waste is comprised of that must be contended with (Thompson and Beck 2017). Excreta are the by-products of absorbing and assimilating nutrients and matter from our food. Much of what we consume exits the body as substances mostly made of water (approximately 95% for urine and 75% for feces) as well as biological lives, matter, and leftover organic carbon and nutrients (chemical compounds which support the growth and biological functions of living organisms – namely, nitrogen, phosphorous, and potassium).

So much of our wastes are composed of water that in many contemporary municipal contexts, where human waste and grey water are mixed, raw wastewater is 99% water (Mihelcic and Zimmerman 2014). The exact composition of the remaining nutrients, organisms, and matter in excreta varies depending on diet, age, behavior, and substance (Cease et al. 2015; Kuhnle et al. 2013). For instance, each manifestation of waste – urine and feces – is processed differently through the body, giving them unique characteristics.

Unless an illness is present, urine is filtered through the kidneys as a sterile liquid. Dissolved in urine are several substances that include some organic nitrogen compounds that are transformed into ammonia, which gives it its distinct smell (Mihelcic, Fry, and Shaw 2011). Feces, on the other hand, are partially made up of indigestible fibrous material (e.g., cellulose) which are decomposed by microbes and acids and pass through the intestinal tract gathering mucous, dead cells, and bile along the way. Roughly a quarter of feces is comprised of this solid

matter as well as fungi, viruses, parasites, and billions of bacteria (Rose et al. 2015). It is the gases produced by these bacteria that imbue feces with its unmistakable odor[11].

These overarching properties of human waste, their wetness, nutrient concentration, and, in the case of feces, pathogens, are richly entangled in contemporary technoscientific waste management[12]. Management strategies are frequently consumed with all of them at once through heterogenous ecological and technological relations. A few patterns related to these properties have emerged over the millennia.

The wetness of Human Waste

Human waste is sticky and moist. After multiple deposits it becomes an odorous, sloppy mess. For much of human history, managing waste's wetness was easy enough. Let it lay where it lies, and the soil will soak it up. As settlements emerged however, so did increasingly complex entanglements for organizing these damp, soggy substances.

At its most basic, managing human waste is concerned with collection and storage. Except for open defecation, which is still the primary practice for 800 million people worldwide, collection requires some sort of container or end point. For many rural communities that container was, and is, as simple as digging and covering up a hole in the ground (e.g., Haarhoff, Juuti, and Mäki 2006). Whether through invention, cultural exchange, or colonial imposition[13], much of the world now relies on some version of a toileted containment system. Toilets have

[11] Disgust at human waste odors is culturally dependent. In the contemporary technoscientific context, it was a result of the discovery of germs combined with emerging social values of cleanliness and order in 19th century Europe (e.g., Barnes 2006).

[12] In the spirit of management's open-endedness, the makeup of excreta now also includes emerging chemicals of concern (e.g., pharmaceutical drugs, endocrine disrupting chemicals, etc.), a new a challenge with unknown effects (US EPA 2015).

[13] For a examples of the colonial imposition of toileted technologies see Anderson (2006)'s discussion of the medicalization of waste in rural Indonesia, and McFarlane (2008)'s pre- and post-colonial analysis of urban India.

been communal, private, built in the interior of a structure, a standalone chamber pot, or placed within a designated outhouse; the wastes they receive have been stored in cesspits, flushed through sewers, pumped into trucks, or carried to fields (Antoniou et al. 2016).

Some containment systems deposit directly into pits, where wastes are covered with either sand, wood ash, or dirt (e.g., Morgan 2008). While these systems work well in low density communities, they can become overwhelmed when large populations depend on them. It is more common, although certainly not guaranteed, for urban areas to attempt to convey these wastes away from households. Because excrement are ultimately tacky, viscous materials, water is used to transport them through pipes. The practice of washing or flushing wastes down pipesis a ubiquitous and ancient one.

The first known urban collection technologies emerged approximately 5000 years ago in various places all over the world. In Babylonia (3500 – 2500 BC) homes were occasionally equipped with drainage systems and public latrines with a cesspit (George 2015; Lofrano and Brown 2010). The Minoan civilization (3500 – 1100 BC) on what is now Crete, built clay or stone sewer systems with toilets made of wood or stone, and floors of gypsum in many of their palaces (Angelakis, Koutsoyiannis, and Tchobanoglous 2005). Homes in the urban core of the ancient Indus city of Mojenjo Daro (2450 BC), in what is now northern Pakistan, were attached to a centralized sewage drain made of copper large enough for an adult to stand in (Jansen 1989). Some combination of chamber pots, toilets, drains, cesspits, or sewers can be found in virtually every preserved ancient city through to modern times (Antoniou et al. 2016; Halperin, Le Moine, and Pérez Zambrano 2019; Hunt 2019)

The process of water-fed transport converts waste into *wastewater* which has presented two contemporary challenges related to its wetness: scarcity and containment. Recycling water is

a novel and energy intensive practice for ensuring a drinking source for large populations, particularly in water scarce areas. The challenge to "Toilet to Tap" models is that they often rely on expensive and scalable technologies, and public outreach models for convincing the public it is safe (Duong and Saphores 2015; Stotts et al. 2019).

The second persistent challenge is containing the sheer volume of wastewater running through labyrinths of underground pipes. Not only do material dimensions of entanglements fail, such as pipes and pumps, but many cities, ancient and modern, utilize combined sewers that merge with stormwater drains. Failures to contain the amount of stormwater generated during a storm event leads to frequent dumping of untreated wastewater into canals, rivers, lakes, and streams (Black and Fawcett 2010; WHO and UNICEF 2019). The ecological dynamics of untreated waste entering bodies of water helps illustrate the two sides of nutrients.

Two sides of Nutrients in Human Waste

Waste management practices are often preoccupied with either encouraging or minimizing the effects of nutrients on people and plants. For much of pre-industrial history and beyond, human waste management included enriching soils with nutrients, leading to more consistent and productive crop yields. For some communities, the non-human entanglements of waste-as-fertilizer practices were uncomplicated. Anthropologist Tulasi Srinivas (2002), for instance, describes defecation as a social activity in rural India up until the late 1940s. Prior to the introduction of the toilet, gendered groups would bring clay pots of water and gossip as they fertilized fields in the early morning.

Scaling-up the use of waste-as-fertilizer brings health hazards from bacteria and heavy metals (Rahube et al. 2014), which has led to richer non-human entanglements. In 19th century

Chinese agriculture, converting human wastes to fertilizer was a well-developed economic practice. The process was labor intensive involving the collection of wastes in buckets, their storage and fermentation in large pots[14], and eventual mixture with water to distribute onto farmland using pails. It was estimated producing 12 pounds of nitrogen required the waste of 800 people (Mihelcic, Fry, and Shaw 2011). As the national population sharply increased over the century, there was a "metabolic rift" however, in which most of the waste was created by people in large cities. Rural towns' modest populations did not produce enough to maintain sufficiently fertile soil to service urban areas. Some towns began erecting free latrines with toilet paper to capture the waste of visitors, although this was only a half measure. In urban centers, which lacked public latrines at the time, an industry of laborers shoveling feces off the streets into buckets and collecting household "night soil" emerged. Following collection they would travel by boat or cart to sell to rural farmers as fertilizer (Worster 2017).

Similar night soil collection and fertilization entanglements were developed during Japan's population boom starting in the 16th century, extending into the 20th century (Hanley 1987; Szczygiel 2020). The entanglements of waste-as-fertilizer has been used, to varying degrees, in most major urban developments across the globe from antiquity to present day, although more typically within networked centralized systems and rarely at a national scale (Angelakis et al. 2018). Eventually agriculture in both China and Japan, and the rest of the world, came to depend on cheaper and less labor-intensive chemical fertilizers (Caple 2017).

Although less common than in the historical past, waste-reuse entanglements continue in various forms. Small rural and peri-urban communities unable to afford large centralized systems or facing down poor water quality/scarcity, utilize re-use technologies like composting latrines,

[14] Fermentation of human wastes not only dries out human waste but removes pathogens as well (Andreev et al. 2018).

riverbank filtration systems, or sewage farms (Doucet 2013; Libby, Wells, and Mihelcic 2020; Naughton et al. 2018; Öberg et al. 2014; Okem and Odindo 2020; Orner and Mihelcic 2018; van der Geest 2002). Other novel nutrient entanglements include feeding pigs through toilets installed above their pens (Lee and Hyun 2018), and sewage treatment processes specifically designed to support biodiversity through nutrient enrichment (Cunningham and Gharipour 2018; Fuller and Glue 1980).

These examples illustrate efforts to entangle the nutrients found in waste within farming and other productive social practices. It is this dynamic which the phrase "a captured material agency" refers to . The disciplined actions of farmers were intended to create conditions amenable to the material properties of waste. Those same processes of enhancing biological life can entirely reconfigure an ecosystem in other contexts, however. When high concentrations of nutrients enter waterways, they enrich a community of biological agents competing over them.

Historically, toilets were mostly connected to cesspits or, if connected to sewers, were limited to a small number of wealthy households. Consequently, the visible negative impact of nutrients was minimal. Throughout the industrial revolutions of the 19th and 20th centuries however, pour flush toilets connected to dedicated sewage pipes became increasingly common in major city centers (e.g., Gandy 1999). The booming population of sewer connected people led to massive amounts of untreated sewage entering riverways (e.g., Naden et al. 2016).

An increased volume of nutrient rich wastewater can both reshape landscapes through soil and coastal erosion and lead to severe eutrophication, or the process by which aquatic vegetation, typically bacteria and algae, consume the increase of nutrients and come to dominate those ecosystems. As they grow, they deplete oxygen supplies, crowd out other species, and

block sunlight, suffocating all other flora and fauna (Chapin, Kofinas, and Folke 2009; Mihelcic and Zimmerman 2014).

Eutrophication is particularly severe in vulnerable *oligotrophic* ecosystems like estuaries and shallow reefs, which are defined by their low nutrient availability. The increase in algal activity from nutrient inputs can destabilize and destroy these delicate ecologies, which in the case of coral reefs, took hundreds of years to emerge (Altieri et al. 2017; D'Angelo and Wiedenmann 2014; Lapointe et al. 2019; Wear and Thurber 2015). The consequences are devastating for everyone who relies on these communities for their livelihood, coastal resilience, and sense of place.

The destabilizing effects of nutrient inputs do not arise solely from large sewered systems. Across the world, onsite systems like septic tanks and latrines contribute to the process of eutrophication (Carey et al. 2013; Lapointe, Herren, and Paule 2017; Meerhoff and Bloetscher 2007; Schoen et al. 2017). In part because these systems are not designed to remove nutrients from wastewater, only to separate wastes from human contact. Contemporary human waste management attempts to resolve these issues by removing nutrients during wastewater *treatment*.

In urban European contexts treating waste went through numerous iterations including practices like filter presses, which heated and pressed sewage sludge to create drier (but not entirely dry) waste "cakes" that could then be transported to farmland (De Feo et al. 2014). In the 20th century, through the logic of chemistry, the nutrients nitrogen (N), phosphorus (P) and potassium (K) were identified and behaviorally understood as primary contributors to the ill ecological effects of human waste (Mihelcic and Zimmerman 2014). These observations led to an extensive and complex set of entangled practices for removing them from wastewater.

Treatment practices vary widely depending on the treatment systems (e.g., small onsite or large treatment facility; dry climate system or wet weather system). Treatment aims regarding nutrients are to convert them into either solid removable particles or gases that can dissipate in the atmosphere. For instance, a common process is to convert organic nitrogen to ammonia (ammonification), followed by its transformation into nitrate (nitrification), and a third and final transformation into nitrogen gas (denitrification)[15]. There are separate non-human dynamics during each step, such as an abundance or absence of oxygen, as well as the presence of various forms of bacteria. Alternatively, phosphorus is often removed from wastewater by adding metal salts which bond with phosphorus to create solid participles which can then be filtered out. These are only two processes among dozens of practices Passive removal practices, sometimes referred to as green infrastructure, also use wetlands, or transitional land between aquatic and terrestrial ecologies, which rely on biodiverse ecosystem to consume nutrients before wastewater enters larger water bodies (Mihelcic and Zimmerman 2014).

The Pathogenicity of Human Waste

In addition to being wet and nutrient rich, human wastes are comprised of organic life, including pathogens. These organisms have had, and continue to have, a devastating impact on people's health. Harmful pathogens can infect food if crops are irrigated with untreated waste (Verbyla et al. 2016). They can cause illness from swimming in polluted waters and contaminate drinking water sources leading to water-borne diseases like giardia, typhoid, malaria, and diarrhea (Valli 2002; WHO and UNICEF 2019). Consistent infections can lead to stunting in

[15] This process is a common practice referred to as 'activated sludge' which requires numerous technologies and steps to accomplish.

children, disrupted productive activities, and death (IHME 2017; Wahid, Maria, and Hidayanty 2020).

Similar to nutrients, contaminated water bodies result from either onsite or large sewered systems, depending on the mode of treatment, the location of the water table, and geology (Borchardt et al. 2003; Gonzales 2008; Schaider, Ackerman, and Rudel 2016; Swistock and Sharpe 2005; Yang et al. 2017). Additionally, like the removal of nutrients from wastewater, there are many different practices for neutralizing pathogens.

They may involve using "natural" low energy methods, requiring no electricity or mechanical movement, or energy and technologically intense industrial treatment plants. An example of low energy biological treatment might include a waste stabilization pond which uses a series of shallow pools and relies on sunlight, soil absorption, and bacterial consumption to remove pathogens. Alternatively large production systems may use chemical disinfectants to kill the remaining pathogens after the particle and nutrient removal (Jiménez et al. 2009). Perhaps more common worldwide is to use management strategies, like a pit latrine toilet which empties in a cesspit, to distance people from harmful pathogens until they can be pumped out and the waste relocated.

Managing the properties of waste illustrates a broad range of non-human relations. These relations are entangled with heterogenous biological, ecological, physical, chemical, and technological processes. The forms, responses, and capacities conditioning the kinds of entanglements are never deterministic. Amidst these non-human relations are people making sense with each other as a social process of organizing (Weick 1979:42).

Social Institutions in Human Waste Management

The social institutions of human waste can intersect across its non-human entanglements in heterogeneous ways. For instance, in 2011, Hurricane Earl brisked past St Thomas, in the United States Virgin Islands. It's 70 mph winds tore through the small landmass leaving streets crowded with debris and a fractured power grid. Many homes, including mine, went without electricity for about a week. A few days after the storm I returned to work at a restaurant downtown on the cruise ship & yacht dock with running power and water.

Waiting for customers I remarked to a coworker, "You know, I don't really mind not having power, the hard part…", "… is the water" he interrupted, slowly whispering under his breath. I knew what he meant. It wasn't the drinking water. It was having enough water to continually refill the upper tank of the toilet. And, in the absence of working ceiling fans and the post storm mugginess, the smell that would accrue if you didn't.

The loss of electricity had a cascading effect on many households. It is common to rely on current to pump water from cisterns located either below or adjacent to the home. For an island with majority septic systems, no cistern water also meant no easily flushing toilets. I was only able to return to work because the dock was the first area serviced by the Water and Power Authority (WAPA), the island's private/public utility.

Downtown St Thomas is also one of the few areas receiving both water services from WAPA and sewer services from the Wastewater Division of the Virgin Islands Waste Management Authority (VIMA). Those integrated into these centralized systems, at least downtown, had running water, and were able to easily use their bathrooms, with relatively little delay. The dynamics of managing waste were not limited to these examples. Some households

had generators. Others had gravity fed cisterns. But the majority waited on the utility to make repairs and restore electricity.

The provision of power was the only infrastructural entanglement with the state in my home. When any non-electric issues arose, I relied on market institutions. For instance, during the hurricane a large tree landed on my house, cracking the cistern. A fact I would not realize for another six weeks. Cisterns collect rainwater which was generally sufficient to supply my home. Only during severe winter dry spells would I need to order a truck to come refill it (generally at the cost of about one month's rent). After paying to refill the cistern twice in as many months, my landlord paid a contractor to find and seal the leak. At which point I paid to fill it a third time.

The aftermath of Hurricane Earl highlights both the primacy of repair and maintenance in preserving order (Graham and Thrift 2007; Howe et al. 2016) and how the diverse matrix of non-human relations in waste management is overlaid with equally heterogenous social institutions. Institutions which are both normative and material. In rural Zambia, for instance, a man being seen using a public latrine by an in-law can be so shameful that open defecation in the privacy of the bush is preferable (Thys et al. 2015).

Similarly, some communities avoid using latrines due to cultural taboos around handling waste (e.g., Coffey and Spears 2017; Libby, Wells, and Mihelcic 2020). In urbanizing communities norms around flush toilets are often entangled with values of cleanliness, class, and morality in what is referred as the "urban sanitation imaginary" (Morales, Harris, and Öberg 2014; see also Morales 2016; Helgegren et al. 2018). For development and state institutions, expectations of management involve various aspects of a "sanitation chain" in which waste is not only collected and transported, but safely treated (e.g., Funamizu 2017).

Regardless of their normative expectations, social institutions are enacted through material practices- organizing and treating wastewater, laying pipes, and studying ecological relations - performed by individuals and organizations. To maintain their social capital, these performances require legitimization, which is continually being re-entangled with both the symbolic and non-human dimensions of waste management. Consequently, the social institutions of waste management vary widely depending on their technological and political arrangements (Chong et al. 2016; Lawhon et al. 2018; McFarlane, Desai, and Graham 2014). There are, however, general distinctions between decentralized and centralized practices and their institutional entanglements.

Decentralized/Centralization

Most of the world relies on decentralized waste management strategies. Briefly, decentralized practices are those that are self-contained, e.g., isolated to a specific geographical location (whether public or within a household) and only serve a small number of people (Mihelcic and von Sperling 2019). The types of strategies run the gamut from low tech – hole in the ground, composting, pit latrine, septic tanks - to high tech pre-treatment, and small cluster systems, etc. The range of practices are too diverse to succinctly summarize here (see Tilley 2014; Dubois and Boutin 2018; Prabaharyaka 2020). Typically, either members of a household, a waste collector, or a small community organization are responsible for their care and maintenance, although public toilets may be managed by the government. Challenges emerging from decentralization are typically related to maintenance, expertise, resources, and accountability (e.g., Domínguez Aguilar and García De Fuentes 2016; McConville and Mihelcic 2007; Tsinda et al. 2013)

For instance, in the United States nearly 18% of households rely on some form of decentralized waste management (US Census Bureau 2019). When tested, collective systems frequently contribute to excess nutrients in nearby waterways (Carey et al. 2013; Diaz-Elsayed et al. 2017; Lusk et al. 2017; Schoen et al. 2017) and the biological contamination of drinking water supplies (Borchardt et al. 2003; Conn et al. 2012; Dai et al. 2019; Hynds, Thomas, and Pintar 2014)[16]. Knowledge about the performance of individual systems is generally unknown by users, often because the cost of monitoring is too expensive (Fizer et al. 2018; Gorman and Halvorsen 2006; Withers et al. 2014).

Sourcing parts for, and knowledge of how to fix, decentralized waste management technologies can also impede people's ability to use them to their full capacity (Fuchs and Mihelcic 2011; Naughton et al. 2018; Wells et al. 2016). The failures of various forms of decentralized systems, particularly as population densities grow, eventually becomes a public problem. Monitoring and maintaining on-site systems is labor intensive and expensive. State entities are often designed in such a way that they lack the funds and bureaucratic capacity to manage them at the household level (e.g., Nelson and Shephard 1998; Spirandelli et al. 2019).

Thus, struggles to manage waste in these contexts presents tensions for communities and city officials. In many urban communities, decentralized management persists regardless of environmental, social, and economic hazards. Others use hybrid models, such as collection trucks which periodically pump out septic tanks and cesspits before bringing collective wastes to a central treatment facility. However, without proper oversight, mass collection systems can become just as hazardous as the consequences of decentralization (e.g., Prasad and Ray 2019). Commonly, if possible, the option to centralize a system emerges because it not only centralizes

[16] This isn't to say that onsite systems always fail. When properly sited and maintained, they work as effectively as large centralized treatment facilities (e.g., Robertson, Van Stempvoort, and Schiff 2019).

treatment but accountability as well (Ratner and Rivera 2004; Wells et al. 2019; Zimmer, Winkler, and de Albuquerque 2014). Motivations for centralization are also driven by waste management's increasing interdependence with water and power (Mohebbi et al. 2020; Wakhungu 2020).

The centralization of accountability is not to say that the centralization of collection and treatment is uncontroversial, perfectly democratic, or effective. Subsuming diverse people under a collective technology does not simply address problems but reshapes the patterning of social life, including its ecological and economic entanglements (Serneri 2007). Constructing city-wide infrastructures requires the rationalization and coordination of urban spaces where waste can be received, transported, and treated (Gandy 1999). Consequently, there are no innate politics to the introduction of sewered technology, its implications will be contested, sought after, or ambiguously accepted based on existing social institutions (Pfaffenberger 1992a).

It is for this reason, regardless of the articulation of benefits, that sanitation interventions become "Wicked Problems" (Rittel and Webber 1973). Wicked problems are open-ended, complex problems, with intractable tensions resisting clear solutions. Nonetheless, the cost of inaction is great, interventions require making decisions when future outcomes are uncertain, and there is no obvious solution satisfying all the diverse relationships associated with the problem. As engineers vested in developing useful and usable technological practices have noted, there are no apolitical universal strategies for dealing with social problems (McAlister et al. 2022; Mihelcic et al. 2017).

For instance, Alley (2002) documents the struggles between the techno-scientific state and religious local communities in managing wastewater entering a sacred river in India that cannot, by definition, be polluted. The different modes of reasoning influenced both the

management, accountability, and discourses around human waste as a polluting category. The state could not regulate any activities in the river, instead having to mitigate pollution by treating any waste's arriving through tributaries (Alley 2002).

Beyond disagreements about *what* pollution is, the marginalization of social groups can be compounded through the exclusion of sewer services (Flowers 2020; Leker and MacDonald Gibson 2018; McFarlane and Silver 2017). Although frequently, local state institutions lack the funds to extend services (Lemos et al. 2002; Naman and Gibson 2015), or the capacity to enact creative treatment processes (e.g., Öberg et al. 2014). Centralized systems also create *point source* pollution, wherein when they fail, all the collective waste is dumped into a single location rather than dispersed through the community, which can intensify its impacts (Ehalt Macedo et al. 2021). The visibility of centralized waste management, its inequalities, and shortcomings bring into focus the politics of the democratic state and the processes of techno-scientific expertise.

The State

The state is a complicated topic in anthropology. One that has been deployed with a dizzying number of contradictory claims about what it is, what is does, and where it is located (Aretxaga 2003). Historically, there were two schools of state conceptions – either the state as an idea or as a centralized apparatus acting in rationale terms for the "public good" (Abrams 1988).

The first school has been largely critical of the second. Scholars have highlighted the ways states act counter to the interests of the "public" they purport to serve (Nugent 2004; Trouillot 1990), and the ways they attempt to create "publics" to reinforce their aims rather than the opposite (Escobar 1995; Pigg 1992). Others have noted how the de-politicizing tools of

rational statecraft – calculation, policy, etc. – act as unwitting foils to successfully implementing projects (Ferguson 1994; Gururani 2019; Mosse 2005; Scott 1998; Yelvington, Simms, and Murray 2012; Wells et al. 2019). The summary of this literature is the confirmation of the impossibility of a value-neutral, objective, and technocratic "rule-by-nobody" (Arendt 1951).

Consequently, these analyses are preoccupied with what Sherry Ortner refers to as *Dark Anthropology* (Ortner 2016), or a fixation on suffering and the moves of power, domination, inequality, and oppression. Perhaps the most fitting in relation to human waste management is Michel Foucault's concept of bio-politics, or the ways which biological human processes are managed as they relate to authoritative knowledge, power, and subjectivation (Foucault 1978). The common view of bio-politics often places the state as the key actor inventing and dominating society. However, the technological means and social desires around bio-politics, like securing water infrastructures for instance, may, in certain circumstances, invent the state (e.g., Meehan 2014). Paying attention to the management of collective biological functions, and its non-human entanglements, engenders a few questions. Where exactly is the state? What is the state composed of? And perhaps most importantly, why do state processes unfold as they do?

The state doesn't appear to be an easily identifiable nor fixed entity. It's performances can be, and often are, an amalgamation of different actors and objects across porous geographic and institutional sites (Gupta 1995; Joyce and Mukerji 2017; Painter 2005; Schuller 2007). When the state is re-cast as an "unsettled" series of negotiations emerging within various institutional contexts, the distribution of knowledge and power becomes equally porous (Bonilla 2017). In response, many scholars have moved from the ideological analysis or the "effects" of statecraft,

to a relational view of how it is practiced. Doing so shifts the emphasis from seeing the state as an ideological mask for power, to the challenge of enacting democratic public policy[17].

For instance, Workman (2019), in a detailed study of the politics of authority in water development in Lesotho, extends Ferguson (1994)'s metaphor of bureaucratic "knots" of power. Rather than fixed arrangements of power, she reveals a range of social formations outside of conventional bureaucracy. When state power is viewed relationally, it no longer appears centralized, instead materializing as dispersed and contingent on local contexts and actors. The result is different and changing modalities of state power; where "rather than a knot of power, a new tapestry has been woven, from which people pull various strings, connected to the state in myriad ways" (Workman 2019:12).

Other relational studies of states have similarly illustrated how the complex interplay of different people, institutions, and objects pattern dynamics more so than the whims of an overarching elite (Mosse 2011; Yarrow 2011). Although this isn't to say that inequality in access to state services isn't made through relations of social power (e.g., Deitz and Meehan 2019; Wells et al. 2022)

Relational approaches to the state as a distributed set of entangled practices makes visible the ultimate challenge of statecraft: the differing and contradictory desires of people engaged with state processes. After all, many of the coercive aspects of bureaucracy are welcomed as instrumental pieces of social order (Lea 2021). Its tensions are just as often a result of a "who" than a "how." For instance, in Southern Belize, Van Ausdal (2001) articulates how grass roots rejections of state development are no less political, and no less a dimension of state development, than that which they reject. The democratic struggle, as noted by Haines (2019)'s

[17] As Abrams (1988) notes, studying the state only as an idea, as a mask for power, is just as likely to construct a myth as it is to reveal actual power.

study of climate expertise in Belize, is how the production of knowledge can manage the expectations of the various stakeholder desires. Similarly, Rottenburg (2009) portrays the reliance on state documents as the real villains of rational statecraft, as they can't change as quickly as the context of desires does. For this reason, illusions of apolitical statecraft can be useful in allowing stakeholders with varying interest to participate in projects through "ambiguous agreement" (Ennabih and Mayaux 2020).

The somewhat circular concerns about knowledge and action, power and authority, warrant a consideration of why the state might exist in the first place. Pragmatist philosopher John Dewey argued it is the tensions about desires, emerging as social problems, which invent the liberal democratic state (Dewey 1927). In attempting to resolve disputes, those acting in the capacity of the states seek legitimization through authoritative knowledge and accountability. However, he further notes that "observations of consequences [of state action] are at least as subject to error and illusion as is perception of natural objects" (p. 29). Consequently, the authority of the state must always be "rediscovered" (Latour 2007). A rediscovery always enmeshed in evolving political and material dynamics.

Following Dewey and Latour, within the context of this research the state will be cast as an open question to a public problem. The particular entanglements surrounding the problem and its proposed solution will give definition to a what the state is and how it is enacted. As other social scientists have noted, regardless of the mode of statecraft, its visibility, and consequences, are entangled with socio-material practices (Agudo Sanchiz 2020; Meehan 2014; Schouten 2013). For instance, the unknown efficacy of decentralized systems can become a diffuse public threat as urban areas become denser. But how do actors attempting to enact state processes come

to know about public problems? And how do they come to strategies for resolving them? The answer is, very often, techno-scientific expertise.

Expertise

The image of the expert is a seemingly universal one, although this is not to say that all expertise is valued universally (Oppenheimer et al. 2019). But in nearly every society, expertise is deployed in ways that are both inherently interactional and value laden (Carr 2010). Scholars have noted the forms in which modern technical expertise can lead to a type of reality abuse, where actual social relations are obscured in favor of idealized ones (Ingold 2002; Geertz 1973). After all, the road to claims of universal truths is paved with complex and contingent relations hidden from the final product (e.g., Latour and Woolgar 1979). While these criticisms are valid in relation to abuses of social power by those who wield science, I would caution against privileging the practices of science as distinctly western or elitist.

While the institutions of techno-science may be unique to modernity, its practices and roles certainly are not (Latour 1991). Throughout time people have studied relationships to understand outcomes and manage effects: as political theorist Mark B Brown notes, "Many of the attributes typically associated with science (logic, reason, method, evidence, and so on) can also be found in nonscientific activities, and no single list of attributes is shared by all the fields of study typically deemed part of science" (Brown 2009:165).

Further, the social reality of planning and action presents a complicated picture of the power of technoscience. Universal knowledge is never really universal in practice (Tsing 2005). Much like the politics of the technologies they design, the deployment of expertise eventually becomes situated in complex institutional arrangements (Bijker, Bal, and Hendriks 2009;

Dickson 2013), where understanding is a process of learning through action (Lave and Wenger 1991; Suchman 2007; 2011).

The longevity of scientific knowledge is also inherently non-permanent. It is through the evolution of organizational knowledge and practice paradigms that regulations and expectations of waste management change (Shifrin 2005). To appeal to public interests and retain authority, some form of "evidence as infrastructure" emerges from which experts, the state, and the community can evaluate and assess (Calkins and Rottenburg 2016; see also Asdal 2008). Although the ability to *influence* its use is distributed through the entanglements of its implementation.

Economist Albert Hirschman, following the observation of World Bank development projects, noted how belief in the transformative power of expertise was a key factor in the will to intervene in complex wicked problems. He describes both an overconfidence in the organizational capacity of expertise to address problems *and* an underestimation of the actual challenges that lay before them as "the hiding hand", supporting complex projects (Hirschman 1967).

Hirschman's hiding hand is the optimistic tone by which I'm approaching the social institutions of waste management. I do so with the knowledge that state processes are nearly always political and technical messes. Power is never evenly distributed and experts produce knowledge and interpret their aspirations within the pre-existing arrangement and technological practices of their institutions (Douglas 1986). Even if they feel ambivalence about its outcomes (Smith and Smith 2018). My intention in moving forward is merely to position state relations and expertise within the lessons of the anthropology of the state. To view them as a series of legitimizing practices, which are influenced both internally by the constraints of its origins (e.g.,

the institution, discipline, etc.) but also by the contexts by which it is meant to be useful (e.g., see Haines 2019).

Matters of Care in Human Waste Management

So far on our journey of thinking shit through I have emphasized the sticky materiality of waste and the complicated dynamics of social institutions. While both these explorations have identified some of the social problems emerging from their entanglements, I would now like to finish the trek with a small step away from interacting agencies, towards the intellectual and ethical practices of "composing" processes (Latour 2010).

The world is pluralistic, filled with wicked problems and partial truths. The ground floor of emerging problems is littered with "facts". But, as the insights from non-human relations have insisted, and the studies of the state have belabored, they cannot be objectively extracted from their social practices. How then can we "know" better about which facts to pay attention to, to collect, to articulate into action? One strategy, proposed by Bruno Latour, is to move away from "*matters of fact*" to "*matters of concern*" (e.g., Latour 2004).

The shift is both philosophical and political. Rather than attempt to dominate by using a fact as a polemic, a matter of concern represents the complex entanglements holding facts together. The movement shouldn't be confused with a shift away from reality, on the contrary, matters of concern rush towards it, absorbing all the agencies and relations making facts meaningful. By including the sociotechnical entanglements through which things, happenings, and knowledge are visible, we enrich our understanding of their social and political *interests*. The consequence is modes of management critique attuned to its everyday entanglements (Hoag 2011).

There are some limitations to considering *matters of concern*. Namely, they require an articulate and visible concern to present itself. The inclusion of only active voices was intentional on Latour's part, who has expressed decades of frustration at "environmentalists" who arrive, outside of social problem contexts, with pre-fixed causal explanations and moral judgements. These antagonistic tactics have been counterproductive, particularly in advancing the politics of technoscientific practices (e.g., Latour 1999). The focus on *matters of concern* is a request to approach critique in the language and manner by which people experience the processes under evaluation. This framing is not standard relativism, however. In fact, as Latour once asserted, "a little relativism takes one away from realism; a lot brings one back." (Latour 1988:173). Matters of concern combine the many fine grain entanglements undergirding interests to understand their presence in the world.

Philosopher María Puig de la Bellacasa presents an interesting addendum, or alternative emphasis to matters of concern, by arguing not to throw out the critical baby with the bathwater of self-righteous corrosive critique. She notes how enriching our understanding of practices through observations of their entanglements also raises the issue of how to consider ethics, in what she calls *matters of care*. Matters of care are more affective, more concerned with what is important in life full-stop, and more speculative than the narrowed managerial implications of matters of concern (de la Bellacasa 2011).

Care is not an exercise in purity politics nor a tilt towards concepts of universal justice. There are no non-innocent actors. We are always flailing against an unmanageable web of existing relations we finds ourselves enmeshed in (Shotwell 2016). Matters of care are a call for responsibility to our neighbors, both human and non-human, who might otherwise be absent

from accounts of interests and for whom we acknowledge our interdependence within connected spaces (de la Bellacasa 2012; Popke 2006).

The emphasis on the non-human aspects of technoscientific practices resonates with human waste management, which is always entangled with ecological worlds. The *interests* of these ecologies require a human champion however, or we run the risk of anthropomorphism. Although as she notes, maintaining an entirely anthropocentric point of view threatens to "paralyze our ethical imagination" (de la Bellacasa 2017:219). Her response has been to place the author, or researcher, as the guide to reconsidering non-human ethical engagements in a process of *eco-commoning*. I wish to extend the meditation on the ethics of care and matters of concern beyond my own imagination. I am far more interesting in the speculative anxieties and hopes of those entangled in specific human waste management practices and the "ecologies of support" they appeal to (Duclos and Criado 2019).

Speculation

The process of managing is always making and remaking entanglements from which opportunities for ethical considerations emerge. These considerations are by nature speculative; they conceptualize a future space achieved through a series of actions, based on the emotional aspirations and imaginations of the present (Janowski and Ingold 2012). Which is to say, we are always making a world that has not yet arrived[18].

Consequently, these "matters" are not only hopeful and anxious but fluid. Imagine, for instance, the risks of waste management. Life is full of risks, the total sum of which are unknowable (Douglas and Wildavsky 1983). The fears and aspirations surrounding the

[18] e.g., subjectivity is created in the meeting between the past, the present, and the future (whitehead 1925:90).

management of waste are then by definition selective and value rich. Matters of care present a particular desire for unrealized worlding practices.

These "matters" are then always theoretical although they may feel empirical. For instance, in the late 1990's the Belizean government privatized a series of basic infrastructure services including the national water and wastewater utility. A nationwide survey culminated in the lament "people is all that is left to privatize" with the expectation that state power, and thus resident power, would diminish in the face of neoliberal development (Mustafa and Reeder 2009). However, only a few years later the utility was re-purchased by the state. This example is not a refutation of truth, only an acknowledgement that speculations are always that, speculative. So, while their ethics are affective, often passionately so, speculations are also always in the process of being rewritten.

The attention I would like to place on these speculations is in the kind of composing they perform, what and who do they include in their matters of care? Take another example, anthropologist Sophia Haines phenomenological study of the anticipation around a road in rural Belize. The planned road would run through the town of Toledo, a poor, mostly Mayan, community subsisting on agriculture. The potential of infrastructural change invoked a range of imaginative concerns. People expressed hopes and anxieties about articulating with the larger economies, an increase in outsiders, disruptions in trust and safety, loss of land and landscape change through capitalist expansion, and changes in the sensory experiences of everyday life. (Haines 2017). The care and attention of relations upon which people speculated revealed an ethical landscape.

Caring In Human Waste Management

The question in relation to waste management is, how do residents' matters of care re-stage the ethics of their everyday material and institutional entanglements and/or how they influence its direction? These matters will invariably depend on social position, and many have been broadly conceived within this text already. Communities all over the world have appealed to the ethics of management practices as they relate to citizenship and modernity (Appadurai 2011; Morales, Harris, and Öberg 2014), ecological health (Diez et al. 2019; Hawkins 2006), economic expansion (Hutton et al. 2008; Van Minh and Nguyen-Viet 2011), constructing new human-environmental relations through waste re-use (Mihelcic, Fry, and Shaw 2011; Trimmer et al. 2020), and public health (Mara et al. 2010; Vargová et al. 2020). But ethics, like all human practices, are always in the process of fresh invention. When we survey the landscape of motivations for human waste management, and the ecologies of support to enact them, what new possibilities for ethically composing the world emerge?

Chapter Three: The Small History of a Research Project

Unfortunately, there is no "God-trick" in research (Haraway 1988). Theories, methods, and data are always situated within a particular place and time, and guided by specific institutional and intellectual "infrastructures" (Strathern 2018b). The researcher temperamentally glides along these infrastructures, steering the project's direction and goals (James 1907; 1920). The outcome eventually becomes the reconstruction of *a* reality, but never *the* reality. Put more succinctly, "we are a part of the nature we seek to understand" (Barad 2007:26).

Being a part of the world also means we change alongside it. The researcher is never outside the research process nor an entirely fixed entity within it. Novel circumstances tug us in different directions resulting in a *diffraction* of experiences rather than a stable reflection (Haraway 1992). My relationship with the research process shifted as I played different roles, engaged in alternative modes of thought, and encountered new people, ideas, and things. At each turn, differences and frictions produced and refined research boundaries and presented unanswered questions. This chapter follows my experience in constructing, analyzing, and interpreting experiences with human waste management in Placencia.

The project is a consequence of interdisciplinary collaboration between students and faculty in the anthropology and environmental engineering departments at the University of South Florida. I benefited from, and was influenced greatly by, the work and insight of colleagues and mentors while trying to make sense of sanitation in Placencia. By the time I joined the PhD program in Anthropology, interdisciplinary teams had conducted much of the

primary research I used for this dissertation. Their relationship building in Placencia laid the groundwork for easily identifying and meeting with key players in waste management issues, providing me quick access to warm and inviting research participants.

Further, developing the triptych scalar analysis of entanglements (non-humans, institutions, and matters of care) was the result of tensions born out of an NSF sponsored interdisciplinary traineeship between departments. Entanglement theory emerged as an attempt to find a way of thinking about waste management conscientious of both the pluralistic and political thinking of my anthropology colleagues and the scientific materialism advocated by my engineering collaborators. Yet, as is often the case when trying to appease two opposing forces, I'm sure both sides will be a little unsatisfied.

The end product is ethnographic in scope and style. As anthropology's defining mode of operation, ethnography represents the "most basic form of social research … "bearing a close resemblance to the routine ways in which people make sense of the world in everyday life" (Hammersley and Atkinson 1983:2). Its central concern is understanding a phenomenon in the context within which it occurs. The research process typically begins with participant observation or "hanging out." Researchers build rapport with community members through informal interviews, starting as a "stranger" before becoming an "acquaintance" and finally engaging in "intimate" interactions. The final goal is to talk with others as individuals rather than identities (De Munck 1998).

As they observe and listen, ethnographers jot field notes, develop theories, and create codebooks, sorting and organizing categorical observations into hierarchical models. When multiple instances of data substantiate a claim as well as contradict or confirm previous theory, the analysis becomes "saturated," and the research can draw conclusions (Morse 2015). The

simplicity of the ethnographic approach initially presented itself as an easily adaptable method for exploring the activities surrounding human waste management.

The description of standard ethnography however, is, of course, nonstandard, representing the myth of an 'average' research process in a sea of diverse practices. Satisfying the commitment to understanding meaning-making through the people who produce it requires alignment between research paradigms and modes of inquiry (LeCompte and Schensul 2010). An ethnography of entanglements in waste management presented an acute challenge, requiring a rethinking of *fieldwork*.

Anthropological fieldwork, as James Faubion and George Marcus note, is not what it used to be. Rather than the (imagined) Malinowskian ideal of long-term contact within an isolated cultural milieu, it is equally, if not more, common to be engaged in interdisciplinary work with colleagues extending beyond a singular physical site (Faubion and Marcus 2009). Such was the state of affairs that proved true for me, as my work more closely resembled "Yo-Yo Fieldwork", where there was a back and forth between brief field visits, digital encounters, and training experiences (Wulff 2002).

The Yo-Yo quality of fieldwork was a consequence of both the processes I was studying and external circumstances. Many of the people and practices involved in human waste management were not active long-term, particularly in relation to the social institutions involved. Management actions moved in fits and starts across numerous sites. Consequently, much of the data emerged from people's reconstructions rather than direct observation. Exacerbating this conundrum was the COVID-19 pandemic, which limited my fieldwork to three visits to Belize. Eventually, I was forced to augment research through digital encounters on Zoom and WhatsApp. The result is a Frankenstein effort, where data were produced under different

contexts with different approaches, and compiled to make sense of entanglements, in ways both empirical and speculative.

From Systems to Entanglements

Ethnographic research is rarely linear (Faubion and Marcus 2009). The long and winding road to completing this dissertation was not an exception. There was considerable overlap between analyzing existing data collected by colleagues, conducting fieldwork, and receiving interdisciplinary training through an NSF research traineeship (NRT). Any advance in one area was necessarily tested against lessons learned from the others. The consequence was an evolution in the questions asked and theoretical framing from "systems" to "entanglements".

I joined the NRT, called "Strong Coasts", after my first year and a half as a PhD student. The program combined graduate students from anthropology, marine science, and environmental engineering into a working group focused on community-based coastal resilience in Florida and three Caribbean sites (Belize, Barbados, and the US Virgin Islands). While students from all three departments shared a broad concern for many of the same contemporary problems - such as environmental justice, climate change, inclusive design, etc. - their routes and approaches differed. The traineeship adopted systems thinking as a universalizing theoretical frame to conjoin the disparate disciplines.

Donella Meadows, a leader in the field of systems modeling, defined a system as "a set of things—people, cells, molecules, or whatever—interconnected in such a way that they produce their own pattern of behavior over time. The system may be buffeted, constricted, triggered, or driven by outside forces. But the system's response to these forces is characteristic of itself, and that response is seldom simple in the real world" (Meadows 2009:2).

At first glance Meadow's description of systems is a good fit for interdisciplinary work. In theory, integrating various components to understand (or design) a whole is at the heart of anthropology, ecology, and engineering. As one of the founders of general systems theory argued, the principles of systems thinking date back to at least the origin of western philosophical and scientific thought (Von Bertalanffy 1972). More specifically to our program, interdisciplinary systems collaboration was meant to be carried out through modeling.

Figure 3. *A picture from the introductory meeting for Strong Coasts. Apparently, I [RIGHT] said something right to my new friend and environmental engineering colleague, (the now Dr.) Maya Carrasquillo [LEFT]. January 2019. Photo by Maya Trotz*

The engineering preference was to design causal diagrams representing a dynamic system of interactions within a fixed set of variables (Meadows et al. 1972; Meadows 2009). These *system dynamics* (SD) models describe the stocks and flows of interdependent relations to identify leverage points for producing a specific outcome, such as sustainable sanitation management (Figure 4). Management is also boosted by the identification of system archetypes (Braun 2002).

SD models operate by defining key *measurable* variables in the system (e.g., number of people in Placencia, gallons of wastewater effluent, etc.). The relationships between them are modeled using differential equations (which calculate the rate of change between them - e.g., the rate at which an increase or decrease in one variable causes an increase or decrease in another). The goal of a SD model is to move past classical mechanics to consider feedback loops and non-linear dynamics. Consequently, the more variables added to the model the more complex it becomes.

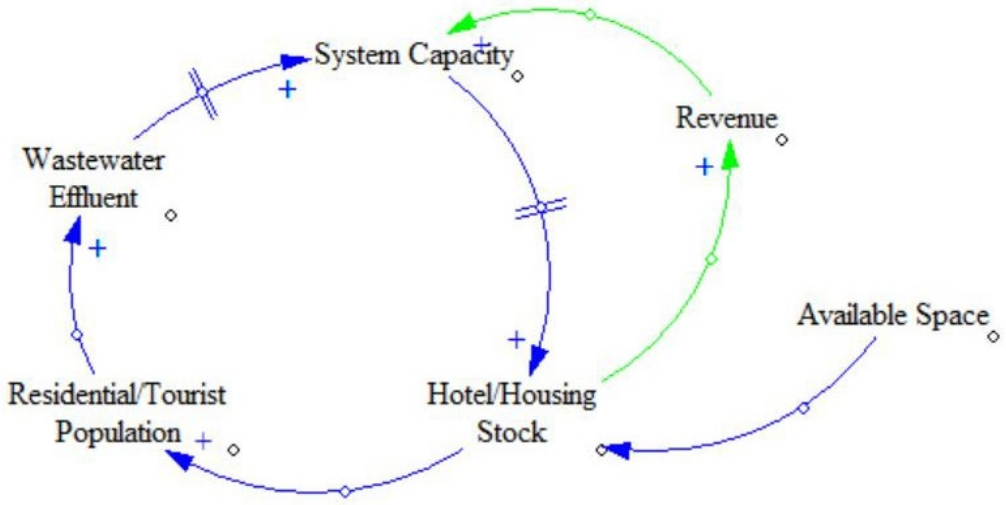


Figure 4. *A basic system dynamics model of wastewater management. The graph is characterized by a positive feedback loop between increasing the capacity to treat wastewater, housing development, and revenue (highlighted in green). The logic of these graphs is to configure causal relationships within a complex arrangement to understand how interactions mediate effects. For instance, in this case we can see how housing stock produces more revenue, which provides funds for greater system capacity, and thus the ability to accommodate more housing units.*

As a counterpoint we were also introduced to systems modeling within environmental anthropology, including the empirical-conceptual models of Roy Rappaport (e.g. Rappaport 1968) and Stephen Lansing's use of agent-based modeling of water management in rice production in Bali (Lansing 1991). These models included different types of relationships and dynamics between human actors, biotas, environments, and ideologies. For instance, for one exercise we operationalized the conceptual toolkit drawn from *systems ecology* as outlined by H.T. Odum (1994), but modified by the Human Ecosystems "Kuchka" working group at the University of Georgia, as described in Pavao-Zuckerman (2000) (Figure 5).

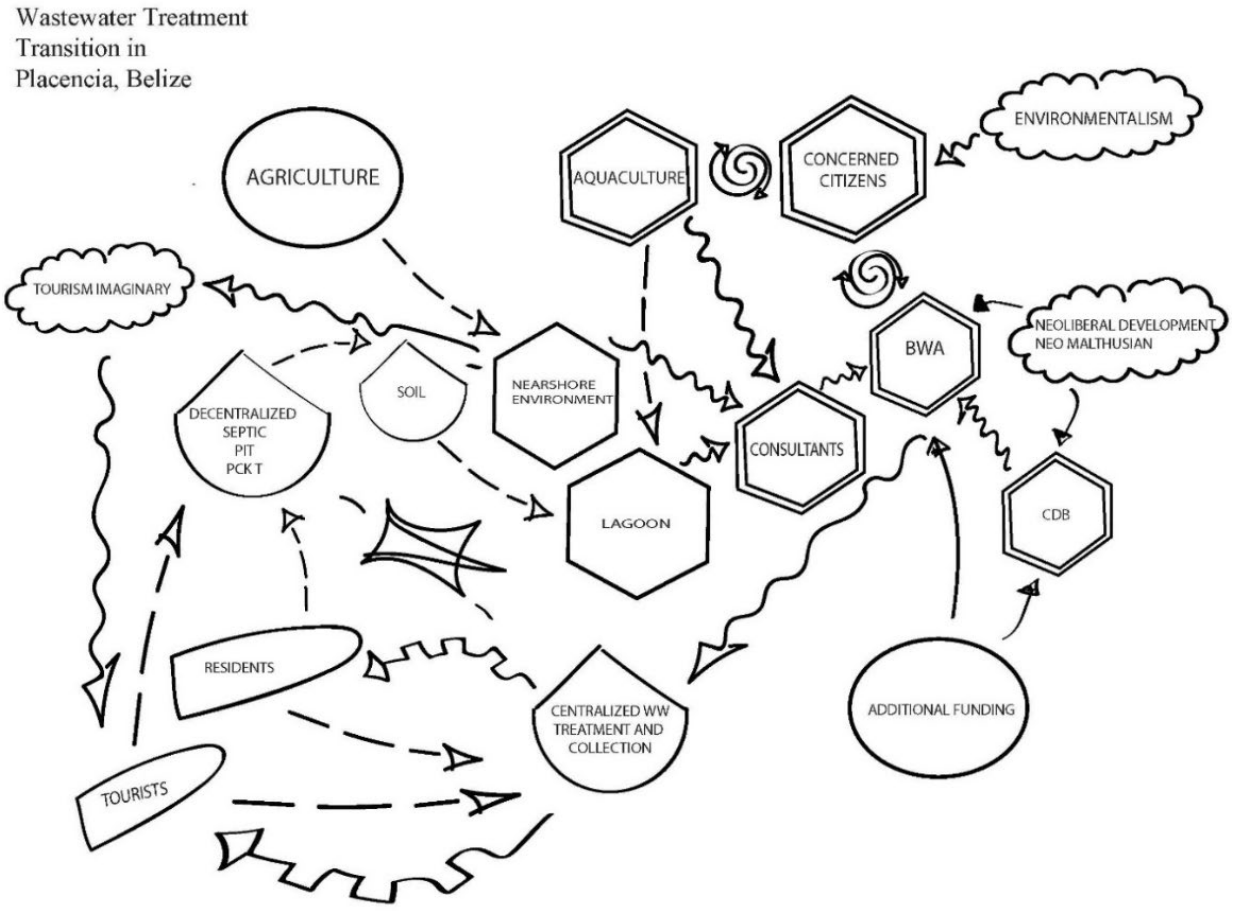


Figure 5. *A systems ecology model. Adapted from HT Odum the model explores the proposed centralized sanitation in Placencia. In a much more complicated design, the shapes of agents, as well as the connections (swiggly, swirly, and straight) all indicate different types of relationships, allowing for more diverse causality in the graph compared to SD models. For instance, in this example the "tourist imaginary" is shown as influencing tourist arrivals. It is understood that these relations are conceptual however, and therefore may be subject to change differently than the influence of nutrients from agriculture into the nearshore environment.*

These exercises weren't my first introduction to systems thinking or modeling. Prior to joining the program, I had engaged with Social-Ecological Systems (SES) theory when completing a Master's in marine and environmental science (Alexandridis et al. 2018; Webb 2013). SES theory was my first experience attempting to eliminate the distinction between "people" and "nature", as one of its key assertions is that the "delineation between social and ecological systems is artificial and arbitrary" (Folke 2006:443). Modeling SES dynamics for that work relied on network techniques (social and semantic) derived from theorists like complexity researcher Albert-László Barabasi (Barabasi 2009) (Figure 6).

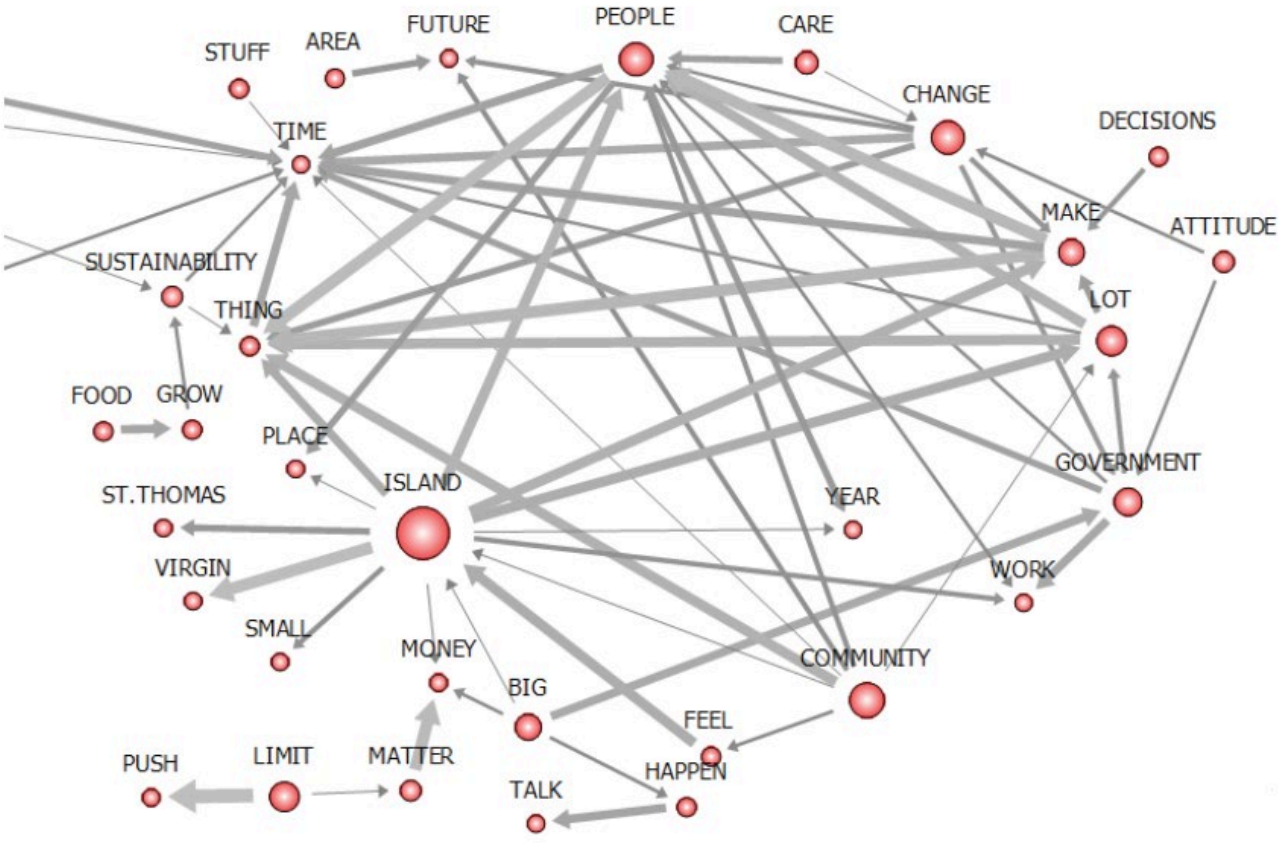


Figure 6. *A semantic network model. Illustrations was created from a 3-hr. planning session with Rastafarian farmers in St Thomas, USVI. Network modeling is less concerned with causality as it is with describing conceptual relationships based on the frequency of their co-occurrence within a sample of interactions. Within this graph the relations are linguistic concepts derived from transcripts. These relations are contingent or situated within the confines of the group and the discussion. The model is particularly useful in reducing large sets of texts to understand key conceptual relations within discourse.*

The intellectual genealogy for each model type is rooted in General Systems Theory (Von Bertalanffy 1950). Although formally interdisciplinary, there are significant philosophical distinctions between the behavior, causality, and methods of systems between the disciplines. Most striking being the causal mechanistic equations of SD models as compared to functional systems based on the observation of biological life. For instance, biological and/or social systems are more likely to incorporate adaptation, assuming systems change over time due to the agency of the actors involved (Binford 1962; Chapin, Kofinas, and Folke 2009; Darwin 1859).

These types of systems are thought to be characterized by emergent properties, where systems self-organize independent of a centralized force (e.g., the organization of an ant colony, or the rise of bowling culture) (see Lansing 2003). The degree to which a system-as-a-whole resists change from either internal or external forces refers to its resilience (Berkes, Colding, and Folke 2003; Holling 1973). The conclusion from scholars thinking about emergence and resilience is that system problems are likely to be idiosyncratic and thus solutions are more likely to be sustainable if derived from bottom-up management approaches (e.g., Ostrom, Janssen, and Anderies 2007).

The Strong Coasts experiment was to consider how to create system models using community-based approaches. The act of building a model could then act as a "boundary object" for groups to conceptualize problems and their dynamics (e.g., Star and Griesemer 1989). Because SD models rely on reducing the world into fixed entities with singular interpretations, they require a great deal of buy-in from groups interested in coming to a consensus.

However, as I would learn through my fieldwork and readings, management is a messy affair. There are different actors, technologies, and environments *situated differently* within the system. Important facts, passions, and behaviors change as people respond to information, jockey

for positions of power, and become entangled in new relationships. The degree to which systems modeling struggles to contain these issues was highlighted by Rittel and Webber's concept of "Wicked Problems" (Rittel and Webber 1973).

Wicked problems, coined in 1969, were inspired by the shortcomings of the previous 20 years of systems thinking as a method for solving social and organizational problems. Rather than easily bounded relations, wicked problems are concerned with how conceptions of systems are often interconnected with other systems, and the way the relationships to, and expectations of, systems are diverse. Further, planners who intend to implement systems are not able to test potential solutions in situ, act in politically neutral ways, nor are they given the luxury of being wrong.

Rittel and Webber's insights posed a few questions I was not equipped to answer. How can a model include all the different realities of the people involved? Which is to say, how do you treat the heterogeneous properties of people, entities, or events? How is power, the means by which processes unfold, distributed throughout a system as it changes? These questions were exacerbated by my introduction to science and technology studies, starting with Bruno Latour's *Pandora's Hope* (Latour 1999), and the linguistic bramble of post-structuralist and anti-foundationalist philosophy they drew inspiration from (e.g., Deleuze and Guattari 1980; Dewey 1927; Heidegger 1977; Simondon 1958).

Perhaps the most influential takeaway from this literature was the shift from uncertainty being an epistemological problem (something we can contain if only we gather enough evidence) to an ontological problem (something that will never go away and is part of being in the world) (e.g. Law 2011). Abstract, high-level description of systems (quantified or conceptual) appeared to discount the variety of practices undergirding management and the diverse relations and

knowledge gathering that give rise to them. I began to see *consciousness as an ongoing adventure* (Stengers 2008) and wanted to explore how people make sense of a changing world as they navigate it.

Consequently, my thinking about systems slowly pivoted away from decisions about how to model interacting components, to questions about what those components contain and how we learn about them. Within the context of waste management, what types of processes were undergirding *management?* How did managers come to conceptualize and organize waste? How did entities, and their behaviors, emerge? There was pleasure and pain in this shift. I am, by temperament and skill, a quantifying thinker. I excel in and enjoy statistics and modeling. Abandoning a view of systems as abstract representations of social life with discrete and scalable variables left me a little unmoored. It required learning a new skillset for discerning and articulating (narratively and philosophically) relationally defined processes. Processes that potentially spread out into ever expanding entanglements with porous boundaries through space and time.

Suddenly the purpose of research was no longer a search for natural laws to save us, if only we obey them (c.f., Stengers 1997). Sitting on the balcony of an old hotel in San Diego, California, and after just enough tequila, I attempted to clarify my position to one my co-advisers. Systems, technologies, institutions, or even "people", were no longer totalizing categories of objects, they were "dances of agency" (Pickering 1995), containing numerous "lines of flight" always calling their interpretation into question (Deleuze and Guattari 1980:100). He asked if I found that scary, that the world might be, for all intents and purposes, unknowable. While that was the pain, it also created the pleasure of infinite discovery, a juggling

of increasingly granular analyses revealing the heterogeneity of practices often subsumed under a more abstracted banner (e.g., development, sanitation, management, etc.).

The motor behind my evolving questions and concerns about the research process arose through reading, training, and fieldwork. They were also the result of my interactions with colleagues. Perhaps stubbornly, I felt compelled to make an anthropological contribution to how engineers think about systems or management. The result may be, as a close engineering colleague teased, "a really inefficient way of doing systems thinking."

Standing on Other People's Shoulders

The fieldwork for this dissertation began in 2013, although I was not yet a part of it. Professors from the Anthropology and Environmental Engineering departments at the University of South Florida had created a working group funded through a National Science Foundation's Partnerships for International Research and Education (PIRE) grant. PIRE's aim was providing collaborative research experiences for graduate students. The working group spanned many projects in many locales, one of which was a study of wastewater reuse in Placencia, Belize.

Over four years, small interdisciplinary teams of students lived and worked together for months during summer fieldwork sessions. The initial intention of the project was to explore local attitudes about waste management and potentially design context-sensitive wastewater reuse technologies. These investigations led to a number of engineering-centric outputs (Haberstroh 2017; Kalivoda 2017; Prouty, Mohebbi, and Zhang 2018).

However, changing circumstances in Placencia led the teams to broaden their scope. Shortly after they arrived on the peninsula for the first time, the state announced proposals for both a cruise ship port just off Placencia's southern shore and a peninsula-wide centralized

wastewater system. These momentous events had the potential to substantially change the daily rhythms of life on the peninsula, prompting residents to question tourism, state interventions, and environmental care. Pivoting to these issues led to further publications considering the impacts of rapid tourism development (Koenig 2016; Vitous 2017; Vitous and Zarger 2020; Wells et al. 2016) as well as attitudes and participation in infrastructure interventions (Prouty et al. 2017; Wells et al. 2019).

I joined the project in 2017 when their field work was finished. However, the team had compiled a general set of audio-recorded and transcribed interviews (ones not specific to any graduate students work)[19]. These interviews became part of the data I used for my case study. They ranged from 30 minutes to 1.5 hours and included field notes contextualizing conversations. They were semi-structured around eight general prompts regarding: 1) human waste management, 2) tourism, 3) coastal health, 4) water supply and quality, 5) cultural history, 6) human health concerns with water or wastewater, 7) the arrangements of social institutions, and 8) participants demographics and background. (See appendix x for copy of interview protocol).

Collecting interviews was an ongoing occurrence for them over the years, and the total number included three times as many that were not audio recorded. Through informal interviews and participant observation, the teams slowly mapped out local social institutions. From there they took an ego-centric networked approach to sampling (LeCompte and Schensul 2010:66).

Networked sampling focuses on how people and institutions are interconnected in relation to a set of phenomena. In practice this involved the team seeking out formal and informal local organizations associated with environmental management, tourism, and

[19] IRB# Pro00012766.

community health. Throughout the interview, they would ask interviewees for suggestions of other key people to interview about those arenas, in a process known as snowballing (Parker, Scott, and Geddes 2020).

Since sampling was networked, participant demographics were not meant to approximate the peninsula as a whole. Further, ascertaining comparative local demographics can be challenging due to the structure of households in Belize (Wilk and Miller 1997). Table 1 presents participant's demographics wherein the majority were male (59%), between the ages of 26 and 64 (76%), and Belizean (80%) who identified as either Creole (36%), white (30%), Garifuna (18%), or mixed (16%). I applied text analysis to the transcripts to get a basic understanding of patterns. For instance, in total there were 8,211 conversation exchanges across all the interviews, nearly half of which were in relation to prompts about either human waste or tourism (Table 2 and Table 3).

Table 1. *Demographics of Interview Participants from PIRE (n=46)*

Demographics of Interview Participants

		Count	Total %
Sex	Female	18	41%
	Male	26	59%
Age Range	18-25	1	7%
	26-40	30	28%
	41-64	22	48%
	65+	6	15%
Nationality	Belizean	35	80%
	Ex-Pat	9	20%
Ethnicity	Garifuna	8	18%
	Creole	16	36%
	White	13	30%
	Mixed	7	16%

*Age, Nationality, and Ethnicity information was not collected for two interview subjects.

Table 2. *Text Statistics from Interview transcriptions. Statistics reflect the total number of exchanges between researchers and interviewees combined, and the richness of the conversation (e.g., total number of words spoken and number of unique concepts).*

Test Statistics of Trascript Data

	Combined	W/O Interviewer
Sentences	8211	4137
Total Cases (utterances)	22864	17510
Type/Token Ratio	330176	272205
Unique Words (Types)	9385	8981
Word per utterance	.028	.033
Words (Token)	227343	188085
Words Excluded	14.4	15.5
Words per sentence	40	66

Table 3. *Text statistics of interview transcripts by prompt. Most exchanges were related to either human waste or tourism, followed by coastal health, water supply, and cultural history.*

Text Statistics Based On Topic Prompt

	Words	Types	Total Utterances	Utterances (Percent Total)
Human Waste	76574	4243	2194	27%
Tourism	87167	4926	2062	25%
Coastal Health	61464	4330	1463	18%
Water Supply & Quality	43287	3086	1050	13%
Cultural History	36598	3068	903	11%
Human Health	13899	1566	425	5%
Institutional Relationships	3585	764	92	1%

My analysis of this dataset was predominantly qualitative. Codes were assigned to statements iteratively until a coherent codebook was constructed. At first 125 individual codes were created, which were then collapsed into 30 themes, contained within seven categories. The Category/Theme/Code hierarchies were combined and reshuffled until eventually settling on seven categories, with 19 themes, and 88 codes (see Table 4).

Table 4. *Themes and Codes from Content Analysis. Table includes total number of statements related to each code as well as percent of total statements made.*

Categories and Themes From Codebook

		Statements	Percent Total Statements
Tourism	Development Desires/Concerns	111	8%
	Development Dynamics	89	6%
	Cultural Tourism	71	5%
	Tourism Jobs	20	1%
	Total	**291**	**21%**
Drinking Water	Drinking Water Sources	156	11%
	Drinking Water Quality	78	6%
	Total	**234**	**17%**
Human Waste Management	Disposal/Treatment	146	10%
	Concerns	40	3%
	Total	**186**	**13%**
Coastal Health	Coastal Concerns	94	7%
	Non-Tourism Jobs	73	5%
	Coastal Activities	18	1%
	Total	**185**	**13%**
Social Institutions	Water Boards	93	7%
	Local Institutions	87	6%
	Total	**180**	**13%**
Cultural Dynamics	Seine Bight	20	1%
	Placencia Village	43	3%
	History of Peninsula	35	3%
	Relationships	43	3%
	Local Philosophies	19	1%
	Total	**160**	**11%**
Centralized Sewers Proposal	Proposal Concerns	50	4%
	Proposal Processes	72	5%
	Proposal Appraisal	37	3%
	Total	**159**	**11%**

Unsurprisingly the seven main categories resembled the interview structure: drinking water, human waste management, centralized sewer proposal, coastal health, tourism, social institutions, and cultural dynamics. Interestingly, although there were relatively few responses to the interview prompt regarding institutional relationships, social institutions represented a large volume of coded statements. Reading the interviews back, people did not appear to know how to answer the question when presented abstractly, but frequently referenced institutions when discussing water, human waste, the environment, and tourism.

In general, participants preferred to talk about institutions in relation to the practices with which they were engaged, rather than their abstract purpose. Further, they would often detail how various practices were performed, by who and why. The discussions almost always included reference to the minute technical aspects of these practices, owing perhaps to the anthropology/engineering dynamic of the interviewers. Finally, intertwined within discussions were both concerns and preferred alternatives to these practices in relation to either their intended purpose or indirect effects.

These insights inspired both my search for process-oriented theories and the triptych analysis of scales of *non-humans, social institutions,* and *matters of care.* The degree to which the technical, institutional, and matters of care were interrelated is evidenced by a cluster analysis of codes in which they tended to group together based on practices. Code co-occurrence was calculated using the Jaccard Index based on five-paragraph windows, and the distance between codes was calculated using multi-dimensional scaling (Wutich, Ryan, and Bernard 2014). In an eleven-cluster analysis references to management codes (e.g., managing the coast, managing garbage, history of waste management) tended to cluster in relation to the details of those domains (stress = .394; R^2 = .353) (A visualization of the cluster analysis was too detailed to legibly fit into the word document).

Content analysis of the interviews provided rich detail for discussing the processes of entanglements, but also prompted questions related to the practices outside of the immediately local (e.g., what about foreign experts, state bureaucrats, finance banks, and utility engineers?) (Bernard and Gravlee 2014:533). Further, the variability in how people performed, interpreted, and discussed human waste management highlighted their agency and creativity. Therefore, I

needed an analytic approach that was not overly rigid in relation to geographic or social boundaries nor overly structural in terms of people's agency.

Fieldwork 1: Rapid Ethnographic Assessment

My research trips to the field could best be characterized as "Rapid Ethnographic assessments." Rapid ethnographic assessments, as the name suggests, is a quickened and targeted way of doing ethnography when the central aim of research is already established (Harris, Jerome, and Fawcett 1997). It operates by finding key leadership around the problem context to diagnose and map out important dynamics and social relations (Johnson and Vindrola-Padros 2017; Taplin, Scheld, and Low 2002; Van Holt et al. 2013). It was an appropriate approach for my research for a few different reasons.

Firstly, a store of qualitative and quantitative data about human waste management had already been collected. From that I had developed a good understanding of the 'facts of the case' (Whiteford and Trotter II 2008), which guided who I wanted to speak with and the questions I wanted to ask. Secondly, I am an older student and the ability to pack up and move my family for extended periods of time was not feasible. Thirdly, the COVID-19 pandemic, which restricted domestic and international travel began the semester after I became a PhD candidate expected to start fieldwork.

My first visit to the Placencia Peninsula was in December 2018[20]. I had spent the previous 18 months collaborating with environmental engineers on data collected during the PIRE project and was itching to give better context to those insights. Arriving after a series of studied controversies proved helpful in shining a different perspective on events. By 2018 the

[20]IRB# PRO00033749

cruise ship port on nearby Harvest Caye was built, but the centralized system was still in planning limbo and no longer a topic of conversation.

Participant observation for this trip was entirely informal. I spent most of my time walking up and down Placencia village on the lagoon and seaside. I took pictures and noted the different architecture and septic systems. If homeowners were nearby, I asked them about their system. In fact, I asked everyone I talked to about their system. People were surprisingly open about their wastewater infrastructure. A young bar-back at a restaurant even asked if I could get him a job where he could learn more about them and their maintenance. He probably knew about as much as I did.

Beyond how they thought their system worked and how, or rather *if*, they maintained it, there were discussions of the consequences of flooding and hurricanes. Much of what was said mirrored the texts I had read from the PIRE project. No one had many thoughts about the centralized proposal however, despite it being a heated topic in the PIRE dataset.

Figure 7. *Septic system behind a large office building on the main street. September 2021.*

On the third day there I took a five-hour bus ride to the capital and attended the unveiling of a new LIDAR equipped plane. The unveiling revealed the many partnerships, local and international, required to get expensive and technical projects off the ground in Belize. I was also able to have dinner with Dr. Ulric Trotz, the Deputy Director of the Caribbean Community Climate Change Centre and father to one of my advisers, Dr. Maya Trotz. He was then, and has been since, instructive in understanding some of the environmental politics of the Caribbean region.

In between exploring Placencia Village and visiting up north, I partook in local tourism activities (scuba diving, kayaking, trips upriver to see howler monkeys, etc.) engaging tour operators, guide shop owners, and people at bars and restaurants in casual conversation. The dynamics of the new cruise ship port were complicated. Some residents found it preferable, others opposed aspects of it. More often people talked about their strategies for making the best of it.

Over 10 days I got a better sense of the geography, the all-encompassing nature of tourism, at least in Placencia Village, as well as a couple dozen people's general attitudes about wastewater management on the peninsula. Six months later I returned for two weeks with the Strong Coast NRT cohort of eight students, five engineers and three anthropologists.

Many aspects of this second trip were much more formalized. For the first week, we systematically visited eight small developed cayes to understand their food-water-energy dynamics: and for me, their human waste practices. The *work* part of field*work* included photographing and cataloging how each island addressed these needs. Luckily, I had engineering colleagues with me to describe the types of wastewater systems and how they worked. On two of

the islands, I was able to talk with property managers. It became very clear there was no silver bullet to managing waste on cayes miles from the mainland.

Our Strong Coasts team also hosted three meetings at the Placencia Village community center. During those meetings I made contacts and had discussions with the heads of tourism in Placencia, current and past members of the village council, the head of the village council, and the founder and employees of a community-based coral restoration organization, Fragments of Hope Ltd. As could be expected, they expressed a myriad of views about problems of human waste management, the centralized proposal, and rapidly growing tourism.

One of the meetings was a presentation and discussion with anthropologist, Melissa Johnson, who gave us an overview of her new book "Becoming Creole: Nature and Race in Belize" (Johnson 2018). She has since been kind enough to exchange emails with me and has shared literature she thought would be helpful to my dissertation.

Figure 8. *Strong Coast group at the Placencia Community Center. June 2019. Photo by Maya Trotz.*

Finally, the second trip coincided with presentations related to the progress of the centralized sewage system. Specifically, there were two meetings, a closed-door technical presentation with stakeholder groups (e.g., environmental NGOs, community council members, and local experts) and a less technical community presentation more appropriate for the public. Thanks to Strong Coast contacts, I was able to attend both. The presentations outlined the preliminary results of a *nutrient fate and transport* study conducted by the Canadian engineering firm CBCL Limited.

Their study focused on the distribution and sources of two key nutrients associated with human waste, phosphorus, and nitrogen, found in excess in the Placencia lagoon and near shore water. While some of the nutrients were naturally occurring within the ecosystem, most came from agriculture runoff, aquaculture ponds, and wastewater systems. Highlighting case studies throughout the Caribbean, they explained in detail the deleterious effects these nutrients have on coral reef ecosystems and by implication, local livelihoods. The centralized wastewater system would not be able to address all the nutrient inputs, but it would ease the coming burden expected from population growth. Thus, the study, intended to justify the final design of the system, drew imaginaries of environmental health, economic growth, and scientific governance into relief with one another.

Following the presentation, I approached the CBCL consultants, the Caribbean Development Bank consultants, and Dr. Brian Lapointe, a marine science consultant from Florida Atlantic University. They greeted me warmly. In fact, after introducing myself as an Anthropology PhD student, the CBCL consultant asked me, "how did I do, describing the history of the peninsula in the presentation?" In a small-world coincidence, Dr. Lapointe knew one of my previous advisers at the University of the Virgin Islands. Finding a common language and

intersection of interests with the consultants helped create an easy chemistry and starting point for learning from them (e.g. Souleles 2018). Over the next six months, for instance, Dr. Lapointe was kind enough to walk some Strong Coasts engineers and myself through the dynamics between wastewater and coral reefs, as well as some potential methods for studying them in the reefs around Placencia.

I was also able to meet Frederick Sandiford, BWS's lead engineering consultant, who was on hand to answer people's questions after the presentations. In his estimation, it was going to be another four or five years before the project came into fruition. First CBCL Limited needs to finish their fate and transport study, then BWS needs to contract a new consultancy firm to rework the original designs, and finally, the GOB has the herculean task of raising $40 million to ensure they can fully construct the project. Both the development bank consultant and Mr. Sandiford acknowledged that increasing costs were the cause of the project's delay. All told, being present at the community meeting was seminal in my understanding of institutional responses to wastewater challenges in Belize. Everyone I met agreed to being interviewed shortly after I returned home.

The third and final rapid ethnographic visit was for one week in the fall of 2021. The motivation for this trip was to meet with an indigenous rights activist I had developed a relationship with since my last visit. In the spring of 2020 Lisa Carne, the founder of Fragments of Hope Ltd., asked if any Strong Coasts student could assist Cynthia Ellis, the ambassador for the fledgling Garifuna Nation, in organizing a conference. I volunteered to help design fliers and contact people, which began a fruitful relationship. Over the next 9 months I acted as a kind of in-house designer for the organization. In September of that year, after months of phone calls and

WhatsApp conversations, Cynthia was going to be in Seine Bight to hold community meetings regarding the construction of a gas station in town.

The community meetings did not take place as planned, unfortunately. However, I was able to attend a virtual meeting a month later. Additionally, during this last trip I was also able to shadow an anthropology colleague who was collecting interviews for a project on behalf of Lisa Carne. Four of the interviewees were community leaders I had spoken with previously, which allowed me to ask follow-up questions about events and things I'd learned over the past two years.

Figure 9. *Meeting With Cynthia in Placencia. After months of talking and strategizing we met in person along with Strong Coast colleagues and one my advisors Dr. Maya Trotz. From left to right: Alex Webb, Cynthia Ellis, Kris-An Hinds, Maya Trotz, Christy Prouty. September 2021.*

Fieldwork 2: Virtual Encounters

My trips to Placencia left several processes about human waste management hidden. Attending the unveiling of the LIDAR plane and the technical and community nutrient fate and transport meetings had taught me that there are many relationships behind large state projects. The ongoing and evolving nature of these projects presents a sampling challenge. Many different people, representing different institutions and types of expertise, have come and gone over the past ten years.

The team from the CBCL limited, for instance, was only one of three major engineering consultancies hired to study aspects of the centralization project. Even then, within CBCL different consultants with different expertise have been brought into fulfill a portion of the project, although there is one general project manager. Similarly, Frederik Sandiford is BWS's engineering consultant, but was not part of the project when its initial design and conception was funded by the InterAmerican Development Bank.

Studying projects like this requires a reconfiguration of the length and character of fieldwork (Marcus 2008c). Many aspects of large multilateral projects are not suitable to classical conceptions of the "community", "municipality", or even "the state", which are implicitly based on a particular form of geopolitical thinking (Herod 2011). In addition to understanding very localized practices, I wanted to understand how expert practices unfolded as well. Which actors are involved in different practices? And how are they performed? Who is enrolling who into a community of aspiration? (e.g., Latour 1987). The complex reality of negotiations between these fluid practices revealed it is not enough to "Study Up" (Nader 1972), but "up down and sideways" (Espig and de Rijke 2018).

A suggested method for understanding multinational technocratic and bureaucratic processes is through their social networks (Marcus 2008a; Powell 2008). Tracing social networks is both a sampling tool and a window into understanding how people who do not share proximity with each other, or permanent organizational ties, navigate through the project. Initially, I had secured funds and made plans to visit the CBCL offices in Toronto, the Caribbean Development Bank headquarters in Barbados, and Belize Water Services headquarters in Belize City. The COVID-19 pandemic made that impossible.

I had, however, collected many business cards and emails during my pre-pandemic trips. Luckily, nearly all of them agreed to do interviews over either Zoom or Microsoft Teams. These interviews were not only convenient, but in the case of one consultant who was trapped indoors, welcomed. As a bonus, virtual interviews are easy to record and refer to.

I was also able to piggyback along with an engineering colleague on a zoom call with an entrepreneur who builds custom wastewater management infrastructures throughout Belize, including in Placencia Village. He was incredibly illustrative and informative about the creative ways he has found to manage waste as well as the specific technical and social challenges to doing so on the peninsula and the cayes.

Finally, I was asked to write a blog post based on a talk by an anthropology colleague who is Belizean. She had been part of a team that developed a decentralized network of local museums in Belize called the Houses of Culture. I asked her to collaborate on the blog post with me, and as we were talking, she shared a contact with me for a Garifuna man who was the liaison for the House of Culture in Dangriga, the Garifuna capital of Belize. He was very warm and allowed me to record a sprawling video call on WhatsApp about the social dynamics of the Garifuna along the South Coast of Belize.

The interview protocol for these digital encounters were semi-structured[21]. Although the direction they took varied widely between participants, depending on their relationship to the project. Generally, I asked at least three basic questions: 1) How did you become a part of the project? 2) What do you do in relation to the project? And 3) What do you think the result will look like in ten years? These questions were enough for each interview to last between 1.5 -2.5 hours. Rather than content analysis, analysis of these interviews text retraced the processes of management in narrative form (Law 2004; Latour 2005)

In addition to those interviews, I attended a virtual Seine Bight community meeting with the Garifuna Nation on zoom and six conferences about constructing a pan-indigenous coalition with participants from all over the Caribbean and Latin America. The Garifuna are the primary ethnic identity within Seine Bight and have a complex and contentious history with the Creole people of Placencia Village. The research has thus far been Placencia Village-centric and working with the Garifuna Nation allowed me to expand my thinking.

Acting as their in-house designer allowed me to meet with various members of the organization, none of whom currently lived in Seine Bight. My relationship with them was mostly technical, as I helped them create fliers, digital signatures, and prep documents to send to state leaders. Through conversations on both Zoom and WhatsApp, we discussed development and social issues in Seine Bight, however. Although I could never quite get them interested in human waste management. Attempts at those conversations tended to pivot talking about potable water.

[21] The interviews and questions were deemed exempt from IRB by the USF IRB Review Board. STUDY000570

Table 5. *List of Virtual Interviewees (n=11).*

Virtual Interviews Related to teh Design of the Centralized Wastewater Proposal	
	# of Virtual Interviews
Belize Water Services	2
Caribbean Development Bank	2
CBCL Limited Environmental	2
Environmental Specialist - Consultant	2
InterAmerican Development Bank	1
Human Waste Management Entrepreneur	1
Houses of Culture Liaison in Dangriga	1

Ethics in Anthropological Research

Ethics in anthropology is an interesting phenomenon. More often than not, the role of the anthropologist is to provide humanistic descriptions of how people come to think and behave the way they do. The necessarily interpretive nature of the discipline can lead to internal tensions and over representations. It is alluring as an anthropologist to consider yourself a do-gooder. It has become common within the discipline to take a populist stance, where the researcher speaks for the "voiceless" and/or aligns themselves with an ideological cause (often based on a well-reasoned theoretical position) (de Sardan 2015).

The crafting of the anthropological identity is a historically western one, however, prone to blind spots in our relationship with, and conceptualizations of, fieldwork (Ntarangwi, Mills, and Babiker 2006). An interesting saga to illustrate the confounding interaction between fieldwork and theory is Sidney Mintz's, *Worker in the Cane: A Puerto Rican Life History* (1960). In the late 1940s Mintz had published a few articles exploring labor and sugar cane production from a Marxist position. His primary collaborator was Taso, a cane field worker. Shortly after Mintz left Puerto Rico the first time however, Taso, whom he characterized as a

political activist set within a larger global narrative of capitalist resistance, abandoned his political views, and converted to Christianity.

Taso's seemingly abrupt life changes caught Mintz completely by surprise, motivating him to return to Puerto Rico and eventually write *Worker in the Cane*. In a retrospective written nearly 30 years later, Mintz noted the inescapable asymmetry between himself and Taso. While Mintz transcribed interviews and observed, Taso labored in the fields all day before sharing his life story in the evening. And when his research was all done? Mintz was able to go off and teach what he learned in universities leaving Taso to the field. Despite these differences, he defended both his decades long friendship with Taso and writing a work from Taso's words, leaving himself absent from the account (Mintz 1989).

Nearly two decades after that publication, Katherine Ewing criticized Mintz for overly identifying with Taso despite their different positions in life. Her assertion was that ethnographic relationships should be understood within the contexts of the ethnographer's positionality (Ewing 2006). Mintz argued back that inserting himself and acknowledging the differences between he and Taso was not the preferable correction to his earlier writing. Instead, he wished he'd worked harder, perhaps as hard as Taso in the fields, to be a better ethnographer – knowing the language better, asking better questions, feeling less sorry for himself (Mintz 2006). For Mintz, the answer to the perceived asymmetry between researcher and subject is to do better work with greater clarity about the subject.

Greater clarity and descriptions of persons, as opposed to social calculus between researcher and researched, was also advocated by Haitian anthropologist Michel Trouillot. He noted how what was once the "savage slot" in the bygone era of cultural evolution, had become the still marginalizing "suffering slot" in contemporary anthropology (Trouillot 2003). For

anthropologist Derrick Hodge, addressing this issue can be accomplished, at least in part, by explicitly identifying the methods of data construction to which an ethnographic retelling relies, which is often missing from anthropologists' accounts (Hodge 2013). The lack of transparency in methods and analysis substantiates George Marcus's grouchy commentary, "in place of ideas, anthropological discourse has become overly moralistic" (Marcus 2008b:4).

Part of the discipline's turn to moralism is an acknowledgment that anthropologists are not objective observers identifying natural processes (e.g., Clifford and Marcus 1986). The researcher invariably becomes another member of an intricate set of relations through the ethnographic process (Mosse 2006). How they navigate the webs of relations they become a part of, greatly shapes their understanding of processes and, therefore, the ethics of their conclusions.

For instance, it was just as important to resist exoticizing the challenges on the peninsula as it was to avoid confusing access to the "up" (utility employees, consultants, etc.) as access to "real" moves of power. Like the communities they interact with, studying "up" reveals just another set of heterogeneous actors collaborating within cultural constraints (Schwegler 2008). People make choices and behave in response to their relationship with events, not as atomized free-standing actors (Strathern 1991). It follows then that those choices should be viewed within the context they occur and their capacity to influence processes, requiring a shift of interpretation from responsibility to "response-ability" (Haraway 2016; Hoppe 2020).

These insights left me with a precarious question I do not have an answer for. When, where, and why do we place our moral judgments? Social scientists have noted the ways interpreting research through predefined ethics can obscure the actual processes by which events unfold (Vayda and Walters 1999; Agrawal and Gibson 1999; Walker 2007). Worse yet, particular traditions have a tendency to translate people's expressions in service of an academic

meta-language suitable for their analysis rather than accurately representing their informants experiences (Latour 2004b). The aim of an anthropology *with* is to maintain a commitment to understanding the world by the people in it, without an overly theoretical interpretation nor an overly myopic ethnography (Ingold 2014). The ethics of this research was an attempt to thread that needle.

Chapter Four: Placencia, Belize

When Belize became an independent state in 1981, the Placencia Peninsula was only accessible by boat, private plane, or the occasional tractor large enough to cross the marshy wetlands. There were less than a thousand people living on the peninsula. Most of the property and businesses were owned by a half dozen or so families who settled there in the 19th century. Life on the narrow 17-mile-long sand strip off the south coast of Belize was largely self-sufficient.

Water was sourced from hand dug wells or rooftop catchments. In times of drought, or if your water source gave you a bellyache, you could rely on reserves kept in the water tower, a large cement catchment on the southern end of the peninsula. The fishing co-op provided electricity each night until 10 pm using a newly acquired generator system; otherwise, residents used kerosene lamps to produce light. Meals were cooked on wood burning stoves in outdoor kitchens. Sanitation predominantly consisted of depositing human waste in the bush, in outhouses with "night buckets", or on toilets over the mangrove lagoon, also known as an overhung latrine.

Placencia Village councilwoman Doris Leslie maintained the only telephone in her part-time post office, as she had done for the last 20 years. There were only two tourist resorts on the peninsula, the Sea Spray Hotel, which the Leslie's opened in 1962, and Rum Point, which the Bevier family built in 1973. Over the next four decades, the peninsula transformed from quiet fishing villages into a burgeoning tourism destination with an emerging human waste management problem.

The isolated peninsula was, and primarily still is, comprised of two ethnically and economically distinct communities. Placencia Village lies on the southern tip and was established by European and Creole peoples, or those who share an ancestry of British colonialists and Afro-Caribbean people. Five miles up the road is Seine Bight, a Garifuna (Garínagu) community. The Garifuna peoples' history began in the 18th century between Africans fleeing enslavement and indigenous Carib and Arawak on the Caribbean Island of St Vincent. While the Garifuna fiercely defended their lands, they were ultimately overwhelmed by British colonial arms and forcibly taken to Roatan Island and Costal Honduras (Koenig 2016). Many were eventually compelled by the British to settle along the south coast of Belize as part of a territorial agreement between Spain and England in the beginning of the 19th century, and are now considered "indigenous" to Belize (Palacio 2007).

Figure 10. *Map of the Placencia Peninsula.*

At the time of state independence, the Placencia Village was experiencing a technological and economic metamorphosis. Fifteen years prior, the introduction of snorkels and on-board boat engines had helped fishers go farther faster and stay under water longer. A local retired archbishop, Arthur Dunn, convinced fishers to form a co-op and negotiated a trade arrangement with an American Ship in the mid-1970s. Within a few years the fishing co-op was enjoying success as a global and regional purveyor yielding over 40,000 lbs of lobster, 75,000 lbs of conch, and 750,000 lbs of fish annually (Carne 2013). The co-op acquired the generator system powering the town initially to support an ice maker to store catches for trade.

Figure 11. *The Old Placencia Village Water Tower, no longer in use.*

The Garifuna, who had named Seine Bight after their popular practice of seine (net) fishing, were excluded from the development occurring in the village to the south. As was the case for Belize as a whole, the Creole of Placencia Village were severely prejudicial against the Garifuna. Consequently, they were not incorporated into any of the rapidly growing economic activities on the peninsula (Koenig 2016). More than one Creole person told me how their parents would refuse to give water from a cup to a Garifuna person on a hot day, instead only offering it in an old coffee can or dried coconut.

Depending on the Garifuna narrator, Seine Bight residents were either resentful towards Placencia Village residents or indifferent because they had their own self-contained practices. The Garifuna had settled Seine Bight sometime in the 19th century, although their population fluctuated significantly. For instance, following hurricane Hattie in 1961 most residents moved inland establishing the farming village of Georgetown. Households that remained on the peninsula mostly traded food and fish for cash or goods with folks to the south and on the mainland (Palacio 2001). Some residents also worked on nearby plantations on the mainland, although opportunities fluctuated inconsistently alongside the global market (Moberg 1992a; Flores 2013).

Easier access to the peninsula first came with an unpaved road built in 1984. Bus routes running from Toledo and Dangriga made it more convenient to visit family or shops on the mainland. Infrastructural expansion also brought more outsiders to the villages. In the early 1990s, the national utility extended their grid to connect with the peninsula, transitioning from the co-op run generator system to state supplied electricity. Soon after, the abandoned private airport in the center of the peninsula re-opened for commercial flights in a bid to promote eco-tourism to the area.

Figure 12. *Stalled housing development on the north of the peninsula. Photo by Eric Koenig*

The push for tourism accelerated in the aftermath of Hurricane Iris, a category IV storm that passed directly over the peninsula in 2001. The storm's 144 mph winds destroyed nearly 80% of buildings. Foreign investors swooped in, taking advantage of low land prices to develop tourism products (Alexander 2008; Spang 2014). In the years after, construction on a casino, expensive homes, boutique hotels, high rise "spreadsheet architecture" condos, and planned communities sprung up all over the peninsula. On the north side of the peninsula, much of the development has remained unfinished for years.

Iris's 15ft storm surges revealed how vulnerable local sanitation was as untreated human excreta flooded the streets for days after. Throughout the development boom, wastewater treatment has remained decentralized. Households use a variety of methods to manage their waste, depending on their situation, such as septic tanks, soak pits, or direct discharge. These strategies are not all well adapted to the environment or the growing number of users, however, and human waste has been seeping into groundwater, the lagoon, and the reef (Haberstroh 2017). Realizing current infrastructures were inadequate, residents and the state have attempted to find

solutions to match the rate of growth but have struggled to keep pace. Development has persisted regardless. In 2017, a controversial cruise ship port was finished on a small Caye a few miles offshore, with ships bringing thousands more people to spend the day in the area.

The transformation towards tourism and the lack of adequate wastewater treatment capacity is not unique to Placencia. Since Belize first gained sovereignty, the state's development agenda has centered on environmental ("eco") tourism and "wise capitalism" (Medina, 2004), but has struggled to ensure safe sanitation. Enacting capitalism in "wise" ways has come with challenges as the state and communities walk the delicate balance of growing its economy while protecting its environment, all of which the state has done while navigating international finance and trade. The most aggressive tourism development has occurred along the coast, where wastewater treatment has remained largely ad-hoc and gained prominence as a nationally recognized problem (Niña and de Molina 2011).

Sanitation and Development in Belize

Placencia is the only peninsula in Belize, a small country of less than 23,000 square kilometers. Located in Central America, south of Mexico and east of Guatemala, Belize is largely land locked with only its eastern border facing the Caribbean Sea. It is both one of the smallest and the least densely populated countries in Central America with approximately 390,000 citizens (The World Bank 2020). Just under half the population lives in urban centers with roughly 15% living in the old capital, Belize City. A third of Belize's citizens, like those in Placencia, live in towns with less than 4,000 people. The dispersed rural settlements of Belize, along with uneven development across the country, have made ensuring adequate and safe sanitation a challenge for the state.

Belize Water Services (BWS), the state-owned utility, provides sewer access to just over 10% of the population between their service areas in Belmopan, Belize City, and San Pedro (Ramos 2014). The plant in Belmopan serves 7,900 consumers, 59% of the city, treating 200,000 gallons per day. The Belize City plant serves 37,500 households, 61% of the city's population, and treats 1.5 million gallons of sewage per day. San Pedro Town serves 3,400 households, 40% of the town, and treats about 160,000 gallons of sewage per day. Outside of these service areas, the vast majority of human waste management occurs at the household level with 35% of homes utilizing septic systems and the remainder relying on pit latrines with a small population of people practicing open defecation (Silva 2015).

Like the global struggle to provide universal access to safe and effective waste treatment, the Belizean state's goal of increasing access to improved sanitation has made strides over the years but is still a work in progress. In 1990 only 75% of Belizeans had access to improved sanitation. During the UN Millennial Development Goals, the Belizean government ambitiously committed to ensuring 100% access by 2015. The number varies by source, but estimates suggest they fell short with 20-30% of the country still reliant on unsafe treatment strategies (UNDP Belize 2011; Grau et al. 2014; WHO and UNICEF 2016). Similarly, Belize lags in meeting international standards for bathrooms in schools, with only 30% reaching the target of 1 toilet per 25 girls (UNICEF 2020).

The Belizean government is currently investing heavily in BWS to reach its sanitation goals. From a development banking standpoint, the utility is an example of successful neoliberal restructuring common to state development in the 90s and 2000s. As a development bank consultant asserted to me, "BWS might be one of the healthiest utilities in the Caribbean in terms of their [economic] efficiency." (See also GEF-CReW 2017). However, while access to safe

sources of water is nearly universal throughout Belize, BWS struggles weekly to supply consistent service. Employees and consultants often cite a lack of funds, institutional support, and capacity as key barriers (e.g. Grau et al. 2014).

BWS is aggressively pursuing infrastructural growth through the development or improvement of centralized wastewater treatment systems along the coast and on larger cayes. Several projects are currently under review. The entanglements of centralized wastewater strategies have slowed them down. Centralized systems require reliable water access and are substantially more expensive than alternative onsite systems (e.g., Daudey 2018). To implement and design these infrastructures the state has turned to development institutions and international engineering consultancies.

Belize as a Latticework

A succinct description of Belize as a nation-state is challenging. The economic and cultural bases of Belize have gone through radical changes from its earliest colonial settlements through to its post-colonial developments (Wilk and Chapin 1988). The Creole and Garifuna communities described in Placencia for instance, only marginally represent the complexity of the country's populace. The demographics of Belize not only exemplify the historical transnationalism of the Caribbean (Mintz 1998), they also tell a complicated story of colonialism wherein colloquial ethnic and governmental census categories have been made and unmade in attempts to shore up power and give definition to a "Belizean State" (Cunin and Hoffmann 2013; Johnson 2003; Medina 1997).

When British pirates first came to Belize in the late 1600s, native populations were so small and discrete they had little interaction with early settlers. Over the following three

centuries of colonization, however, a lattice work of cultures would enter Belize with varying degrees of integration and conflict within the colony (Bolland 2003). It may be more accurate to describe Belize as comprising a mosaic of cultures as opposed to a multi-cultural nation. Peoples have come to Belize at different periods under different circumstances, settling different lands.

For instance, the Garifuna people were forced to Belize from Guatemala and Honduras at the turn of the 19th century settling along the south coast as part of a treaty between Spain and Britain. Until the 1960s, the Garifuna, along with other indigenous villages, practiced the alcalde system of governance wherein villages retained relative autonomy, being governed by a local "headman", while under British rule by electing a local official (Moberg 1992b). Their unique language, customs, religious beliefs, and political sensibilities set them apart from the British and Creole folks leading to them often being ostracized for their "backwardness" (Wells 2015). The alcalde system was adapted from the neighboring Maya. In the mid-19th century, the Caste War of Yucatán between the Spanish and the Maya sent thousands of Maya and Mestizo (Maya/Spanish) into northern and western Belize. Constant resistance to British rule forced the colonial administration to enact the alcalde system into law, giving relative autonomy to any groups considered "indigenous" (Moberg 1992b).

The Creole identity would come to comprise the people forced to Belize via the slave trade in Jamaica and British colonialists. Following the abolition of slavery in 1839, many Creole peoples remained along the coast and the northern lowlands, becoming fishers, hunters, and small scale farmers (Johnson 2003). Plantation owners and ex-slavers responded to abolition by financing Indian and Chinese immigrants as indentured servants to work banana and citrus farms (Brereton and Yelvington 1999). In the last quarter of the 19th century, Americans from the

southern states began arriving to escape post-civil war conditions and develop a state more amenable to labor dynamics in their favor (Wainwright 2015).

The turn of the 20th century brought even more diversity as a large Lebanese population migrated from Mexico, spearheading the chicle trade in Belize (Roessingh and Darwish 2012). In the 1950s, a contingent of Canadian Mennonites were welcomed into Belize to escape persecution in their home country. As of 2020, Mestizos (Maya/Spanish) make up 52.9% population followed by Creole (25.9%), Maya (11.3%), Garifuna (6.1%), East Indian (3.9%), Mennonite (3.6%), White (1.2%), Asian (1%), and other (1.2%) (WorldFactBook, 2020).

Globalized economic development in Belize followed similarly complex routes as the peoples who have come to live there. During initial colonial encounters, accessing the coast required navigating the Belize Barrier Reef System. For 16th-century transatlantic sailing ships, getting through the reef posed a dangerous proposition. British pirates and buccaneers capitalized on that difficulty by hiding in the wooded and watery lowlands after intercepting and pillaging Spanish ships. They soon discovered the marshy lowland soils of central and northern Belize were also ideal for logwood, which was becoming a valuable commodity as a dye for the European textile market (Craig 1969).

Logwood grew in dense thickets along the 10 easily navigable rivers that run deep into the interior, making transportation networks on land unnecessary. As buccaneers began realizing the value of logwood, they started selling it back to Europe in lieu of, or combined with, looting Spanish ships (Camille and Espejo-Saavedra 1996). Although it contributed to the world-building efforts of colonial England, early production differed from the typical aristocratic plantation economies of other islands. Extraction practices were small scale, initially operated by one- or two-person teams of rough-around-the-edges sailors, whose population numbered in the

hundreds. As logwood became more valuable, small British settlements tried to establish a foothold with forced labor but they were only temporary as they were disrupted by infighting between Spain and Britain (Bolland 1975).

It was not until 1787, after years of intermittent fighting, that Spain agreed to give England official rights to govern a formal settlement and extract logwood. The agreement came with two stipulations: 1) settlers would not develop large scale agriculture to compete with Spain, and 2) Britain would evacuate all Mosquito Coast settlements, bringing enslaved peoples, the Garifuna, and freed Black people to British Honduras (Belize). Shortly after, the logwood industry dwindled, and the new encampments shifted to mahogany extraction.

The Mosquito Coast evacuees numbered five times the original settlers, two-thirds of whom were enslaved. Their forced labor propelled the resource and labor-intensive mahogany industry. Mahogany trees are much heavier, widely dispersed, and on dry ground far from the transportation waterways used for logwood. Women, who were a small minority of the population, ran small farms. Even with the influx of people, settlements were small. In 1790, there were approximately 287 free folk and 2000 enslaved people living along the coast under British supervision. Consequently, infrastructure development remained tightly clustered near Belize City, with limited development in the interior. For instance, while there had been an extensive shipping port for a century, the first major highway, known as the Western Highway, extending 77 miles from Belize City to Guatemala, was not built until the 1930s (Bolland 1975).

Throughout the 19th century banana farming, sugar plantations, and lobster would become major exports alongside Mahogany, although all three industries were wiped out after a massive hurricane in 1931 (Bolland 1975; Huitric 2005; Moberg 1992a). It would take another 50 years to recover. To survive through the ebb of flow of industries, coastal Belizeans moved

away from small-scale farming towards fishing (Palacio 2001). As of 2018, only 6.9% of land is used for agricultural purposes in Belize (World Fact Book, 2018). Thus, in contrast to common plantation economies in the Caribbean, which transformed landscapes with levees, aqueducts, reservoirs, and canals, Belize lands remained relatively unaltered through its colonial encounter. The lack of development in Belize would go onto to become the primary incentive for developing the nation as a global eco-tourism destination.

Four Decades of Development 1981 - 2020

Belize's path to sovereign statehood in the late 20th century was entangled with international institutions. The decolonization process was underway in the 1960s with the establishment of an autonomous government but it was not until the United Nations intervened in a border dispute between Belize and Guatemala that the colony was afforded statehood in 1981 (Shoman 2010).

Shortly after independence, the United Nations Development Programme (UNDP) initiated the Belize Public Investment Project, sending a group of consultants from New Zealand to investigate avenues of economic development in agriculture, deep-sea fishing, forestry, and tourism. They immediately identified the relatively "pristine" environment of Belize as ideal for tourism. For instance, despite experiencing significant agricultural development throughout the 70s, Belize maintained 75% forest cover in 1980 (Cherrington et al. 2010). Additionally, construction on the more than 400 cayes and along much of the coastline was minimal. Supported by the UNDP, the new Belizean government prioritized eco-tourism as a central economic development strategy and began seeking funds from multi-lateral development banks (Pearce 1984).

The potential for tourism in Belize was multi-dimensional. Part of the attraction stemmed from Belize's lack of development. Their "advantage" to tourism development was the result of their not being competitive for entering new global agricultural or manufacturing markets, which were well established and saturated. In contrast, their 'backwater' status differed from the extensive mass tourism that had been developing throughout the rest of the Caribbean, opening room for niche market exploitation.

However, development finance had been so successful at establishing tourism infrastructure throughout the 1970's that the World Bank ceased lending development funds for tourism by the 1980's. The bank's logic was that since tourism was flourishing, it would be more appropriate to allow the private sector to continue to fund it (Hawkins and Mann 2007). Thus direct foreign investment began to flow into the Caribbean, mostly towards more mature markets, but some trickled to Belize (Williams and Williams 1999). Of the funds that did, the majority went into further developing agricultural production since the barriers of entry were lower (Medina 1997). For instance, the old Stann Creek railway was converted into a paved road, to link citrus production to the port in Dangriga.

As much as Belize's undeveloped state was an attraction for tourism, it was also a challenge for investors. Often, they would have to develop entire areas themselves such as on the largest offshore island, Ambergris Caye. Throughout the first decade of independence, eco-tourism remained small scale. Tourism activity provided measurable economic benefits to communities but not enough to sustain management costs (Lindberg, Enriquez, and Sproule 1996). During this same period, there was yet another massive shift in demographics, as large numbers of Creole and Garifuna Belizeans emigrated to the United States and Central American immigrants moved into Belize (Woods, Perry, and Steagall 1997).

Managing environmental relationships is an intrinsic function of states, as is the regulation of spaces, both private and public, as well as who may use them and why (Scott 1998). Regulations regarding environmental spaces in Belize converged with the environmental statecraft emerging in international finance, following the Brundtland report and the UN mandate for "sustainable development" (Goldman 2005).

Through the lead up to independence, environmental regulations in Belize were marginal and unenforced, with the state focusing on increasing agricultural and manufacturing production. Swiftly after independence, the government of Belize passed the national park system and wildlife protection act in concert with the Belize Audubon Society (BAS). Together, they established a wildlife sanctuary, a national monument, and a national park all co-managed by BAS. The international and local push for biodiversity protection along with market driven community based and co-management arrangements like the one with BAS, would result in over a quarter of all Belize's land having a conservation status of some type.

As the government began developing relationships for managing conservation areas, their reach was limited in terms of providing wastewater treatment services. Belize Water Services had two service sites, one in Belmopan and one in Belize City. Belmopan had become the nation's capital after hurricane Hattie devastated Belize City for a second time in 30 years and was the first to receive a treatment plant in 1970.

Figure 13. *The main facultative lagoon at the Belize City Treatment Plant. Photo by EC Wells.*

The plant is made up of a settling tank and four sludge drying beds. The beds are connected to 1.5 miles of 18" pipe emptying treated effluent into the Belize River. The sludge produced in the drying beds was later made into fertilizer for agriculture – primarily utilized by nearby Mennonite farmers, although this is practice has since dwindled. The second treatment plant was built in 1980 in Belize City. The system uses a two-cell facultative lagoon that removes bacteria from and discharges the effluent into the Caribbean Sea through a series of canals cutting through a mangrove wetland to take up nutrients.

The Neoliberal Turn of the 1990s

In the 90s, after two decades of de-emphasizing infrastructure, development banks brought built environments back to the forefront of the development agenda. However, rather than invest in states to create the foundations of economic wealth, neoliberal theories of

development assert that the public sector should not have a monopoly over infrastructure (Estache 2010). The implementation of neoliberal policies was widespread through development lending institutions (e.g., IMF, Worldbank, IDB, etc.) manifesting as *structural adjustments* setting conditions under which governments could receive loans.

Loans now needed to support a) *privatization* to boost efficiency, b) *liberalization* by removing subsidies or other government interventions, and c) *stabilization* by cutting government spending (Stein 2008). David Harvey defines the underlying theory of neoliberalism as:

> "…a theory of political economic practices proposing that human well-being can best be advanced by the maximization of entrepreneurial freedoms within an institutional framework characterized by private property rights, individual liberty, unencumbered markets, and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices." (Harvey 2007:22)

Hilgers (2012) argues it is that last sentence that suggests why neoliberal theory has so often been disastrous in practice. Realizing that market order is not a natural order, neoliberal theory requires a Weberian model of the state that enforces an institutional framework of fair play despite it being historically and culturally situated. The result is a decentralization of state services, which has the unfortunate effect of shifting authority to NGOs or private organizations who spear head co-management arrangements, blurring the mechanisms of accountability (Schuller 2007).

For instance, a situation arose in the Cockscomb Wildlife Sanctuary in Belize in which the state and BAS dispossessed nearby Maya people while attempting to include them in the NGO management arrangements. The state's reinforcement of the commodification of protected nature led to unresolved conflicts between local people, the NGO staff, and the state (Medina 2015). Although as Zarger (2009) illustrates, the political ecology that underpins contemporary

frictions between Maya and the Belizean state is much older than the structural adjustment period.

Burris (2007), in a comparative study of NGOs in Belize and Malaysia shows how the proliferation of NGOs and community-based management structures has resulted in chaotic and reactive policies as issues of jurisdiction and colonial technical expertise collide. A report presented to the Belizean government found similar results suggesting the management milieu is overlapping and overcrowded, complicating the effective management of protected areas (Meerman 2005). The ability of NGOs to easily access development funds also resulted in an increase in "fly by night" development projects in which organizations provide technical or financial interventions without identifying community-based needs or integrating into a local management structure.

For instance, while visiting a farm in Central Belize in 2019, the farmer showed me his waste-to-energy biodigester. The biodigester collected the wastewater from his pigpen, which holds four very large pigs, converting the waste into biogas. When it was originally set up, he was able to pipe the gas directly from the pigpen to a small shack up the hill where it supplied enough fuel to cook beans or coffee on his stove. It worked that way a few years ago anyway. The tank was no longer airtight, and therefore the pipe never pressurized. He wasn't sure how to fix it. When I asked how he got the tank he said something to the effect of "A Japanese group installed it and showed me how to use it." He didn't remember who the group was. Nor did they explain how he should go about repairing it. Consequently, the biodigester and pipes now sit unused.

In a study of the impacts of IMF restructuring policies on the quality of bureaucracies from 1985 to 2014, Reinsberg et al. (2018) found that the reduction of staff, removal of

subsidies, and privatization of operations diminished the capacity of bureaucracies to address social needs. Instead, the trajectory of previous government concerns, such as management of critical infrastructure, became increasingly dictated by private market interests (see also Strang 2016). For the Belizean state, structural adjustments projects included the privatization of nearly all their utilities.

At the turn of the millennium, Belize sold a majority stake in three of its utilities. The Belize Water Services (BWS), which services water and wastewater, Belize Electric Limited (BEL), and Belize Solid Waste Management Authority (BSWaMA). Each of these deals deviated from strict neoliberal policy as the Belizean Social Security Fund purchased a minority share of each to help fund pensions, however. Additionally, the outcomes of privatization varied.

Belize Electric Limited leveraged its new private partners to construct three controversial hydro dams in the face of significant opposition – in 1995, 2002, and 2009. The new ownership of BSWaMA improved solid waste treatment to accommodate tourism growth in the more populous north. They were able to secure a loan from IADB and OPEC to install a new dump facility capable of efficiently processing waste produced along the urban corridor in the north to expand growth.

The Chinese and OPEC lending agencies have had a strong presence over the past decades, funding the construction of the Southern Highway along the Guatemalan border in 2011 to increase international traffic (Haines 2017). In the case of BWS, privatization dramatically improved the reach and efficiency of the utility with access to improved (centralized) water rising from 43% in 1995 to 97% by 2013 (MDG Report Belize 2013). The government re-purchased the utility in 2013.While privatization has, in many cases, led to more efficient

functioning, its fundamental free market logic has resulted in utility profits that have not been redistributed to the citizenry, instead emboldening more foreign investment.

Both the privatization and protection of the coast skyrocketed throughout the 1990s. The Belize Barrier Reef, which runs along the entire 190 miles of Belizean coastline, became a UNESCO World Heritage Site in 1996. The reef is also home to Laughing Bird Caye National Park as well as the Blue Hole and Half Moon Caye National Monuments, among others. The reef makes up almost 80% of the total area of the Mesoamerican Reef System, the second-largest barrier reef in the world.

Amidst these protected areas, some of the more than 400 cayes studding the reef were developed into tourist destinations with mixed degrees of infrastructure. In 1996, BWS constructed their third centralized treatment plant on one of the largest islands, Ambergris Caye, otherwise known as San Pedro. The plant utilized two facultative lagoons followed by a maturation pond with impermeable layers at their bottoms. Before reaching the sea, the nutrient enriched effluent from the maturation ponds is discharged through a dispersion pipe into a surrounding mangrove wetland for "polishing." The development and regulation of the reef reshaped coastal livelihoods as many fishers elected to avoid the instability of the fisheries market for the seeming stability of operating day trips for tourists (Key 2002; King 1997; Huitric 2005).

Figure 14. *Facultative lagoons and maturation pond on Ambergris Caye. Photo by EC Wells*

Mass Tourism in the 2000s

Tourism development in Belize fundamentally changed in 2000 when the nation's first cruise ship port in Belize City ushered rapid growth to northern Belize, with ships bringing 3.5 cruise tourists per overnight tourist by 2002 (CESD 2006). The location of the cruise ship port in Belize city encouraged extensive growth on the largest barrier islands such as Ambergris Caye and Caye Caulker. As cruise ship development was booming in the north, businesses and community residents in Placencia had slowly integrated tourism into the local economy, although many preferred to keep tourism low end and small scale (Key 2002; Wells et al. 2016).

These slow developments took a dramatic turn when Iris, a category IV hurricane, made landfall on October 8th, 2001. The eye of the storm winds went directly over the Placencia Peninsula. The hurricane damaged nearly every home along the peninsula, most losing their

roofs. It also decimated the nearby banana and aquaculture industries. All told, Iris caused $250 million in damages, which equaled over a quarter of Belize's annual GDP (Alexander 2008). Rebuilding efforts focused heavily on capitalist tourism-as-recovery, transforming the peninsula by encouraging foreign investment.

The government's neoliberal approach to recovery was strictly economic, with coping strategies after the hurricane — related to family, friends, and community — considered non-development or outside the purview of government responsibility. Similarly, rather than directing aid money into local and national institutions, the government accepted funds through privatizing infrastructures such as the major road and government-owned cayes to allow the market to rebuild the area through foreign investment (Alexander 2008; Spang 2014).

Storm surges following the hurricane also revealed how vulnerable local sanitation practices were. Overwhelmed septic tanks and latrines flooded into the streets for days after the event. It became evident that inadequate waste treatment strategies were placing human and environmental health at risk as well as being increasingly unable to accommodate the growing number of visitors (Wells et al. 2016).

A few Residents sought out Engineers Without Borders to develop a more robust centralized solution a few years after Iris. The initial design was adopted and modified by the national utility, Belize Water Services, who announced a proposal to residents in 2010 (Wells et al. 2019). The new iteration of the project was to be re-designed by international consultants and funded through a multilateral wastewater development finance scheme operating within the Caribbean region. The centralization project, like the many abandoned construction projects on the north of the peninsula, remains unfinished. In 2019, the engineering consultant at BWS stated in a public address that it would be at least another four years until construction can begin.

In the meantime, high-end development has occurred across the peninsula as foreign investors plan ambitious projects. The most extensive of which is the construction of Belize's second cruise ship port on Harvest Caye 3.5 miles off the coast of Placencia village in 2017. Norwegian Cruise Lines (NCL) funded the $50 million development, receiving a 25-year concession in the form of a $4 (out of $7) per person tax rebate from the Belizean government.

The project converted a small uninhabited Caye, co-owned by NCL and the Belizean government, into a destination stop for ships holding over three times the population of the town. The newly renovated Harvest Caye has restaurants, bars, shops, swimming pools, and a zip line[22]. Besides employees, local residents from the mainland are not permitted to visit, however. The project continued despite resistance from the Belizean Tourism Industry Association based on its incongruence with Belize's sustainable tourism master plan (BTIA says no to proposed cruise port in Southern Belize 2013). Currently, over 200 ships carry nearly one million people, double the population of the country, to Belize every year, making it the fastest-growing tourism market in the Caribbean in 2018. Nearly 15% of incoming tourists visit the south coast of Belize.

Contemporary Placencia (2010 – present)

There are now roughly 3,100 residents on the Placencia Peninsula, 1,700 in Placencia Village and 1,400 in Seine Bight. Although, outside of official census documents, people typically estimate the population of Seine Bight at 2,500 people. Most guests reach the peninsula on a small plane connecting from the international airport in Belize City. Busses run through the now-paved main road as well but, depending on where in Belize one is coming from, the trip can take many hours. When visitors arrive, they sign up for tours and go inland by van to see Maya

[22] All shops are Belizean owned as is one bar. Otherwise, businesses are owned by contractors hired by NCL.

ruins, cocoa farms, and waterfalls or visit one of the cayes by boat. They eat at restaurants and bars, frequent shops, and enjoy the beach. And of course, they leave behind their waste.

Besides tours, the key draw for tourism in Placencia Village follows along the "sidewalk," the narrowest main street in the world, at just under four feet wide. The thin walkway extends a quarter mile along the beach, shouldered by shops, restaurants, and hotels. In addition to the many new hotels and condos, residents are converting homes into short-term vacation rentals. Thanks in large part to access to piped water, most buildings are now equipped with flush toilets depositing into privately managed septic tanks or cesspits.

Tourism growth on the peninsula has occurred around Seine Bight rather than within the town proper. Foreign investors have built large private high-end resorts lining the beach and lagoon side to the north and south of town often utilizing "package" wastewater treatments of variable efficacy (Prouty 2018). Subsequently, residents have less capital invested in the increasingly dominant tourism economy. In addition to flush toilets and septic tanks, some homes in Seine Bight also rely on outhouses with pit latrines with a small minority of people dumping "night buckets" in the nearby lagoon.

The ethnic differences between communities have remained relatively stable. There are also increasing numbers of ex-pats from the United States and Canada moving into Placencia Village and Maya Beach, a small resort community recently developed to the north of Seine Bight. Overall, residents of both communities have held generally favorable views of tourism as a livelihood strategy (Key and Pillai 2006), although many scholars have articulated how the national pivot towards hospitality has left Belizeans with few alternative options for work (Belsky 2009; Boxill 2003; Diedrich 2010; Karlsson and Bryceson 2016; Moreno 2005; Van Ausdal 2001). Additionally, while many citizens are optimistic about tourism work, they have

also expressed concerns about the impacts of largely unregulated development and growing inequalities (Koenig 2016; Vitous 2017).

Figure 15. A*rt for sale along the Placencia Village sidewalk.*

Chapter Five: "The Cow Does Not Belong in a Horse's Gallop[23]"

Awala has a list of 10 names. Each one represents a middle-aged single mother who manages their families' bodily wastes using "night buckets." Night buckets operate as you might expect. A person deposits their waste into a pail, typically within the confines of an outhouse, and then dumps the contents into the bush, sea, or lagoon each morning. The Seine Bight village council selected the names and gave them to Awala who, after volunteering for a couple years, is now the town's sanitation manager.

They've tasked him with supplying each household on the list with a toilet connected to a septic tank. Building a septic system requires a few steps. First, he digs a hole in the ground and castes a concrete base. He then places about 75 cement cinderblocks around the edges and across the center, producing two separate chambers. He fits three pipes – one for the inlet, outlet, and inter-chamber – before sealing the inside and outside with plaster. Finally, he places a pre-cast cement lid equipped with a breather tube and maintenance holes over the top. In total, the systems cost the council about BZ $875 (US $437.50)[24] each. If there are enough funds, he will also add a soakaway for approximately BZ $150 - $200.

Awala's process embodies the material enactment of managing waste, which is the skilled coordination of entanglements between the properties of waste and those of its infrastructures (Ingold 2012). In order to arrive at the cultural expectations of what waste is and how it should be managed (e.g., Douglas 1966), he must engage in a couple cognitive process.

[23] Belizean Proverb
[24] The Belizean dollar has a fixed 2:1 currency exchange rate with the US dollar.

First the recognition of matter as an object with particular properties or "objectification" (Miller 2005) and secondly, the "categorization" of objects and technologies in relation to each other (Bowker and Star 1999). Which is to say, the knowledge of how to organize the matter he encounters requires that they are rendered into entities and processes that are manageable (Weick 1995).

That is the idealized version anyway. In harsher light, those same objects and technologies are revealed to have properties outside their intended relations or immediate perception (Harman 2011; Meillassoux 2008). The ability of these objects to vary from their expected entanglements gives them a distributed, and ultimately consequential, "small agency" (Bennett 2010). Managing waste on the peninsula is an ongoing process of creating dependencies which constrain these agencies and produce reliable relations (Hodder 2012). The council's motivation to build septic systems for the names on the list, for instance, is both an act of environmental care and social grace as well as a response to changing management norms on the peninsula.

When the communities on the peninsula were particularly small, a few hundred in Placencia Village and under a thousand in Seine Bight, the use of night buckets and overhung latrines (outhouses sitting above the lagoon or sea) were the conventional methods for managing waste. Neither of which presented any significant problems. The Caribbean Sea to the east and lagoon to the west appeared to adequately dilute the peninsulas' collective wastes. As more people came to the peninsula, so did flush toilets with cesspits, soak pits, and septic systems. As a Placencia Village resident reflected on managing waste in her childhood:

> "Growing up [in the late 70's early 80's] I remember where we have those little buckets that we use and then throw it in the lagoon and then toilets, they brought toilets in. Septic tank evolved. So, we had that. We're still using that today, the septic." – *Jane, Placencia Village council member*

Figure 16. *Example of an overhung latrine at Carrie Bow Caye, Belize. June 2019. Photo by Atte Penttila*

Flush toilets with some form of treatment system, like those constructed by Awala, are now the norm across the peninsula. The adoption of these infrastructural configurations has produced new management processes, including strategies for securing a safe and stable water supply as well as a market for the repair and maintenance of treatment systems. In the spirit of the open-endedness of life however (e.g., Van Assche, Duineveld, Gruezmacher, et al. 2022), the adequacy of these arrangements are being questioned amidst growing concerns about ecological health and economic development.

Like the night buckets and overhung latrines before them, septic systems that were once regarded as conventional now pose risks as new entanglements emerge. It is in this way that the non-human dimensions of emerging human waste problems on the peninsula are not derived from static ethical-technical conceptualizations. Rather, problems are a consequence of changing circumstances and new understandings of management processes. Along the peninsula, the non-

human entanglements of management have included the relationships between human waste (including nutrients and pathogens), water, tourism, technologies, and ecologies.

Changing Strategies, Changing Entanglements

Beginning sometime in the late 1980's, the transition to flushing toilets with containment systems came slowly and unevenly throughout the peninsula. The behavioral norm of using household toilets and containment systems coincided with a steady population growth and tourism development. The first entanglement of these new systems involved the desire to flush it in a toilet and convey it away from the household.

Prior to 1996, homes relied on either rain catchments and/or wells for potable water. The use of toilet and septic systems organized and contained waste near the household. However, due to the peninsula's high-water table and sandy soil these new treatment strategies eventually began to contaminate groundwater, making well water unsafe. Management practices are not only entrapped by entanglements, they produce them as well (Hodder 2012).

The earth under people's feet, ©n geological terms, is relatively recent. Over the last few millennia, sand deposits from the Caribbean Sea as well as saline organic silt and mangrove peat from the lagoon have created a substrate resting, at times, only inches above the water table. The water-table is so high, for instance, that wells can often be dug by hand. Surface soils are not only in close proximity to the water table, they are also loose, coarse, and acidic allowing for easy drainage as well as being inhospitable to nutrients (SEA 2014a). These dynamics create problems for septic systems which depend on several feet of dense soil to prevent wastewater from mixing with the water table. Consequently, a concerted effort driven by the Government of

Belize and peninsula residents emerged to shift the source of drinking water to a centralized system drawing from an aquifer across the lagoon. As a senior resident of Seine Bight described:

> "Well, Minister Hall was the one that bring up [the centralized water] project to this community because certain people want to come in and want to build septic. Then you can't have a well and having a septic because then you must remember that when the septic started to leak, go into the sand, and then go into your well, that is why we decide that we should have our own water system." – *Pablo, Seine Bight resident*

The new water source and its centralizing infrastructure produced e a more reliable and consistent supply. It also created two new modes of governance on the peninsula in the form of the Seine Bight and Placencia Village water boards, each established by the government of Belize to maintained and operate the system. While the centralized water system avoided one human waste problem, problems of accountability, pollution, and population growth remained.

Recognizing the poor performance of these waste treatment systems on the peninsula, Belize's Department of the Environment (DOE) has issued increasingly comprehensive regulations on human waste disposal. Their ability to enforce these regulations is limited, however. For instance, a common response to asking who is responsible for managing waste went something like:

> "It's all individually done by homeowners. In theory, there's legal minimums for septic and all that, but the people who are in charge of those inspections don't really care. The building board, or whatever they call themselves [the central building authority]." – *Greg, Placencia Village resident*

With a few exceptions, such as the Seine Bight council paying Awala to construct new systems, the onus to build toilets and install treatment or containment systems has been, and largely still is, on the property owner. Consequently, residences have installed a mix of different strategies depending on the owner's knowledge, priorities, and funds – a common state of affairs in much of the world (e.g., Lawhon et al. 2018). A door-to-door survey conducted by a British

engineering firm in 2012, suggested there were three general forms of residential waste management on the peninsula: 44% of residences were using septic systems, 21% were using soak pits (what locals refer to as a "bottomless septic"), and 35% were using direct discharge (Halcrow 2012).

The distribution of these strategies varies between Seine Bight and Placencia Village (. Many residents in Seine Bight, particularly those of Garifuna heritage, have been excluded over the past few decades of economic growth on the peninsula. Unemployment is high, with many families relying on remittance from relatives living in the United States. Consequently, since homeowners must self-fund their treatment systems, Seine Bight residents are more likely to use direct discharge and soak pits compared to Placencia Village (see Figure 17).

Treatment strategies for small businesses are similar to residential homes, with 54% using septic tanks, 36% using soak pits, and 10% using direct discharge. Several large hotels and resorts also comply with DOE regulations for installing and maintaining "package" onsite wastewater treatment plants, although the performance of these systems is not well monitored (Halcrow 2012; Prouty 2018).

Further challenging the performance of these systems is the peninsula's seemingly unending tourism growth. Septic systems which were well-designed for their household are not equipped to accommodate the increase in tourists staying in a single residence. Not only are more people arriving on the peninsula, but tourists typically use more water, and therefore create more wastewater, than the average resident (Becken 2014). As a local sanitation entrepreneur, reflecting on the dynamics of growth and the sizing of treatment systems stated:

> "Some of the [systems] are completely undersized. I was at a place that was a residence of five people, and I think that's something that was doing OK, but now they turn it into a guest house, and they can have up to 30 people." *Mr. Garcia, owner of Eco-Solutions, travels to Placencia to install and manage treatment systems.*

The introduction of new technologies prompted the government to intervene by constructing a centralized system for reliable and clean water. In the decades since the centralized system was implemented, nearly all households have running water and flushing toilets – although as the engineering survey noted, a few still use night buckets or overhung latrines. Due to the ad-hoc nature of building systems however, they are heterogeneous acrossthe peninsula, performing different processes and requiring different maintenance.

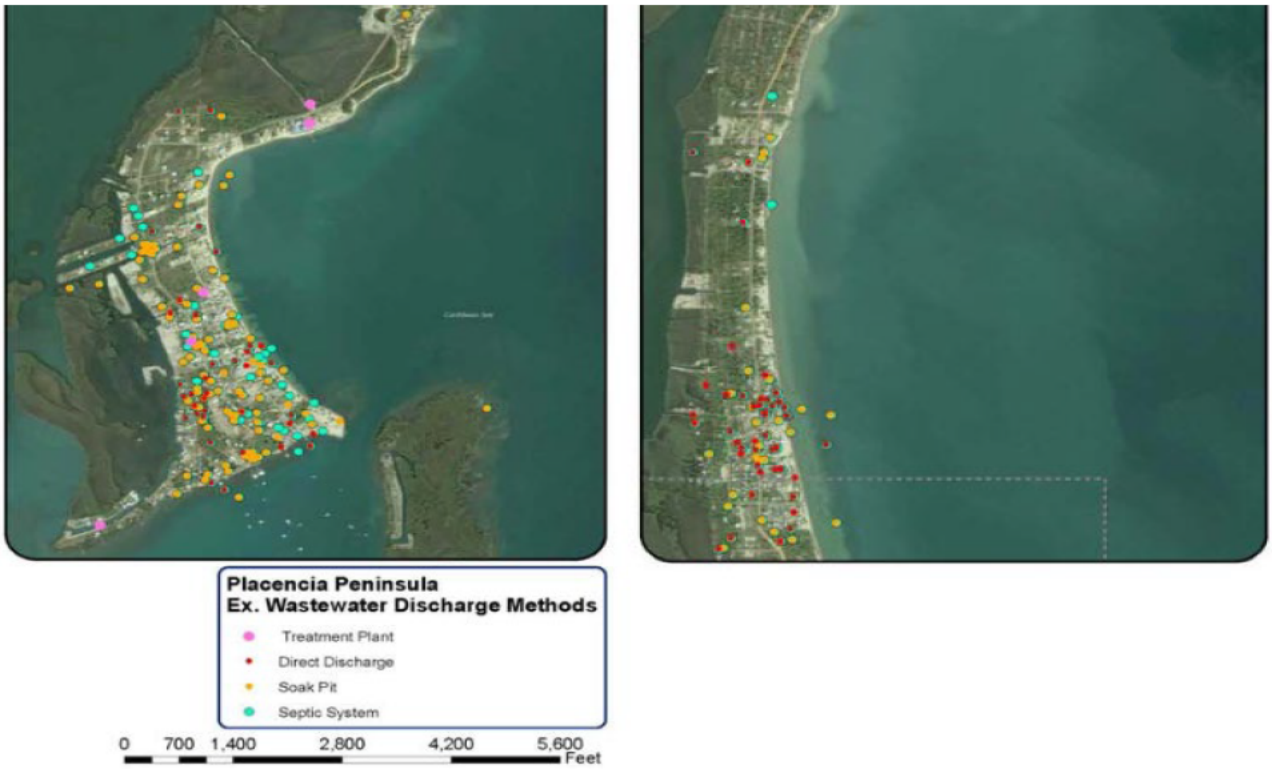


Figure 17. *Distribution of wastewater discharge method in Placencia Village [Left] and Seine Bight [Right]. Graphs modified from (Halcrow 2012:59).*

Heterogeneous Technologies and Management Processes

The design of any system is imbued with assumptions about the world it is operating in. Their actual performance, however, is conditioned by entanglements between the physical and social environments they are embedded in and the materials they are constructed from (Maxcy-Brown et al. 2021). Along the peninsula, a two-chamber septic made of bonded cement, like Awala's, is only one design among a few different configurations.

Classifications of systems differed depending on the resident's conception, and often deviated from an environmental engineering characterization based on its functioning. For instance, many people described single chamber septic systems without an outlet (what the Halcrow report referred to as a cesspit), while others referred to bottomless septic tanks (or what the engineer report referred to as a soak pit). Discrepancies between understandings of systems and how they function has been observed in other locations with similarly mixed treatment types. Reflecting on his study of treatment systems in Indonesia, anthropologist Indrawan Prabaharyaka notes how difficult it is to create generalized classifications given the messy entanglements of decentralized methods in practice (Prabaharyaka 2020).

Variations of a "septic" systems are not only the most common treatment strategy on the peninsula but throughout Belize as well (Silva 2015). A septic system, as defined by environmental engineers, is a self-contained, underground wastewater treatment system. They typically exist on-site to the residence; Belizean code states a minimum of 10 ft within the homeowner's property boundary.

The intention of a septic system, at a minimum, is to separate people from the pathogens in their excreta. Flushed wastes (known as blackwater) flow into the tank where the contents separate into three layers. Greases, fats and oils rise to the top creating a layer called *scum*.

Denser solids settle at the bottom of the tank becoming *sludge*. The outlet hose for the tank resides within the middle layer to allow wastewater to flow out of the tank while leaving the scum and sludge behind (Figure 18).

The longer wastes stay in the tank, referred to as hydraulic residence, the better separation of the three layers. This can occur within a single, two-, or three-chamber tank, with more chambers translating to better separation. The longer the hydraulic residence, the lower the viral and bacterial load in the effluent flowing out of the tank (Adegoke and Stenstrom 2019a) [25].

The tank is only intended as one half of the septic system. The outlet from the tank sends wastewater into an underground drain field, which, on the peninsula were usually described as bottomless septic tanks, soak aways, or soak pits (Figure 19, (a), (b) and (c)). Soak pits operate much like a septic tank except they are made of porous materials and lack a concrete bottom. They are also often filled with rocks or gravel to keep from collapsing and promote biofilm growth.

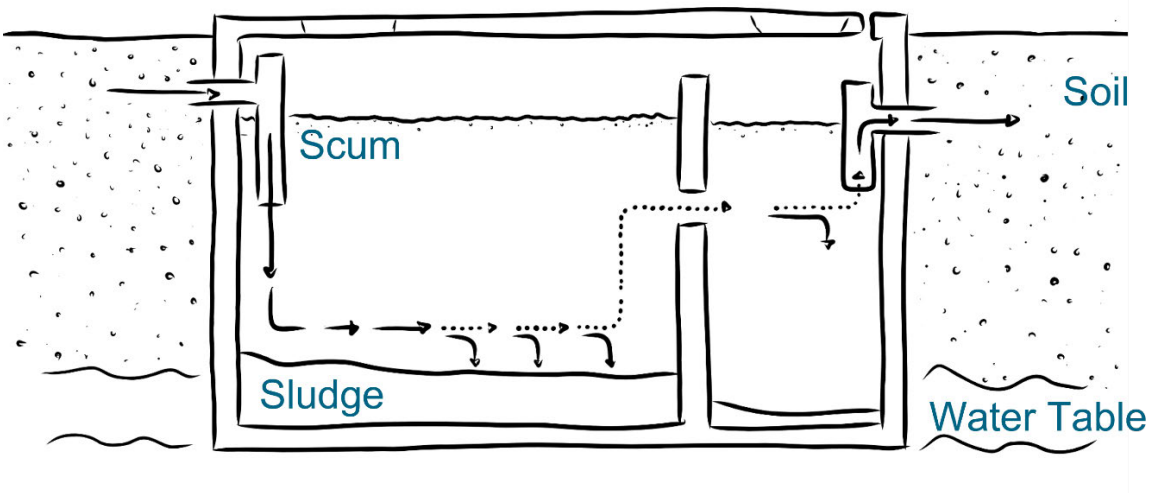


Figure 18. *Septic tank showing three distinct layers: scum (oil, fats, and grease) on top, clarified water in the middle, and sludge which settles to the bottom. Illustration by Alex Webb and Angel Webb.*

[25] This description is related to a fairly simple design. The interior of septic tanks can become quite complicated with the use of various types of filters and flow direction which further remove pathogens and phosphorus.

The expectation for soak pits is that as wastewater flows out from the bottom and sides of the tank, the surrounding soil matrix will filter out small particles while microorganisms digest the remaining biological material. To accomplish these processes, it is recommended that there is at least 6 ft between the bottom of a soak pit and the water table (Mihelcic and von Sperling 2019), a rare occurrence on the peninsula. While soak pits are generally considered *secondary treatment*, where received fluids contain few solids, for many households on Placencia, they act as their primary treatment (receiving direct blackwater). Because the water table is so high, there is little difference between soak pits, or bottomless septic tanks, and direct discharge (Halcrow 2012). A resident noted that most systems, historically, have been built without bottoms:

> "They don't have the cement at the bottom. They're not sealed. They are wide open so that material can be absorbed and of course it's on the coast, so it probably enters the lagoon and into the sea. But most people, as far as I know here in the Peninsula, it is not practiced that they seal the bottom of their tanks." – *Susan, Placencia Village resident*

In this regard the high-water table has a bi-directional relationship with the functional problems of these systems. The same way effluent flowing from tanks and pits can easily encounter the water table, heavy storms and rains can raise the water table flooding the system. As a community leader involved in sanitation described:

> "[The] solids go in along with the liquid. It has a pipe leading into the next tank, but solids are collected in one tank, water is collected in the next tank, and the next tank is overflow. [That's] If you have a three-tank system. If you have a two tank, you just have solids and water. The problem is sometimes that with them being underground too that when you start having heavy rains like this, or these tropical storms where you're producing an excessive amount, you can have it where the tanks literally will get full just from the water. It'll take a couple of days sometimes for that water to dry out enough where it balanced itself back out." – *Rachel, Placencia Village Council member*

Consequently, many homes do not run their domestic water (referred to as gray water) through the tanks to reduce the amount of water entering the tanks. They hope is by diminishing

the volume of liquid in the septic tank at any given time, rising water tables will be less likely to flood the system. The result, however, is grey water running straight into the soil. As a Placencia Village resident explained:

> "My septic is just from the toilet it's not even from the shower. It is quite a basic house but most of the houses here are basic. It just goes straight onto the ground. Into the sand. Certainly, right on the lagoon side, right by the basketball court, all the homes around there. You know when people are taking a shower and you walk past and there is just a pipe coming out the bottom. So, the gray water just goes right out of the house, often." – *Susan, Placencia Village resident.*

In addition to soak pits and chambered septic systems, a third typical design used by residents is a sealed septic tank or cesspits. Sealed cesspits are temporary holding tanks which have no outlet for overflow and will "back up" when they become overfull (Adegoke and Stenstrom 2019b). These systems were historically either completely buried and replaced when they filled up or homeowners would build a new chamber with a hole created to direct the overflow from the full tank. Cesspits also require being pumped out. A problem for many of the older designs which lack a maintenance hole. Consequently, the lids have to be broken, the sludge sucked up, and then a new lid placed on top. Once again, when the communities were small these tanks would fill up slowly, as populations have increased tanks backing up has become more a problem.

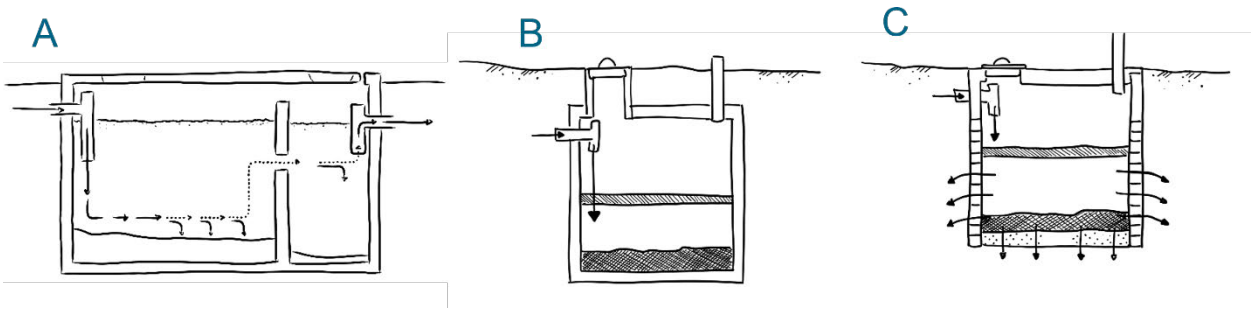


Figure 19. *Diagrams of (a) a septic system, (b) a cesspit, and (c) a soak-pit. Illustration by Alex Webb and Angel Webb.*

Resorts and Hotels

As tourism grows on the peninsula, an increasingly large percentage of the wastewater is derived from visitors staying at resorts. There are dozens of hotels across the peninsula (Figure 22), with rooms ranging from half a dozen to 90 at the largest resort, The Placencia. The specific properties have all been built at different times with different regulatory requirements.

The state has attempted to intervene by requiring stricter (and more expensive) treatment standards. Many large resorts, for instance, must now use a "package treatment plant," which must be signed off by an Environmental Impact Assessment officer. Because each resort is unique in terms of its room accommodations and size, the package treatment plants are all different. A local leader involved in sanitation described the ad-hoc nature of the particulars for how each resort manages their waste:

> "[The] DOE started requiring all of the hotels that were built after 2004 or 2005 to have their own packaged sewage treatment. And they require it in the larger subdivisions like CocoPlum, the individual houses have to have them too. Robert's Grove, Chabil Mar, the Placencia, they're all on packaged sewage treatment plants. [the system] is regulated on a case-by-case basis through the Environmental Impact Assessment process. When they get their EIA approval, … they have to sign an Environmental Compliance Plan, and that is like a contract that dictates what kind of sewage treatment they have to provide." – *Ann, Placencia Village resident*

For instance, the maintenance team for the Chabil Mar, a high-end resort with 22 private villas, described their process as a three-chamber system which chemically treats and aerates guest's waste before recycling it to irrigate the lawn:

> "We have three separate tanks in the ground. The water goes into one with pumps inside that pump it into a main tank. From the main tank it pumps into a circulation system, which treats it with chemicals. There are two compressors in it, that circulate the water, that keep the water rolling. Any time the water flows in what's in there flows to a different section. And from that tank we have a holding tank, and it just pumps that out into the grounds. [where they irrigate the lawn]." – *Owen and Maria, maintenance staff at the Chabil mar resort*

Although the DOE requires resorts to adopt these large systems, they are not monitored after installation. A key feature of infrastructures however, is the organizational capacity to address their inevitable repair and maintenance (Chu 2014; De Coss-Corzo 2021; Graham and Thrift 2007). Consequently, their performance relies on the competencies of the staff and available resources. Some of the challenges associated with this arrangement are sourcing parts – like when the compressors in Chabil Mar's systems break which they have done a few times – and high staff turnover leading to managers with different levels of expertise and commitment. A local leader familiar with sanitation issues noted the challenges with maintenance in relation to knowledge about and accountability for these resort's package treatment systems:

> "They're obligated to [install package treatment plants] now, which is good. That doesn't mean they're properly maintaining them or anything like that, right? They have a central building authority now that enforces it [the installation], but as far as overseeing it after its constructed, I doubt there's anybody. People have their own employees and hope for the best." – *Arnold, Placencia Village council member*

Many of the smaller resorts rely on traditional septic tanks to treat their guest's waste. As DOE regulations have become stricter, owners are struggling to find the funds for these expensive systems given their annual operating revenue. The cost to meet DOE regulations for effluent inspired one hotelier to seek out a centralized wastewater system. As the proposal for a larger system is within the window of possibility, the DOE has given many resorts waivers suspending the requirement for upgrading their treatment systems. As a local boutique hotel owner describes, not only are the systems expensive but due to their lack of oversight it isn't clear they are more effective than traditional systems:

> "The minimum cost on a small system like that was US $10,000. As small hotels we can't afford that. But the government was pushing for all the hotels to have some sort of [advanced] treatment system. The [Chabil Mar] has it right on the side of the road. Sometimes you ride past and can smell a stench. So even their system, I think could do a little tweaking." – *Ewan, Placencia Village resident*

Figure 20. *Examples of resorts along the peninsula. Including the new cruise ship port on Harvest Caye [BOTTOM LEFT].*

Repair and Maintenance

As anthropologists have noted, and the dynamics of resort's package treatment systems attests, there are paradoxes to infrastructures. While they seem to materialize and secure particular types of relations, they are always in the processes of degeneration and can produce risks even as they attempt to ameliorate them (Howe et al. 2016). Consequently, it is impossible to fully understand management processes without considering the realities of maintenance and repair (Graham and Thrift 2007). On the peninsula, repair and maintenance can become costly endeavors involving the material properties of the systems, pump trucks, and accountability.

Tanks on the peninsula are made of either cement or plastic. Historically, and most commonly, they have been constructed from bonded cement cinderblocks (like Awala's). More contemporary options include either pre-cast cement or prefabricated plastic tanks. A Placencia Village council member describes the landscape:

> "Some are cement, some are plastic pre-made, prefabricated ones. Then you have the eco-friendlier type, digester-type and all that. But traditionally people used to have a regular cement septic tank. "- *Arnold, Placencia Village Business owner*

Figure 21. *[Right] A plastic tank and [right] a pre-cast cement tank. Photos by EC Wells*

Each material provides different opportunities and challenges. Cement, particularly bonded cement tanks, are cheaper although they take some work to install. However, while cement's reputation and appearance is as a stable material, it requires certain conditions of care to be as reliable as it seems (e.g., Harvey 2010). For instance, when submerged under or in the water table, they slowly disintegrate. Consequently, many of the sealed and chambered septic tanks throughout the peninsula are leaking and fragile underneath the ground. As an entrepreneur who specializes in designing systems on the peninsula noted in a story of tank maintenance:

> "The other thing is a lot of these people have built septic tanks under the water table, and therefore, they corrode very fast. We were working at a septic tank where we were trying to find out if it was still good to work with. And the guy was digging around the tank and with the equipment [a metal rod], it came apart with one knock, so you could see that there is a lot of corrosion in those things. I mean they were built mostly with blocks, concrete blocks and not done with precast concrete." – *Mr. Garcia, owner of Eco-Solutions who travels to Placencia to install and manage treatment systems*

Plastic tanks come with more idiosyncratic and banal installation challenges such as the need to fill them with water to weigh them down. The water table is often so high, they float to the top as contractors attempt to install them. Additionally, while more stable underwater than concrete they are also more expensive. They might range from BZ $6,000 to BZ $13,000 depending on the complexity of the design. Consequently, people tend to rely on less reliable concrete due to its affordability. A Placencia Village resident noted the tension between the poor performance of bottomless cement septic tanks and their cost:

> "They are mostly one-chamber septic tanks and the plumber had to explain to me that the septic tanks we have here are not built to treat sewage properly. Wastewater doesn't have the time to divide into the different components like sludge and effluent and all that stuff. What happens is that you're getting all this like bacteria stuff leaking out that shouldn't be. So, it's not good for the environment and could be harmful, you know. But it's cheap and people are going to go with what's cheap." – *Ellie, Placencia Village resident*

Pump Trucks and Dump Sites

Typically, a septic tank large enough to accommodate its users, and with enough distance from the water table, only needs to be pumped out every 15 -20 years. The tanks' longevity is owed to the native bacteria who live inside it. Over time they feed on the fecal sludge, decomposing, and transforming it into a gas which escapes through the breather tube in the tank. On average bacteria will break down approximately 50% of the sludge created over the lifetime of the tank (Adegoke and Stenstrom 2019a).

Constant flooding prevents the bacteria from adequately breaking down the accumulated sludge. The effects of flooding, as well as an increase in users, leads many residents to have their tanks pumped out at regular, relatively frequent, intervals. The cost ranges from $100 to $1400 depending on the time year and how many clients the pump truck has that day. Like the construction of the systems, the burden to pay for pumping out a tank is on the homeowner. Consequently, some tanks are left to overflow while others are cleaned out regularly. However, many homes are not accessible to the pump truck and therefore not able to receive service and must allow their septic tanks to overflow. A Placencia Village resident noted, once again, the tension between the need for management and the costs:

> "In people's yards sometimes you see, you know, streaming out, especially when its rainy reason, when you get a big amount. But some people call a truck to come and pump out their systems, and that's fine. But you don't have a lot of people who can afford it, so that's the problem." – *Laura, Placencia Village resident*

An additional challenge to pumping tanks is the presence of maintenance holes. Traditionally, tanks – whether septic, soak pit, or cesspit - were built without pump holes. As pumping has become a necessity the lids to older cement tanks have to be broken and the hose pressed in and manually moved around to suck up all the waste. This required a new lid to be purchased or cast each time the tank was pumped. Modern systems have accommodated to this

new reality by being built with maintenance holes which help to pressurize the suction hose. A business owner in Placencia Village described the changing designs for septic systems to anticipate and accommodate the need for pump trucks:

> "Any sewage overflow… you got a few, you know. And the truck usually come in and suck everything out. You got a number where they call for the system. They just come in the village and do that. They got that under control too. They got more than one truck. It's a white truck with a blue back or a black back on it. Big truck. I got a septic and I built a hole on the side for the big truck to come in and do the same thing. That's a new way they build the septic here. They call it a safety where you don't have to bust the septic again. You got a top, a cap. Where you take it off and push it in and get everything out, you know. Once you figure it's time to get It out." – *Luke, Business owner, Placencia Village*

Figure 22. *A Pump truck on its way to Seine Bight. June 2013. Photo by EC Wells.*

To help make pumping more affordable and accessible, both Seine Bight and Placencia Village councils collect requests and coordinate a time for trucks to service multiple properties at once. There are two companies, one three hours north of the peninsula in San Ignacio and one an hour north in Dangriga. By coordinating with the trucking companies, the councils can reduce individual costs to homeowners. These trucks are not accountable to any of the households or village councils, however. Consequently, several residents and sanitation managers expressed suspicion about where exactly the pump trucks *dump* after they have collected for the day. Haphazard or convenient dumping of waste has been observed in similar market-based collection systems elsewhere in the world (Prasad and Ray 2019). A Maya Beach resident on the north of peninsula describes a suspicious instance that occurred in the middle of the night near her house:

> "A sewage truck was caught dumping sewage on the northern part of the peninsula right out to the swamp. [It happened] about 3 years ago at 2 o'clock in the morning. (laughter). I got the phone call, and I was told where it happened and what happened and did drive by and did see the tracks of the truck on the mound, but I didn't go investigate it. I did call the authorities and tell them." – *Pamela, Maya Beach resident.*

Managing Nutrients and Pathogens on the Placencia Peninsula

Even in perfect conditions, a traditional septic tank is not designed to remove key nutrients from wastewater (e.g., nitrogen (N) and phosphorus (P)). In certain contexts, phosphorus can be absorbed into the earth, although the peninsula's soil is not ideal for this process. Consequently, with the unknown exception of package treatment systems, every single form of waste management on the peninsula enriches nutrients in local waters – in the groundwater, the lagoon, and the Caribbean Sea.

The challenge for the peninsula moving forward is understanding the influence of these nutrients on local ecosystems. Water quality monitoring in the surrounding water bodies has

taken place intermittently finding either no ill effects (Ariola 2003), moderate effects (SEA 2014b), or signs of wastewater contamination (Haberstroh 2017). In between these periods there have been massive algal blooms, a loss of water clarity, sea grass die-off, coral die-off, and declining fish populations (Boles et al. 2011; Wells et al. 2016). It isn't clear what human waste's contribution is to these occurrences. There are numerous confounding processes that could lead to poor water quality. The Lagoon is adjacent to several shrimp farming operations. It also downstream from banana farm operations. There has been significant dredging along the lagoon. And there are the unknown effects of the world's changing climate, which for some residents were expressed about a general anxiety of water quality and speculations about its sources:

> "There was big frenzy going on because there were algae [a bloom that lasted nearly a year and went up and down the peninsula]. It really hurt us for a while. There are a lot of tourists around, people couldn't go diving, they couldn't see underwater so there were a lot of questions coming, "What's going on? Why do we have this?" An environmental association did a study to figure out what was happening and there was some speculation that it had to do with climate change. That it had to do with the run-off from the shrimp farms and the banana farms going on, all the fertilizers feeding the algae. And also, possibly not having a sewage system, bacteria going into the water as well. So that had people trying to figure out what's happening and that's when I first started thinking maybe, maybe we do need a sewage system? And maybe we go look at what's going on and what's getting into our water." – *Ellie, Placencia Village resident*

Understanding the extent of the ecological entanglements of poorly treated wastewater will require long term planning which is expensive and time consuming.

Wastewater Re-Use

Some homeowners and, mostly, resorts have taken a proactive step by adopting re-use management strategies. Many of the larger hotels, who also have some form of package

treatment, use the treated waste as gray water for lawns and plants. A medical officer described his experience with the treatment system on the oldest hotel on the peninsula:

> "The SeaSpray hotel uses an eco-friendly system, where they use some chemicals and tablets and stuff and every month or two months, they clean out the whole sewage system and water and all the gray water, you can collect that water. That's why they have a nice garden if you look around, they have a nice garden around there, and the water that they use is that water, reusable water. And when, let's say, the sludge, the use that as compost and they mix it or whatever and use it as fertilizer and it's working there." – *Adrian, Medical Officer, Placencia Village*

Like the larger package treatment systems for hotels however, systems which re-use waste for irrigation can be prohibitively expensive for small hotels, businesses, and residents. A local business owner who purchased one for their property describes the system as not only much more expensive than tradition but also noted it failed to work as anticipated:

> "The only thing is that those [re-use] systems are kind of expensive, I don't know the exact amount, but everything that we use in this building was expensive. And that system was expensive too. I don't have an amount but for sure much more expensive than just to build one the old way. I think it is worth it once the soil is good. In this case, we were going to grow grass, but the grass never did grow." – *Catherine, Placencia Village resident*

A few residential homes have adopted waste re-use strategies to avoid the unknown effects of poorly treated waste. The most common process is directly discharging their effluent into gardens, although the consequences of it are uncertain. For one resident who owns a series of small bungalows, his motivations were hopeful rather than determinative:

> "We have a rural system. There is a septic tank underground or on top of the ground that is getting full of our excrement. There is a pipe underground. In the end, this stuff, you know, goes underground and you think [of] cholera, fecal bacteria, etc. You think, where the hell is going all these things? So, what I do, I plant coconut trees. I have to clean everything once a year. And at the end, you hope that the plants are helping you to get rid of all of this." – *James, Placencia Village resident*

However, these attempts have come with surprises as unexpected entanglement emerges like unpleasant odors and hungry roots clogging up pipes. For instance, one resident described how the coconut trees he planted near his perforated leach field would eventually clog the pipes requiring him to replace them periodically. Another Seine Bight resident who works on the newly re-developed Harvey Caye (which is home to the cruise ship port), noted how the use of waste re-use can produce an unpleasant odor for both guests and employees across the small landmass:

> "That's what we're using down in Harvest Caye right now. Everywhere [re-using wastewater]. Sometimes they do it and it smells bad, and sometimes they do it and it smells really bad." – *Marcus, Seine Bight resident*

Managing Pathogens

The regular flooding and overfilling of septic tanks suggest that there is, at best, only limited treatment of human waste pathogens on the peninsula. Water quality testing has consistently found E. coli (an indicator associated with human waste) in ground water, in the lagoon, and in the near shore (Halcrow 2012; SEA 2014a; Haberstroh 2017). Many residents have either alluded to or confirmed the presence of pathogens in local waters. A Maya Beach resident noted how studies have been contradictory, suggesting complex dynamics for how and when pathogens enter water bodies and how long they stay there:

> "They found high levels of E. coli in the Placencia lagoon. Very, very high levels. I don't remember the number, but it's in the Environmental Impact Assessment report. But in like, what, 10 days? They did it over, and it didn't show above average levels of E. coli. So that was strange." *Bernard, Maya Beach resident*

However, the introduction of the centralized water systems has avoided the most common association with untreated pathogens, contaminated drinking water. By and large, residents of both Seine Bight and Placencia are very proud of their water systems – the taste,

smell, and quality. No one, including the local medical officer, described any consistent water-borne diseases.

In fact, references to disease were usually directed towards mosquitos and dengue, which is particularly likely during the hot rainy summer months. However, a few people who worked with the water systems did note cross contamination is possible. Since the groundwater is considered contaminated, in the event of pipe breakages, pathogens could enter the water supply. Otherwise, much like the effects of nutrients, the impacts of pathogens from wastewater are largely speculative. A resort owner on the north of the peninsula noted their own experience getting sick which they attributed to contaminated drinking water:

> "As someone who somehow got Hepatitis A while I was living down here… I'm not saying that I got it from swimming into a floating turd or anything like that, but everyone pretty much realizes the geology of the area and the inadequacy of the septic systems that people are using. It doesn't take a genius to see. I mean you go three foot down, and there's your groundwater. You know how that works – it's a narrow peninsula, coliform has to go somewhere." – *Will, resort owner north of Seine Bight*

Speculations on the potential hazards from pathogens were more likely to emerge from stories from swimming, although swimmer's itch is a common condition that can occur without the inputs of human waste. Frank, a Placencia resident who works in tourism attributed incidences of swimmer's rash to periods of wastewater contamination in the near shore waters:

> "Sometimes you have people that have sensitive skin. They will go swimming in the ocean, certain times of the year, and get rash and stuff, and people didn't know what was going on. But that's what's going on [wastewater leaking out to the nearshore waters]." – *Frank, Placencia Village resident*

Another avenue for contact with pathogens from wastewater is speculated to occur after flooding events. Commonly, fields, parking lots, and playgrounds will become flooded after heavy rains. The children who play in these waters will occasionally present with rashes and

irritated skin. Mila, a Placencia Village resident, attributed these rashes to contamination from septic systems, as did many others:

> "I will tell you something though. This is how we realized we needed to have a better sewer disposal system. There are times that it rains a lot and the kids are playing and they get rashes underneath their feet and the kids that play in the ball field pick-up skin issues. When it rains and the water comes up from under the ground, the water table is high, then obviously there is stuff coming up which we attribute to sewer going into the soil." – *Mila, Placencia Village resident*

Knowledge and Non-Humans

Like much of the world, there are a variety of strategies for managing human waste on the Placencia Peninsula (e.g., Lawhon et al. 2018). The relationships between strategies and social problems have emerged slowly as the context of management has changed, however. As population pressures, both residential and tourists, have increased, perceptions of adequate management have changed as the relative importance of non-human entanglements have shifted. These entanglements serve both to inform people's understanding of what management is as well as to introduce worlds hidden from their everyday lives.

There are many objects when managing waste on the peninsula. The high-water table and loose soil are meaningful contributors making the safe organization of people's wet bodily waste difficult. In the context of the designs of septic tanks and cesspits, the "small agency" of these objects appears more influential than human attempts to mitigate them (Bennett 2010). Particularly in relation to the concrete materiality of many of them (Harvey 2010). While upgraded package treatment systems and pump trucks act as emerging management forms, they present other problems, such as the need for repair and maintenance (Graham and Thrift 2007) as well as a lack of accountability (e.g., Prasad and Ray 2019). Despite a consensus of the failure to entangle things with other things (Hodder 2012), the respective impacts of nutrients and

pathogens are difficult to “know”. Their consequences are not yet strongly felt, and for many, waiting until they are is not an acceptable strategy.

The non-human entanglements of waste management on the peninsula reveals its heterogeneous, contingent, and speculative dynamics. “Knowing” about management is informed by and informs its material relations. Attention to the “small agency” of things, the dependencies they engender, and how they become situated in social life adds more texture to the call for contextualized management (e.g., Mihelcic et al. 2017).

The challenge to understanding these contingent entanglements is how to proceed? Solution to management problems must not only grapple with the complicated non-human dynamic of treatment processes but also with the social complexities of differing economic capacities and accountability. Moving forward resolution to waste challenges will be resolved by differing social institutions clamoring for trust, legitimacy, and authority over how waste problems are defined, and potential resolutions are enacted.

Chapter Six: "A Bad Thing Never Has an Owner[26]"

On a Thursday evening in June 2019, a small group of men construct a large white tent on the basketball court in Placencia Village. They've arranged 91 white folding chairs facing a long table with speakers, a microphone, and a projection screen. Soon a panel of experts will present the preliminary results of an 18-month study on the sources, movements, and fates of nitrogen and phosphorus within the watershed[27]. Their findings are an update on the ongoing proposal to build a centralized sewer system across the peninsula. The project has been in development, in one form or another, for 15 years.

A few blocks away the panel is in the middle of a technical exhibition of the same study. The closed meeting is held in the offices of the Southern Environmental Association (SEA), a local environmental management NGO. There is a broad range of attendees. The heads of the Placencia Village and Seine Bight councils, representatives from a half dozen NGOs, hotel and business owners, consultants from the Caribbean Development Bank, and engineers from Belize Water Services (BWS) are all seated attentively. In the mix are myself and Dr. Christy Prouty, an engineering colleague.

Danker Kolijn initiated the presentation with an overview of economic and environmental development challenges emerging on the peninsula. An engineer from the Canadian consultancy CBCL Limited, Danker speaks precisely and slowly. Dr. Brian Lapointe, a professor from Florida Atlantic University hired by CBCL Limited, follows Danker. For 25

[26] Belizean Proverb
[27] In engineering, this is referred to as a *Nutrient Fate and Transport study.*

years, Dr. Lapointe has studied the relationships between wastewater management and coral reef health. His research suggests it is the ratio of nutrients, more than the nutrients themselves, that are detrimental to the reefs. Specifically, human waste and agricultural runoff contain high levels of nitrogen compared to phosphorus. High relative levels of nitrogen lead to excessive algae growth, which outcompetes coral for the remaining phosphorus making it difficult to recover from bleaching events (Lapointe et al. 2019).

Dr. Lapointe is followed by another CBCL Limited engineer, Colin Waler, who traces the field data collection methods and complex hydraulic modeling. The presentation lasts approximately two and a half hours. Somehow, its followed by a lively discussion of its implications for bridging the gap between "a difficult present and a better future" (Abram and Weszkalnys 2013:34).

Immediately after the discussion the experts make their way to the white tent down the street. They are now going to re-articulate the study to a public audience. Unlike the technical discussion, the 90-minute public presentation is a formal performance of state – beginning with the Belizean National Anthem, an invocation, and opening remarks by Ilsa Villanueva, the chairperson of the Placencia Village Council. Danker, Dr. Lapointe, and Colin each give variations of the previous meetings' presentations. The address ends with a brief question and answer session and closing remarks from Belize's Minister of Economic Development. Of the 91 chairs, only about 25 feel the weight of a curious resident[28].

[28] There were approximately 50 attendees but 25 were either my colleagues or representatives associated with the project.

Figure 23. *Four Community Presentations on the Centralized Project in 2019. [TOP LEFT] Public Presentation [TOP RIGHT] Closed Presentation [BOTTOM LEFT] Dr. Brian Lapointe during public presentation [Bottom Right] Closed Presentation. Photos by Maya Trotz*

Community consultations are rare moments when many of the impermanent relations involved in state planning are present at once. Contrary to their appearance as coherent and singular, particularly in discourse, states are constituted through fragmented institutions where authority, legitimacy, and power is dispersed and contested (Bonilla 2017; Gupta 1995; Jaffe 2014; Workman 2019). Following along these kinds of events highlights Pragmatist philosopher John Dewey's assertion that the state as a universal ideal or norm is "pure myth" (Dewey 1927:vi).

Instead, the liberal democratic state is a response to a problem which has drawn in a "public" of concerned individuals and groups. The motives of the state and the public, and the respective power disbursed between them, is contingent on the actors (Abi-Hamad 2012; Jeffrey 2012; Thelen, Vetters, and von Benda-Beckmann 2014). As public problems are formed, they create what I refer to as a "state-gap" which governmental and organizational bodies seek to fill through logistical problem-solving (Harvey and Knox 2012; Joyce and Mukerji 2017).

For instance, the centralized wastewater proposal represents what Carse and Kneas (2019) describe an unbuilt infrastructure in the "suspended present," where it is not "a state of being but rather a social process associated with distinct temporal frames, rhythms, and conditions of possibility" (2019:18). In over a decade of "suspension" the state has blinked in and out of waste management on the peninsula, as institutions experience crises of knowledge, project oppositions, shifts in politics and investment, and the back and forth of expert reports. The struggle for projects to fill the state-gap produce, reorganize, and mediate new social relations (Hetherington 2014; Ratner and Rivera 2004).

The cast of actors at the closed meeting were unrecognizable from meetings held about the same project seven years ago. The staff at BWS has changed, as has the funding agency. The engineering consultants are different people, from a different company in a different country. The respective chairpersons for each village council have been newly appointed, as has the head of the Ministry of Finance. The project has gone through a rolodex of actors through the sturm and drang of its teenaged life. Just a day before the back-to-back public/closed meetings, the consultants had presented to representatives from the shrimp farms across the lagoon. As long as social concerns exists, the state never stops talking. (e.g., Roseberry 1994).

The following chapter explores the unfolding of the state through three anthropological modifications of Dewey's conception of state processes and public problems (Dewey 1927). First, it follows Dewey's notion of the state as an unnatural collection of bodies striving for legitimacy to resolve public problems through institutional practices (e.g., Latour 2007). Secondly, it extends Dewey's presumption of "conjoint action", of embodied problems intertwined with their material environments, to include non-human ecologies (e.g., Bennett 2010). Thirdly, it adopts a priori that action in response to problems is always entangled in a web of relations, both human and non-human. These actions invariably produce more actions, or responses, with unintended consequences and surprises. This truism, shifts the analysis of motivation and action from self-interest alone, to how institutions and people respond to harms, or "response-ability" (Haraway 2008; Lau 2022).

The result is a view of state planning in Belize that is not a rational or deterministic practice of policy nor a Machiavellian display of power. It more closely resembles an inventive struggle for legitimacy amongst evolving participation, desires, and knowledge. Through the life of the proposal, a variety of actors with unique practices and prescribed roles have entered the project, each improvising as they attempt to resolve "public" problems (Koyama and Varenne 2012; Weick 1995).

The Centralization Project Part 1

All projects have an origin. The wheels of the centralized wastewater proposal were spurred into motion by the violent winds of Hurricane Iris. The category IV storm tore through the peninsula in 2001, damaging 90% of buildings and flooding waste treatment systems. The

literal “shitstorm”, brought the shortcomings of otherwise invisible infrastructure to the forefront (Star 1999). Even 17 years later the impact lingers.

On my first visit to the peninsula in 2018 I asked a local businesswoman her thoughts on the proposed centralization project. She digressed into a 45-minute discussion of Hurricane Iris, linking the damage it created and the shortcomings it exposed as an appeal to why the system was necessary. Another business owner articulated the damages as still unresolved:

> “When we built our [septic system], …[they]basically treat some of the sewage then it goes into the soakaway and then that basically graywater goes into the ground. So that is how it works. One of the problems is that after Hurricane Iris, a lot of them got damaged and people simply didn’t repair them. I mean, you know, it was just an oversight. Most people came and, “Oh, it is still there. It is still working. My pipe is still connected to my toilet” and that’s that.” – *Frank Placencia Village Council Member*

The hurricane was a catalyzing “event” – a moment that extends over time as “creativity is harnessed to the tasks of effecting and legitimizing the social transformations that crises often demand” (Hoffman and Lubkemann 2005:315). Residents, international engineering consultancies, development banks, governmental departments, and utility employees have weighed in, contested each other, and searched for resolutions to wastewater challenges on the peninsula ever since.

The national response to Iris was to double down on tourism-as-recovery (Alexander 2008). The Placencia Peninsula was not an exception. The state elected to intervene in human waste management by incorporating more stringent regulations on resorts. Kittie Fox, whose family lineage traces to one of Placencia Villages’ founding families and who owned the hotel Kittie’s Place, pushed back on the state, arguing meeting the regulations was too expensive for mid-size hotels like hers.

Proactively, she reached out to her son who was working with Engineers Without Borders (EWB). In 2005 EWB conducted a community health survey and site visit in collaboration with the Placencia Village water board (PVWB). The results inspired EWB to draft some possible centralized solutions for the board (Fedak 2006). The report is a result of an "entangled perspective" with the peninsula's environment and technical challenges (Hernes 2007).

The first consideration to a centralized project, for instance, is how to gather and move waste along the peninsula, referred to by engineers as collection and conveyance (Mihelcic and von Sperling 2019). The peninsula is flat with little to no elevation change and a high-water table. These conditions make gravity-fed systems near impossible since such a system requires a constant slope that would quickly go below ground water. Should a pipe burst, the system would be flooded. Another common solution for centralized waste collection and conveyance is a vacuum system. While it does not require a grade, any breakages in the lines and the system would lose its vacuum and cease to work. Collection stations for vacuum systems are also complicated and maintenance intensive. A tall order for the water board.

EWB identified a *pressurized* system as the most feasible. A pressurized system includes a few entanglements of course. To become pressurized, every two households would share a pump enclosure, which receives and grinds their waste before sending them into 3" main lines running up the peninsula. The use of pump enclosures requires each household to have electricity, drawing the equivalent of a 40-watt bulb continuously left on. The pump would replace existing septic or soakaway systems and therefore require little cost and labor to hook up to. Since each household would require pumps, EWB recommended the water board consolidate accountability by owning and maintaining them in the event of failure.

The 3” mainlines would extend to a central pump station in the middle of the peninsula, somewhere in Seine Bight. A pump station includes a wetwell, which stores waste and contains submersible pumps sending the waste north of the peninsula to a treatment location. Waste from resorts and residents on the north of the peninsula would feed into these main pipes as they travel to the treatment stage. The pump station would be low maintenance with routine daily checks and cleaning. The entire system would rely on electricity, however. If power was lost during another storm event, the pipes would lose pressure and the centralized system would not work.

The next consideration is what to do with the collective wastes once they are gathered. There were several options. Two were considered but dismissed: the use of a facultative lagoon, which is low energy but produces unpleasant odors and green effluent tinted by algae. The site for the lagoon would be near Seine Bight creating an undue burden on residents. Another dismissed option is the use of cluster treatment systems, wherein five homes at a time could share the responsibility (e.g., cost and maintenance) of an isolated infrastructure. It would require 416 systems to cover the peninsula however, assuming they were funded by the water board, and if maintenance failed would result in worse outcomes than the current infrastructures.

Alternatively, they laid out three viable options: 1) Collaborate with the Ara Macao Resort and feed all sewage into a package treatment system on their property. The effluent would then be used to irrigate their planned golf course. A package treatment system that large would also be energy and maintenance intensive (requiring large mechanical blowers to oxygenate the system). 2) Build a series of small, aerated lagoons with a settling pond. They are called aerated lagoons because they use mixers to supply oxygen and “aerate” the pond. The mixers would be moderately energy intensive and require expertise to maintain. The effluent could be disposed of as fertilizer for banana farms (see Figure 24). Finally, 3) construct a horizontal surface flow

wetland to naturally treat wastes using no external energy (Maiga, von Sperling, and Mihelcic 2019). EWB identified an ideal location for both options 2 & 3 on the mainland across from Seine Bight. They recommended the constructed wetland.

Regardless of which system the water board chose, it was going to require financing. The package treatment plant was estimated to cost US $5,977,000, the aerated lagoon $5,295,850, and the constructed wetland $5,136,625. A local wastewater entrepreneur, Luis Garcia, and Kittie Fox supplied the board with a list of dozens of names for potential funders. Optimistically, and perhaps a little naively, the EWB team assumed the board would be able to secure funding within one year of their draft report. The PVWB would then utilize the local labor pool to construct the centralized systems with a completion date sometime in 2008.

At the time, many people in Seine Bight used night buckets to manage their waste. In the interim EWB suggested installing public vault toilets which empty into a cesspit[29]. The pit would need to be pumped every two to three weeks. They could also deposit their night buckets into the cesspits as opposed to the ocean. Seine Bight was estimated to need four such toilets, at US $7,500 each plus shipping.

This far into the process the only institutions involved were the PVWB and EWB, although board members referenced consulting with the Seine Bight council. It was anticipated that the PVWB would manage the construction, operation, maintenance, and fee collection for the project for the whole peninsula. However, no considerations for the ongoing operation and maintenance cost were estimated neither were fee structures for residents. While the EWB report outlined possible designs and their capital costs, including catalogues for parts and equipment, post-installation finances were left unwritten.

[29] The EWB report references a composting toilet adoption plan in Seine Bight, but it apparently failed to take hold.

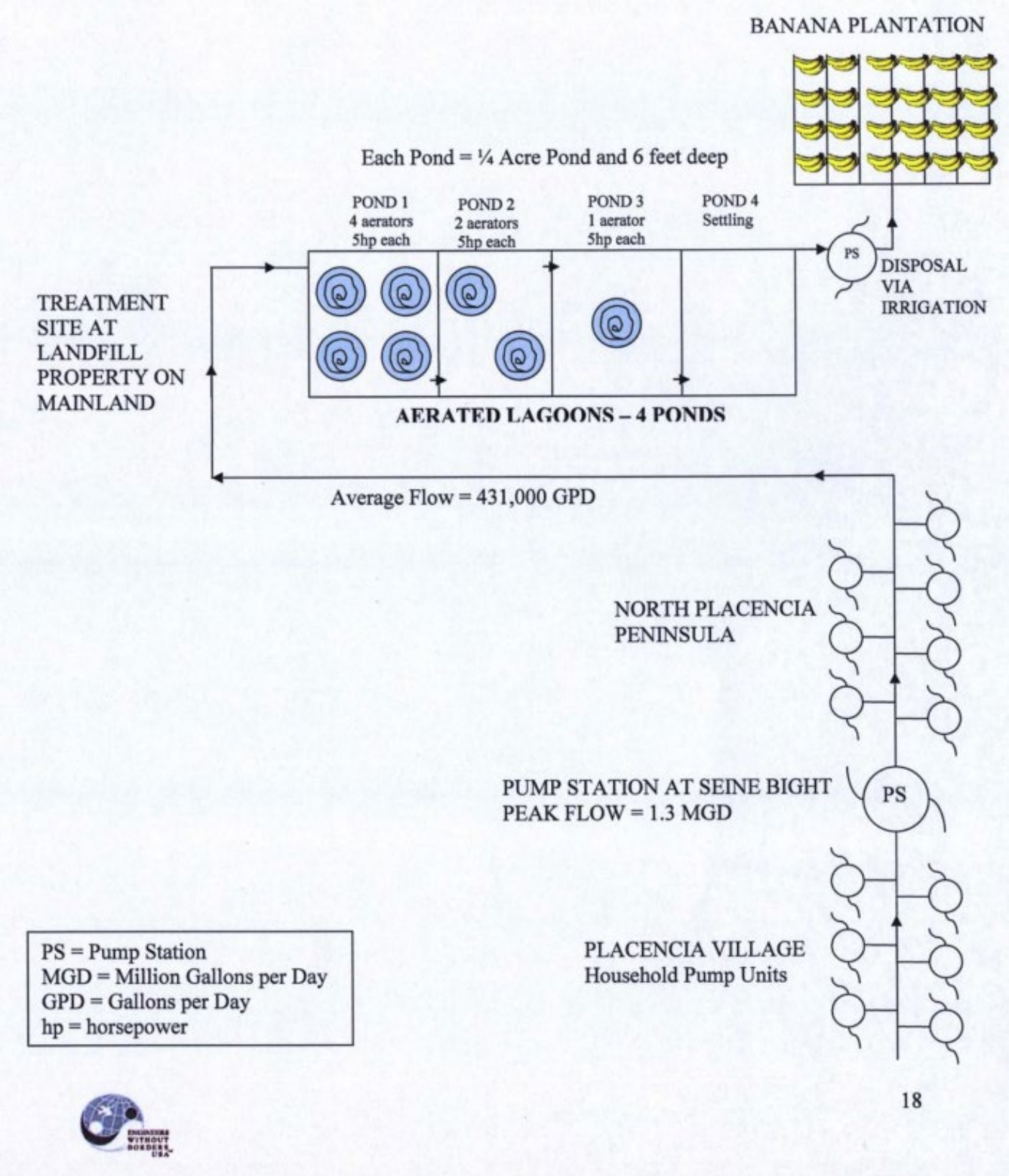


Figure 24. *Example of design for aerated lagoons. The bottom half of the schematic would be the same regardless of the treatment plan. Reprinted with permission from Placencia Village Council.*

Soon 2008 came and went. No system was built nor were any vault toilets aquired for Seine Bight. Then 2009. The rythms of everyday life carried on and funding was never secured. Kittie Fox sold her resort and passed away a few years later.

The Centralization Project Part II

In 2010, three multinational organizations collaborated on a centralized wastewater management funding program titled the *Caribbean Regional Fund for Wastewater Management* (CReW). CReW was financed by the Global Environment Facility (GEF) and jointly implemented by the Inter-American Development Bank (IADB) and the Caribbean Environment Program (CIB), a regional extension of the United Nations Environment Program (UNEP). The program was meant to help enact the *Protocol on the Control of Land Based Sources of Marine Pollution* (LBS Protocol), a binding agreement to protect the Caribbean Sea ratified by regional member states of the United Nations. There are a lot of acronyms in development processes.

CReW was motivated by the recognition that funding is a significant hurdle for the implementation, and innovation, of wastewater management throughout the Caribbean. Based in Kingston, Jamaica, CReW's aim was to devise scalable funding schemes for wastewater projects as well as provide technical, administrative, and community outreach support for nations in the Caribbean community (CARICOM). Sites would be chosen based a "demand-driven, consultative process with water utilities, environmental policy makers, and regional financial institutions" (GEF-CReW 2017:8).

That same year representatives from CReW presented at the annual meeting for the Caribbean Water and Wastewater Association (CWWA). They ended their session with a request for eligible projects from attendees. It seemed like a perfect opportunity for Placencia. The

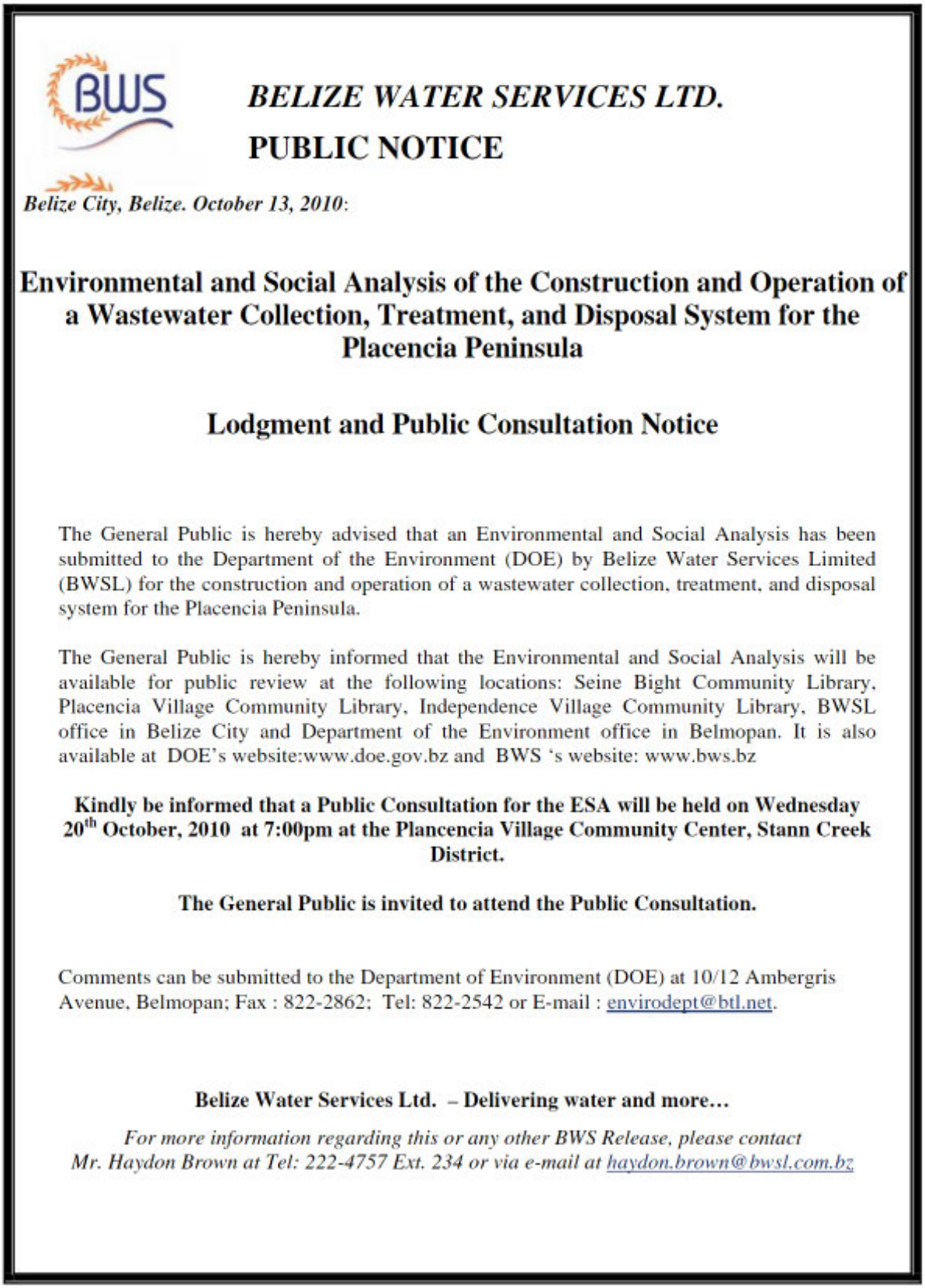
Ministry of Public Utilities had recently sent the project to BWS. As Jerome, a lead consulting engineer at BWS put it to me, "the [EWB] project just kind of fell in our lap." They had just commissioned a social and environmental analysis of the project and held their first public meeting in Placencia (Meerman and Boomsma 2010).

The Village councils and residents at the time appeared to be in broad support of pursuing the project, although there were many details that needed to be worked out. A couple years later, the GOB signed an agreement along with 13 other Caribbean states to participate in the CReW program (Table 6). Of the 13 partners, four evolved into funded projects (see table 1)[30], three of which, including Belize, utilized an experimental national pilot financial mechanism (PFM). The GOB and BWS were now officially entangled within the global assemblage of development finance, ethics, and expertise (Ong and Collier 2005)[31].

The theory behind PFMs, also referred to as a revolving loan, was straightforward, if optimistic. Each state would receive an initial grant to invest in a wastewater management project. The user revenue from that project would then be used to fund additional revenue-generating management projects. Over time, an increasingly large pool of resources would emerge from which to maintain, develop, and innovate across the country.

The scope and complicated structure of funding a construction project sheds some insight on why the PVWB were unable to secure funds for the project. Each country participating in a PFM was required to establish a Pilot Executing Agency (PEA) who would coordinate and maintain the necessary accounts and oversee the Project Management Unit (PMU). The PEA for Belize was the Ministry of Finance (MOF), with Placencia as the project site.

[30] The other 9 agreements resulted in financing for consultations, technical designs, and administrative support.
[31] This is not unique. There are over 450 domestic and multi-national banks who disburse over $2 trillion dollars in development projects annually (Lasnick 2021).



BELIZE WATER SERVICES LTD.

PUBLIC NOTICE

Belize City, Belize. October 13, 2010:

Environmental and Social Analysis of the Construction and Operation of a Wastewater Collection, Treatment, and Disposal System for the Placencia Peninsula

Lodgment and Public Consultation Notice

The General Public is hereby advised that an Environmental and Social Analysis has been submitted to the Department of the Environment (DOE) by Belize Water Services Limited (BWSL) for the construction and operation of a wastewater collection, treatment, and disposal system for the Placencia Peninsula.

The General Public is hereby informed that the Environmental and Social Analysis will be available for public review at the following locations: Seine Bight Community Library, Placencia Village Community Library, Independence Village Community Library, BWSL office in Belize City and Department of the Environment office in Belmopan. It is also available at DOE's website:www.doe.gov.bz and BWS 's website: www.bws.bz

Kindly be informed that a Public Consultation for the ESA will be held on Wednesday 20th October, 2010 at 7:00pm at the Plancencia Village Community Center, Stann Creek District.

The General Public is invited to attend the Public Consultation.

Comments can be submitted to the Department of Environment (DOE) at 10/12 Ambergris Avenue, Belmopan; Fax : 822-2862; Tel: 822-2542 or E-mail : envirodept@btl.net.

Belize Water Services Ltd. – Delivering water and more…

For more information regarding this or any other BWS Release, please contact Mr. Haydon Brown at Tel: 222-4757 Ext. 234 or via e-mail at haydon.brown@bwsl.com.bz

Figure 25. *Flier for the first public meeting about the centralized proposal (2010)*

Table 6. *The thirteen countries that participated in CReW including four project sites*

Antigua & Barbuda	*Barbados*	*Belize**	*Costa Rica*
Guatemala	*Guyana**	*Honduras*	*Jamaica**
Panama	*Saint Lucia*	*Saint Vincent & The Grenadines*	*Suriname*
*Trinidad & Tobago**			

**Sites with specific projects beyond funding and technical support*

The MOF tasked BWS with executing the project. BWS was the preferred executor by both the state and the CReW, as they had the highest operating efficiency of any other utility in the region[32]. BWS engineers agreed with many aspects of the EWB report, particularly the need for a pressurized mains and a low maintenance treatment process, such as the lagoons or wetlands (GEF-CReW 2017).

The EWB report lacked a few vital pieces of information, however. For instance, how much would the system cost to operate? Would residents be able to afford the monthly service fees? How exactly would the project be implemented and what would those costs be? To address these questions BWS acquired funds from the US Trade and Development Agency (USDA) and contracted Halcrow, a centuries old engineering firm from England. They promptly signed a Terms of Reference (TOR) involving payment and reporting schedules so BWS could oversee their progress.

Halcrow's final report was submitted to the MOF a year later in the summer of 2012 (Halcrow 2012). The evaluation was considerably more technical, and eight times longer, than the EWB draft. The report included economic and environmental modeling for numerous alternative options for wastewater load, collection systems, treatment systems, and final disposal

[32] Operating efficiency based on their low rate of non-revenue water, or water loss at the expense of the utility.

processes. Models were based on extensive growth using population (and thus MDG wastewater) estimates for 2040. The report cites that they consulted with both Placencia Village and Seine Bight's community council and water boards to get a range of usages and operating costs.

Also within the document is the murky techno-politics calculation, which in this case obscured the diverse lifestyles on the peninsula (Wells et al. 2019). For instance, when calculating appropriate service fees, the project estimated incomes at 20% above the national average, which would not be true for Seine Bight where many people live off remittance from family in the US. Similarly, the cost of supplying bathrooms for those who do not have them is handed off to BWS and outside the purview of their cost estimates.

Their final recommendations differed from the EWB report. Rather than home pumps, they suggested gravity feed pipes flowing into pressurized mains along the Placencia road. They also recommended a series of facultative lagoons with a shallow maturation pond. They noted two areas suitable for treatment ponds: 1) on the mainland across the lagoon from Seine Bight, or on the north of the peninsula near the city of Riversdale (see Figure 26).

The capital expenditure for the recommended design were also substantially more expensive than the EWB report. In part because they included detailed labor costs, as well as tariff and shipping cost for materials and technologies from the US. In total, depending on the specifics of the design, the project was estimated to cost US $ 10,950,000 which included post installation road repairs and a BWS maintenance facility. However, many features regarding supply chain sourcing and organizational dynamics could influence the end total. Annual operating costs were estimated between US $350,000 – US $500,000.

The same year they received the Halcrow report, the MOF formally created the Belize wastewater revolving fund (BWRF). The terms were as follows: The BWRF would receive a US

$5 million capitalization grant from CReW. Capitalization refers to the use of these funds to acquire and install the physical material of the project – pipes, pumps, etc. Because the cost was expected to double that amount per the Halcrow report, the BWRF would also take on a supplemental US $5 million-dollar loan, at zero interest for 12 years, provided by IDB. CReW would also supply an additional US $500,000 to fund design fees.

Figure 26. *Suggested Sites for Facultative Lagoons. Map reprinted with permission from Halcrow (2012)*

2012 and 2013 proved to be busy and contentious years for the centralized project, with more research being conducted, a series of community consultations destabilizing institutional trust, and the eventual withdrawal of CReW from the project altogether. Creating a linear timeline of events is confusing and difficult as there were different interpretations and experiences with the project. When events unfolded and the degree of community consensus on their interpretation varied depending on the narrator. Unfortunately, none of the BWS or CReW officers are currently associated with the project so there are gaps in understanding exactly why certain actions were taken.

Three Conflicts: Power, Knowledge, and Inclusion

In the first half of 2012, there were several meetings held by the GOB and BWS with both the Seine Bight and Placencia Village councils and water boards[33]. The first of which was to introduce the BWRF, the intention to design system, and the terms of funding from CReW and IADB. During the first meeting, the treasurer of the Placencia Village waterboard noted there was not 100% consensus on the project. However, following the consultation, the meeting notes were changed to insinuate there was, which she speculated was to satisfy the requirements from IADB. This was the first of three significant conflicts and breaches of trust between community leaders and the state.

[33] The town water boards were established by the GOB after the installation of the centralized water system in 1996. Their membership is locally elected.

Conflict #1 – Water and Power

In May 2013 the GOB announced they would be dissolving the Placencia Village and Seine Bight water boards[34]. The announcement was unceremonious and, for local leaders in Placencia, hostile. They called the Placencia chair of the waterboard at 2 pm and announced they would be occupying the office at 9am the following day. Less than 24 hours later they dissolved the existing executive board and conferred management on BWS. Both towns draw water from the same system, so the dissolution occurred in Seine Bight as well. The move was not a surprise however, as it had become articulated within the terms of the IADB for the past year, although BWS, IADB, and GOB representatives had cynically avoiding confirming it when asked (Leslie 2012).

The justification for "taking over" the water board, as many residents referred to it, was two-fold. Firstly, they felt the current system needed updating and improvements to keep up with tourism growth. The PVWB had purchased new and larger pipes and equipment but had yet to install them. The need for updates was not disputed amongst residents. Often when tourism season was high or during large events, like Lobsterfest, portions of the peninsula would lose water pressure. There was also a high level of non-revenue water loss, particularly in Seine Bight. To their credit, BWS improved the functioning and efficiency of the system. At the behest of the PVWB, they maintained the previous employees of the system, who noted less complaints from residents. BWS also brought their own proprietary software allowing customers to pay online and making tracking customers as they move and billing easier for staff.

However, the takeover also destabilized a source of revenue for the communities, particularly in Seine Bight where businesses were charged higher rates to subsidize residents. In

[34] The water boards were established by the GOB in the mid 90's following the centralized water system. Since they were a politically appointed organization, it was technically legal within Belizean law to dissolve the board.

fact, Seine Bight residents over the age of 60 were not billed for their water use at all. Additionally, the profits from both water boards were used to fund small developments and scholarships in their respective towns. The chairperson for the Placencia Village council was able to negotiate to receive the PVWB's savings, which was in the hundreds of thousands, for infrastructure updates along the sidewalk.

The second justification was related to the centralized sewer system. The centralized system was considered too large and complex for the local water boards to manage. It was also, per Halcrow, unlikely to be very profitable. Since it would rely on the water system, the GOB made the case that the water system should be consolidated with the sewer system to coordinate their management and finances. Particularly in relation to the structure of the CReW and IDB funding, both entities required someone to guarantee the loan, including managing accounts, which was more feasible if the water was integrated with the sewer (Leslie 2012).

For leaders in Placencia there is no doubt they were frustrated, hurt, and offended by the manner with which the GOB absorbed the water boards. Even years later, the topic provoked strong emotions for people who were village council or water board members at the time of the takeover. There was no negotiation, or consideration of alternative treatment systems or management structures. A treasurer at these meetings highlighted this dynamic:

> "They claim[ed] they have to take over the water system because a sewerage system cannot run without the main water system, which is perfectly understandable. But it was, our gripe with them is just that they had a total lack [of] trying to work with the village, and work with the system we had in place, and instead of just kind of gestapo-ing their way in." – *Rachel, previous PVWB treasurer*

The PVWB and village council went to Belmopan (Belize's capital) on three separate trips around this time to meet with GOB officials and argue for a smaller, more manageable system. One that allowed for local control of the water boards. Funding for the alternative

systems did not exist however, and the state found themselves entangled with the finance terms of the CReW project, which required enough revenue to supply a revolving fund. Residents were generally supportive of the project although a majority expressed a desire for community input (Wells et al. 2019). The everyday discussions and anxieties around these dynamics emerged in various ways, as people valued and weighed the changing circumstances. Some understood the takeover as a necessary part of the centralized system, which was entangled with the economics of the loan. As Christopher, a Placencia Village council member at the time noted, the take over of the water board was a combination of locally expressed need and the capacity to enact a peninsula wide solution:

> "Today we have septic systems, most houses still do. Probably 99% of homes have a septic system. So that's probably the only means of sewer disposal. The reason for the takeover, like I said is because some villagers saw the need for proper disposal, and I think they worked with a group called Engineers without Borders, and they suggested a particular system, and I think the government looked into funding for that. So that was kind of the reason for the take-over." – *Christopher, Placencia Village council member*

Others felt the response was overblown as there had been several meetings prior to the upset, and that, while elected, the council and water board members were more concerned with their own positions than with representing the public. For instance, Ellie, who was born on the peninsula but lived in the US for a short period noted how she had been able to observe the project from afar for years and didn't understand the shock at the government's presence within the project:

> "I honestly feel like there's people on the water board who were [going on] ego trips. They just hated to lose their position that they're making such an uproar about it. There's a lot of misinformation too, because when I was living in the States, I used to have Placencia on my Google Alert, so I was very interested in what was going on here. And then from 2010 there were reports going out about the government looking at possibly building a sewage system here. There were notices to have for public meeting about a feasibility study and building a sewage system here. And I think there were lots of meetings that people just didn't care

> about, didn't attend, and when it started getting closer and closer to where the government got the funding [and] everything, all of a sudden everybody seemed to care. So, people kind of like give an impression that it's something forced down our throats and it just came upon us. No. This thing's been going around since 2010. There were consultations. They were trying, and people weren't getting involved and they should have. If I was in the government, I would've done what they did too. It's just kind of like a [jam]. You're running on a deadline. If you didn't tell IDB, or whoever ... give 'em an answer you wouldn't have gotten the money to do it. 25 million dollars … just gonna let that pass because some people were mad that they didn't go to all the consultations that were being held in 2010?" *Ellie, Placencia Village resident*

Additionally, leaders in Seine Bight expressed a tacit acceptance to the project and the takeover. Like in Placencia Village, the years of public consultations had not been well attended. Alicia, a Seine Bight Village council member, describes the challenges to managing information when community members do not attend public meetings about the project and yet express their disagreements once the project has begun in earnest:

> "The thing I didn't really like with my people was because we would announce the meeting consultations, everybody is invited, and only a handful of people would go. Then when they get the feedback, they're like "oh no, it's not going to happen and dat dat dat" and when they really found out that it's really going to happen, we were bombarded, "You guys didn't tell us". "No, we invited you to come to the meeting and you didn't care", but actually when they find what's going to happen, what's going to pass, then they are really happy about it." – *Alicia, Seine Bight village council member*

*For a more detailed discussion of the dynamics of the water board takeover see Wells et al. (2019).

Conflict #2 – Baseline Studies

In the process of pushing back on the takeover and the system, the PVWB and village councils identified a few issues noted in the Halcrow report. The project was based on unexamined assumptions about environmental conditions. When pressed about the *evidence* for

the need of the project, Halcrow put the state in a disadvantageous place. Although the lengthy document was meant to be a feasibility study it did not conduct the kinds of studies necessary to determine design feasibility. Rachel, the Placencia Village water board treasurer at the time of the takeover, describes the confusing nature of using studies to support the project, when studies often refer to the need for more study:

> "We asked them all the right questions. We asked them if they could prove to us that there was any contamination out of the sea. And the answer that we got from them were that those were studies yet to be done. But yet those are the same studies that they claim they were using as their basis for why they needed to implement the system. So, whenever we put them with their backs against the wall, they couldn't answer the questions properly." – *Rachel, previous PVWB treasurer*

The assumption on the part of BWS was that due to the EWB report the community was committed to the project (which appeared to be the case prior to the takeover). They had conducted initial social and environmental analysis, although the specific impacts of the project were not well defined as the project had not yet been designed. As the lead consulting engineering at BWS describes, they relied on experts to inform them which studies were necessary, which necessarily required that they conduct an initial study:

> "One of the things about the feasibility study is that it did recommend that a further study be done which was the nutrient fate study. Right, so it was like a catch 22 or chicken and egg situation. And I don't know if they had decided on location before the fate study. Or I don't know if he thought it was to confirm that the treatment plan location was adequate." - *Jerome, consulting engineer, BWS*

Consequently, when the community pushed back, the utility did not have an adequate response. The lack of studies supporting the ecological dynamics of the project infused the third conflict.

Conflict #3 – Siting the Treatment Lagoon

In 2013, BWS hired another international engineering firm, AECOM – based in Los Angeles - to conduct a detailed design of the system based on the Halcrow report (AECOM 2013). While the IDB had committed financing for the study it was not enough to conduct a full detailed design. BWS acquired additional funds from the German international development organization Gesellschaft fur Internationale Zusammenarbeit (GIZ).

AECOM's TORs were to conduct 1) house-to-house surveys about the types of treatment systems in place, 2) conduct community surveys (which they placed at the water offices for residents when they paid their bills), 3) perform outreach for the project (placed fliers in water bills, and deployed small outreach teams), as well as 4) assess how the project would be implemented (e.g., where would mains run? Where would pump stations be located? etc.). During this period, nearly all residents interviewed had some contact with their outreach or fliers or otherwise knew about the project. Jerry, a Placencia Village resident who works in tourism, described meeting representatives and seeing them consult with other in multiple locations:

> "They sent representatives who know about the topic and what's going to happen. And they explain it to pretty much everybody. They went to every business or local homes and stuff like that, and basically educated people on what's going to happen, which only makes sense, rather than just imposing a new thing on someone or on a village." - *Jerry, Placencia Village resident*

They also began conducting public consultations in the summer of 2013. It was at this point that heads of the shrimp aquaculture operations were informed about the project, and more importantly, the potential site of treatment lagoons. The sites were based on the same location from the Halcrow presentations, although this had been missed by reps from the farms.

The aquaculture ponds, which have inputs on the north of the lagoon, were established on the mainland across from the peninsula in the early 2000s (Boyd and Clay 2002). The shrimp

farms have a mixed relationship with the peninsula. They are the largest employer of women in the nation and a valuable economic contributor. They have also been a major polluter of the lagoon (Boles et al. 2011; SEA 2014b).

The northern, and most likely, potential site for treatment lagoons and disposal would be directly adjacent to their intake. They were concerned about failures in the system contaminating their ponds. For instance, if shrimp test too high for coliform bacteria their shipments are banned from exporting. Barbara Ellen, a leader in the local aquaculture industry noted how the treatment plant put their operations at risk for losing their eco-certification label, an important aspect of their brand. Elevated nutrients (phosphorous and nitrogen) could also lead to algae blooms and kill their entire yield, something that has happened even in current conditions. They were also concerned about the system's reliability given the failures to contain other BWS managed treatment ponds. In a clear indication of the relationship between trust and information, she expressed that the government, BWS, and the experts had intentionally not consulted with the shrimp farm operations because she believed they knew the industry would oppose the project:

> "They [BWS] never interacted with us. I am on an environmental committee here in Placencia—called Friends of the Placencia Lagoon—and I heard about it through them…that this was under study, and they were considering the engineering aspects of it. They explained to the shrimp farmers what was going on and we learned that one of the sites they considered for the wastewater treatment is exactly/directly in front of our intakes for four of our farms. I understand that these [treatment lagoons] are anaerobic settling ponds and there's similar systems in Belize City and San Pedro and they do not work properly, and raw sewage is going back into the natural environment. This is our biggest concern that there is no monitoring, no surveillance, no shut-down when things are bad…and our consultant has all those records. We believe we weren't contacted because they knew that we would oppose them. – *Barbara Ellen, Shrimp Farm owner*

In response, they hired a consultant of their own to explain the potential problems the lagoons and disposal could cause. They also appealed to the amount of foreign exchange dollars

they brought in as well as being an important business and employer in the area. They sent the report to BWS and the GOB. The shrimp farms concerns brought the detailed design study to an end. BWS regrouped to consider how to resolve the issue with the shrimp farms. Jerome noted, the complicated dynamics of the system was a learning process for BWS as well and they wanted to respond adequately to the shrimp operation concerns, to build trust and a sense of competency over the project:

> "When the detailed design came to an end, we ourselves were unsure how to counter the shrimp people's complaints. We weren't clear about the ramifications. So, we decided the best way to go would be to step back, do the nutrient fate and have some definitive scientific foundation to move on with now that way, if shrimp people came to us, we could say, yeah, this is the story. This is the backing for the decision. It's not as if we're pulling it out of our hats." - *Jerome, consulting engineer, BWS*

In their abbreviated final report, AECOM also identified several shortcomings and miscalculations in the Halcrow report. The numbers were often inconsistently applied to the various models, relied on faulty assumptions which were either unfounded or based on inappropriate numbers, and the use of regulation limits did not match with the DOE in Belize. Ultimately, their recommendation was to acquire more detailed descriptions before the system could be designed.

For instance, Halcrow recommended each house utilize a gravity fed pipe leading to a pressurized mainline. The system would include a "daisy-chain", or clusters of houses and pump stations, to run sewage up the peninsula. Based on AECOM's initial survey it was not certain whether the topography of the peninsula would uniformly allow that. Similarly, there was no nutrient benchmarking or environmental impact statements to validate their projected models. They noted further consultation with BWS on population and wastewater projections would be

necessary as well as geotechnical and fate and transport studies to ensure the feasibility of Halcrow's recommended design (AECOM 2013).

By the end of 2013, the CReW project felt the problems in Placencia could stall the BWRF. Early in 2014, they shifted the funds away from Placencia to a series of projects throughout the country. They had recently learned from a CReW project in Guyana that putting all their eggs in one basket could lead to diminished, if not entirely absent, results. Instead of building a project from scratch, MOF identified alternative projects in advanced stages of readiness. This included using the $5 million dollar capitalization grant to expand the Belmopan collection system which has not been updated for 45 years. They also increased Belmopan's treatment capacity by adding additional ponds. The IADB portion of the loan was cancelled.

The Centralization Project Part III

Ten years into its initial conception, the project found itself, once again, without a secure funding source and in need of more research. The next move was to acquire funds for a nutrient fate and transport study (NFT). BWS wrote up a solicitation and identified various funding programs within USDA, IDB, GIZ, and the Caribbean Development Bank (CDB). The Ministry of Economic Development created a package for each solicitation and if successful, would become the borrower and guarantee the loan. A couple of years went by.

CDB was the only agency to respond with a grant/loan offer. In the past, the GOB has worked extensively with CDB's basic needs trust program to fund water and human waste management projects. The bank offered $400,000 as a grant and $600,000 as a low interest loan (2%). They also established the procurement guidelines to tender a request for proposals (RFP).

Subsequently, in 2018, BWS hired and developed a TOR with the Canadian Engineering firm CBCL Limited. Unusually, CDB was the payee to CBCL not the GOB.

The Nutrient Fate and Transport Study

The purpose of the study was to better understand where to place the treatment plant – which is still likely to be a series of lagoons – and determine where the outflow should go. An NFT study tracks the sources of two key nutrients (nitrogen and phosphorous) and how they travel through the watershed. Assessing these dynamics required an extensive number of surveys of the larger watershed. The team needed to estimate the non-point sources of nutrients from three primary contributors: human waste, aquaculture, and agriculture. They also needed to project how anticipated changes in the three primary contributors might change in the future as well as how climate change might influence these dynamics. In the end, they should be able to contextualize what, if any, the benefits of the centralized system would provide and how it should be organized on the peninsula. As Zach, the project manager from CBCL, noted, the RFP directed them to construct a scientific justification for where the treatment plant should be located. The specifics, however, were left up to them:

> "[The RFP] was very focused on where does the [treatment] plant go? Where does the outflow go? And we want all your recommendations to be backed by science and to be backed by a defendable approach and modelling of some sort and data collection. That's how the RFP was written. But it wasn't very specific on you what that means in terms of, well, where do you measure? And how much do you measure? We feel like we filled in all those gaps ourselves and developed an approach to answer their main questions." – *Zach, CBCL project manager for NFT study*

CBCL subcontracted Dr. Lapointe and a Canadian environmental management firm called Zuzek, Inc to assist them. Zach had collaborated with Dr. Lapointe, an expert on wastewater and coral reefs, on a previous project in Barbados. As he put it, "We spent a lot of

time working together. And then this thing came up and I was like, perfect. Let's do it again. So, we kind of applied the same method and the same scope as we had previously." Zuzek was hired to assist in visualizing some of their complex models and their many analyzed datasets.

The specifics of the study took shape slowly over time. Initially, the TOR called for bi-monthly water quality tests over a 12-month period. To keep the study in line with the budget, BWS hired four people to collect and process ground and marine water samples locally, sending only the data to CBCL. It is unclear when exactly BWS acquired the Placencia wet lab, but it was funded in part by leftover GIZ funds from AECOM's stalled detailed design phase.

Early on, CBCL found that some of the data didn't make sense, however. On a site visit they noticed the lab was not well set up to process some of the types of data they needed. Therefore, only certain tests were run with BWS staff in Placencia. Processing others posed a problem. Because the concentrations of nutrients in large water bodies are so low, the instruments and tests must be both powerful and calibrated very carefully. Neither of which were possible in the Placencia lab. Rather than spend more money on bi-weekly testing with results they felt were unreliable, CBCL pivoted to two rounds of sampling in the dry season and two in the wet season. In total they collected 67 surface water quality samples.

Not only was Placencia's lab not up to the task, but there were no suitable labs anywhere in Belize or its neighboring countries. Nutrients in water samples degrade over time and must be frozen immediately after they are collected. CBCL researchers had to personally fly to Baltimore with samples on dry ice in big suitcases and then drive them down to the University of Maryland in Chesapeake Bay to be processed.

Surface water samples help understand ambient, or free flowing, nutrients in the water. To understand their ecological dynamics however, they needed to understand how local

vegetation takes up nutrients, referred to as *sinks*. To estimate nutrient uptake and retention they gathered samples of algae, seagrass, and mangrove roots. The samples were partially processed in the Placencia lab including sorting, drying, and grinding. The samples were then sent to the University of Georgia.

In addition to studying the distribution of nutrients and how they flow through food webs, CBCL needed to estimate how they move through the watershed. Which required more data. For months over the course of the year – two in the wet season and two in the dry – they used four tactics to fill in the gaps. They deployed micro bathymetry systems on boats and measured up and down the coast and lagoon. They also deployed an Acoustic Doppler Current Profiler (ADCP) off the southern tip of the peninsula which uses sound waves to measure water currents. The data from these devices allowed them to better model water depths, ocean current, wave heights and directions, and changing water levels.

To estimate water flow upland, they also installed gauges at the mouth of rivers entering the watershed. Additionally, they took groundwater samples to both estimate water quality and map the geology of the watershed. Water, and therefore nutrients, were expected to transport differently depending on the type of earth it is passing through (e.g., sand vs clay, granite vs layered rocks, sandstone vs limestone). Despite the comprehensive samples however, four months is a short time frame for such complex interactions. The tide, rainfall, and human behavior can all influence these delicate relations making predictions notoriously difficult.

They combined this data with estimates of nutrient contributions from human waste, aquaculture, and agricultural activity in the surrounding area. Human waste estimates were based on population and water use dynamics on the peninsula, aquaculture estimates were based on

data provided by the shrimp farm association, and agriculture estimates were based on land size and estimated fertilizer use.

Building a prediction model includes two broad steps. Their models were trained to accurately predict the existing data they had gathered. The algorithm which accurately predicted current conditions is then used to predict dynamics based on population, water levels, and production projections for 2060 (including tourism growth). Treatment plant locations were then evaluated based on scenarios for various nutrients. The longer the range the timeline the more uncertain the predictions however, making the modeling more a practice in scientism than prophecy (Holland 1992).

Figure 27. *The wet lab to study water quality in Placencia Village. Photo by EC Wells*

Their study painted a predictably complex picture but there were a few straightforward takeaways. Their results showed an imbalance of nutrients on both sides of the peninsula, suggesting eutrophication is occurring and the systems are in a critical state based on US recommended limits. However, human waste is, and will continue to be, only a minor contributor of nitrogen relative to aquaculture and agriculture. A complete resolution will require even more institutional collaboration. Reflecting on CBCL's final report, Jerome remarked that moving forward, "it has to be comprehensive, it has to be a multi-sector approach to really bring back the waters."

While the nutrient story was more complicated than the centralized system could address, CBCL's study identified two more areas of concern not originally in their TOR: human waste pathogens and climate resilience.

> "The actual important pieces [to the centralized system] became two things, human health and climate resilience. The fact that this plant would be built at sea level, in an area of the world where they are going to experience aggressive sea level rise, and potentially more tropical storms, [makes it] very vulnerable. Then the fact that the peninsula is flat, to collect the weight of all this waste, to take it to the plants and the pump stations [is] again vulnerable to sea level rise and storm surge So just all that kind of thing. And that really hadn't been thought about at all. [At least in] a lot of the documentation that we saw. If they put in that wastewater treatment system, [and] don't change any of the other industries like agriculture and aquaculture, it's going to have a very small effects on the health of Lagoon, honestly, the only thing that's going to do is remove bacteria, which is huge for the people living there and for potentially safety of tourists and visitors."
> - *Zach, CBCL project manager*

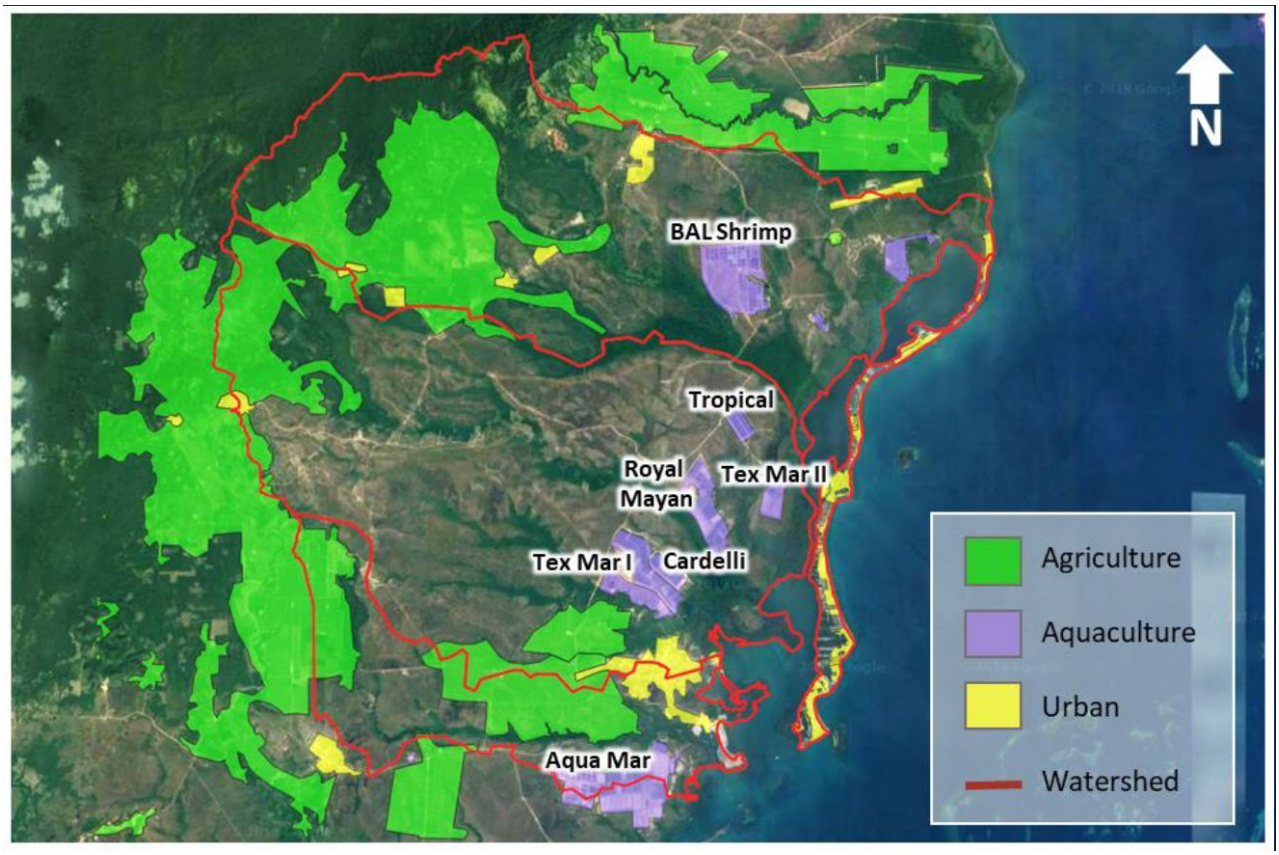


Figure 28. *Map of different nutrient contribution sources in the watershed. Reprinted with permission from CBCL Limited*

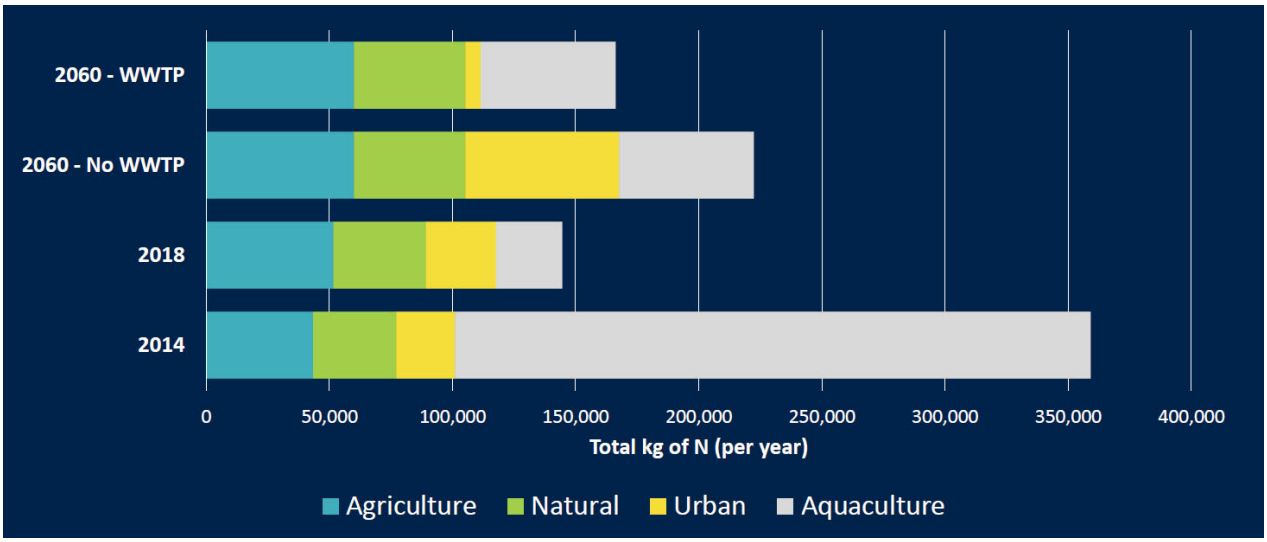


Figure 29. *Future estimates of nitrogen inputs. Values based on model predictions with and without the centralized system. Reprinted with permission from CBCL Limited.*

Considering the effects of climate change (e.g., sea level rise and storm intensity), resulted in a few adjustments to the design recommendation. Some of the negative effects were unavoidable. For instance, there was no version of an affordable and suitable collection system which was not vulnerable, in some way, to flooding. However, considering the likelihood of these changes led to the team adjusting their recommendation for a treatment site. While they endorsed keeping it on the north of the peninsula, it should be moved further inland and direct its outflow to the sea. Siting the treatment plant further inland would provide more security from both climate change and storms surges. The site would also increase the ballooning cost of the project since production infrastructure would have to be built to pump waste upland. Zach expressed how resolving entanglements, particularly construction entanglements, was a driver in the projects ballooning costs:

> "Yeah, I mean, that that really played the role, though. And siting the planet, further inland north of the lagoon played a big role for sure. We put it on higher and higher ground, but then yeah, of course, your production infrastructure will have to be raised and will have to be costly, it's going to cost a lot of money to build that kind of facility." - *Zach, CBCL project manager*

The final recommendation on the treatment plant emerged through a series of community consultations.

Community Presentations and the Discontinuity of Knowledge

The TOR for the project was unusually narrow compared to what CBCL was used to. Because of the previous and ongoing conflicts on the peninsula, they were directed to limit their interactions with communities, including consultations and public presentations. The emphasis was on collecting information about the nutrients exclusively and reporting them in a scientific manner.

BWS was reluctant and unsure of how to proceed with community aspects of consultation. At the urging of CBCL they gave a series of presentations at the midpoint of the study. They had five consultations, two public and three with industry stakeholders. From these a conclusion about the location of the treatment site was drawn. The notion of having a treatment plant near a residential area was uniformly undesirable, meaning the treatment plant to the north was the only socially viable solution.

Presenting their results had similar community dynamics as earlier consultations. They had a difficult time getting general residents to attend meetings. However, stakeholder meetings were much more productive in terms of getting feedback. Jerome noted how difficult it was to engage the "general public" compared to engaging and receiving feedback from groups with members who shared a specific organizational purpose.

> "So, we had several consultations during the study. Public consultations were not well attended. We did a few other [stakeholder] consultations that were well attended. We had village council. We had environmental and other non-governmental organizations from here that we invited to meetings. Those were well attended. We had consultation with just shrimp industry people those were well attended. So, in terms of the village council and the local NGOs in the area we think we may have some input from them in terms of just an ordinary john doe on the street come into the public consultation meeting. Those consultations were not well attended." – *Jerome, consulting engineer at BWS*

Feedback, and formal communication generally, appeared as a throughline for many parts of the project. For instance, while CBCL was in constant communication with BWS (e.g., emails, weekly calls, monthly reports, etc.) they received very little feedback. However, Zach noted in-person communication was much more fruitful:

> "The biggest thing that I felt was lacking was just there wasn't enough feedback and critical assessment of our deliverables. But you know, a lot of Feedback came in those one-on-one conversations when you were in country, you're in the car and [they] dropped something on you, that's kind of when all the good stuff happened. But aside from that, I mean, you get a lot of value out of those in person trips." – *Zach, CBCL project manager*

The preference for informality extended to a kind of institutional not-knowing when it came to the numerous studies conducted by BWS. For instance, when I asked Zach what he wished he'd known at the beginning of the project, his response was telling. He noted how difficult accessing institutional knowledge was outside of personal interactions:

> "I think the biggest challenge on this project, I want to say, [was] data and information. Because with any project we do, it's always 'there's never enough data', and there's always 'not enough information'. It would have been good to understand their whole project. They've been monitoring the lagoon for a long time. Having a better idea of how that plan was developed, how their monitoring plan was developed to why they were monitoring water quality in the lagoon, where that information was going, you know? They had binders and binders of data that no one had ever used or analyzed or imported from anything. People just went out in the field, read off the instrument, put it in a book, and put the book in a binder on a shelf, and no one looked at it." – *Zach, CBCL project manager*

At the end of the two years, Zach and two other colleagues did another series of public and stakeholder presentations. While many of the stakeholder meetings were well received, the relational dependency of information reared its head again during a discussion with the newly elected chairperson for the Seine Bight village council:

> "[things] got really tense, they were really upset. I think there was a newly elected guy in there who came in a couple months before. He was really, really worked up because he said, 'You know, this is a huge project and decision that really impacts us. And this is the first presentation I've ever been to for this project. And I would have appreciated a lot more engagement and involvement. And I can't believe we're here to see the final thing. Where were you months ago, etc.' It ended up being a good conversation, because we were in the same room together for like three or four hours, but it started off like that." - *Zach, CBCL project manager*

Zach rather generously conceded the degree to which BWS is underfunded and how that might influence their ability to keep in contact. Although a simpler explanation, that information travels through ongoing relationships built on trust, seems more likely. For instance, in CBCL's final presentation to the GOB, the DOE and Ministry of Agriculture didn't show up, knowing

they might get put in the hot seat as their study revealed agriculture to be the primary producer of nutrients into the peninsula's surrounding water bodies.

Still Waiting

The centralization project is now in a new phase. The CDB officer involved with the case suggested the cost is now going to be somewhere around US $40 million. It has come a long way since the EWB design. Reaching the new sum will require new institutional arrangements. He suggested it would likely involve three parties, the CDB, the GOB, and a third -either a development agency or private entity.

They are creatively thinking of solutions. The town of independence, on the mainland across from the peninsula, is in a similar situation as the Placencia Peninsula. Perhaps enlarging the project to include Independence could produce more revenue and therefore help subsidize the growing costs.

BWS is pursuing other projects along the coast which have lower funding barriers. From Jerome's point of view there are limited dollars and competing sectors and locations. They are taking the lessons they learned from Placencia as they approach new arrangements. He insists they haven't given up on the Placencia project; it is only hibernating until the funds can be found. The stress of community relations and ballooning cost left Zach more disheartened:

> "I could feel momentum for Placencia slow down. I mean, I've worked on this project for almost two years. And over the course of two years, you could feel it. You feel the wind going out of the sails. We spent a lot of time with the CEO [of BWS] the last visit. And it was clear that politically and publicly and in front of crowds they are still like, we're here for you guys. We have the study. But if we don't find money, you know, this is not going to be a priority for us." - *Zach, CBCL project manager*

While it's easy to turn a cynical eye at the confounding events that have unfolded over the past 17 years, they reveal a certain set of patterns. The project has drawn in different sets of actors with different relations to the project. Each party has attempted to address the problem of action, of producing actionable knowledge (Knox 2016). The challenge has been the very incoherent entanglements, and loss of institutional knowledge, that emerges from these complicated affairs. These circumstances are not unique, frequently economic and infrastructural entanglements result in a "no win" scenarios for both the state and residents (Jepson 2014).

The consequence for residents, however, has been a never-ending chain of entangled and interdependent studies draining the enthusiasm from the project. A resident who had witnessed many projects like this, and been engaged with the project for over a decade noted:

> "Usually when they get the money, they have a general idea what they are going to be doing with it. I mean I have seen like three proposals and supposedly all approved and this and that and the other. And then suddenly, it's changed. I am not following it anymore. (laughter) I quit." *Pam, Placencia Village resident*

As the state continues to struggle for legitimacy it will increasingly be met by an understandable amount of cynicism and disinterest from residents who have gone through an emotional journey. Many of whom have been left feeling frustrated and hopeless. Ann, a Placencia resident who was involved in the development of the project at various points expressed her pessimism about the project and its many studies turning into just more report on a shelf:

> "If you're here for very long and you go to any meetings – every single public consultation - someone at the beginning in the audience will say, "well what's gonna' happen to this report? What's gonna' happen to this policy? What's gonna' happen to these guidelines? Because every other one that we've ever been involved in just gets stuck on somebody's shelf or in a drawer, and nobody ever hears from them again." – *Ann, Placencia Village resident*

State (in)action

Clifford Geertz, reflecting on the anthropology of state planning, commented that despite romantic visions of unity and harmony, "heterogeneity is the norm, and conflict the ordering force" (Geertz 2004:584). I would add that heterogeneity and conflict are always re-ordering as well. For each contentious public problem there arrives a resolution – which is a distinct alien from the finality of a solution – that is hard won and tacitly collaborative. The release of tension is only temporary however, as a new problem emerges over another set of heterogeneous arrangements bumping into each other.

The way events unfolded affirmed Dewey's, and other anthropologists, conception of state processes as ideationally and materially unsettled (e.g., Bonilla 2017). From the very beginning resolving human waste problems were enmeshed with globalized relations (Ong and Collier 2005). The centralized proposal also mirrored Dewey's state formulation – waste problems drew a public in Placencia Village who then sought institutions to resolve those issues through logistical problem solving.

As different actors became involved, they relied on institutional practices to conduct transactions of enacted expertise with the public (Carr 2010). They produced maps as "boundary objects" for public deliberations and reports as evidence (Calkins and Rottenburg 2016; Star and Griesemer 1989). These little tools of democracy (Asdal 2008), extended Dewey's conception of embodied problems to include vibrant non-humans whose agency challenged the certainty of system designs (Bennett 2010). Throughout the process the non-humans of waste management in Placencia – the soil, slope, water table, and local ecosystems – were "conjoined" within conceptualizations and articulations of the most appropriate management strategy.

They also had to continually become re-situated within the evolving needs of the project (Dickson 2013), resulting in unintended consequences. For instance, as BWS became entangled with the IADB loan, they were prompted to dissolve the water boards and provide the project with financial and logistical security. The pushback and protests from that action then contributed to the IADB pulling out of the project. Finally, as more problems followed in the pursuit of a design solution, actors engaged in "response-ability" often appeared, rather than self-interested technocrats, as people struggling to resolve tensions and "flee anxiety" (Geertz, 1973: 254).

The haphazard nature of call and response between the communities on the peninsula, the intervening institutions, and the complicated dynamism of its non-human relations helps frame how information loss occurred so frequently. The production of knowledge was always responsive to specific problems, which once considered either acceptable or inadequate, were discarded as new challenges emerged. Even now, plans are being drawn and relationships secured to consider another set of studies to hopefully bridge the state-gap between the current situation and promise of a better tomorrow.

Chapter Seven: Commoning and Composing

Studying the social and material entanglements of human waste management on the Placencia Peninsula is a little like standing in the eye of a storm. Just outside their everyday dynamics are transformative winds powered by environmental change, political figurations, booming tourism, and economic development. Residents and the state have speculated and reimagined the future of management as they conceptualize and respond to these tempests.

The relationship between existing entanglements and their "selective pressures" of change (Smith, Stirling, and Berkhout 2005) represents a confluence of potential and contingent futures, some of which are interpreted as opportunities, while others are viewed as risks. Juggling the prevention of an undesirable future and the encouragement of an ideal one, can produce competing agendas for management (e.g., Hetherington 2014; Cairns 2018). It is within this liminal space, where possibilities are weighed based on what is and what could be, that *matters of care* emerge (de la Bellacasa 2017).

Matters of care are the ethical configurations expressed through the evaluation of potential futures. They are comprised of the interlinking processes of both *commoning* and *composing*. Commoning is the act of conceptualizing which aspects of a possible entanglement are meaningful and worthy of inclusion, whereas composing is the desirable arrangement of such an entanglement (de la Bellacasa 2017).

How matters of care are articulated and imagined depends on the practices people find themselves entangled in and the kinds of ethics they provoke (Papadopoulos 2018). On the peninsula, the future of waste management was assessed through questions of desire and need,

control and growth. In virtually every discussion with a resident or a state representative, human waste management has become inextricably linked to tourism. Interpretations of these links varied, however. This chapter explores human waste management's entangled matters of care and how conceptions of tourism and the environment, the preferred size and scope of tourism growth, local vs governmental control, and of the expressions of people working within the institutions are shaped by their social positions and roles in relation to management.

Human Waste Management, Tourism, and Ecological Health

At a public meeting held at the Placencia Village Community Center, each speaker took turns presenting a tourism-related issue. Some were emphasizing gender dynamics, others agriculture and aquaculture. There was a lively retelling of the Hero Twins story, a Mayan creation myth of the sacred ball game commonly told to tourists visiting temples. I was speaking about the complications of managing human waste on the many small islands peppering the Belizean coast. The purpose of the meeting was to explore a few of the challenges and opportunities brought on by rapid tourism growth.

From the back of the room Lisa Carne spoke up. She is the founder and director of *Fragments of Hope Ltd.*, a local coral restoration community-based organization (CBO). Lisa shared a cautionary tale about the common assumption that coral reefs hold an intrinsic value to tourism (c.f., Lemay, Rogers, and Martin 2014). She recounted a recent research trip to Mexico, noting how mass tourism has coincided with a steep decline in coral cover along the coasts of their most popular tourist destinations. Despite the decline however, more tourists continue to come. Her point was simple: Not all tourists necessarily care about corals. Many arrive to spend time in sunny weather, with beautiful beaches, lively music, and good drinks. She ended her

story by imploring, “We have examples all around us of what not to do, I just want to bring that to everyone’s attention and say, let’s collectively make sure that we don’t make the same mistakes that are happening right next door.”

Her concern is observable throughout the Caribbean. There has been a measured decline in coral cover throughout the region over the past few decades, yet Caribbean tourist arrivals nearly doubled from 16 million in 1995 to 30 million in 2018. Tourism in Belize skyrocketed during this period from 130,000 visitors in 1995 to almost 1.5 million in 2018 (Caribbean Tourism Organization 2019). The causes of this decline are complex and multiple, but at a minimum, they certainly haven’t *discouraged* tourism.

Figure 30. *Endangered Staghorn Coral colonies on the Belize Barrier Reef. Photo by Maya Trotz*

One of the potential means by which economic growth can impair coral reefs is human waste management. For instance, as perhaps as a future glimpse of the peninsula, the mismatch between tourism growth and wastewater treatment has been a disaster for reefs around some of Belize's largest cayes. San Pedro and Caye Caulker are now established tourist towns with centralized wastewater treatment facilities, although they only service a minority of the people living on and visiting them. On Caye Caulker partially treated sewage discharged into the sea has led to a steady growth in macroalgae and decline in coral cover (Emrich, Martinez-Colon, and Alegria 2017).

In 2018, the multilateral Healthy Reef Initiative issued their Mesoamerican Reef Report card. They identified several sites along the Belizean coast, including San Pedro, where coral cover and fish biomass are critically low. Wastewater treatment was among their primary concerns (McField et al. 2018).

For this reason, motivations for improving human waste management were often framed as the avoidance of a negative ecological future. Ewan, a Placencia Village resident who owned a small tour guide operation, noted how the health of the local ecosystem had declined, attributing it to poorly managed human waste:

> "It's going to allow for a healthier ecosystem. You don't hear that around here too often. It will make for a healthier ecosystem because right now with all the septic, and you have that … sandy soil and septic, you have a lot of leaching of nitrogen into the surrounding area, and so once those washes all into the sea…if you have too many nutrients in the sea, what happens is you have these algal growth, algal blooms that covers the coral. And that's what you're seeing. Years ago, if you were to snorkel around False Caye, which is straight out from Maya Beach area, you used to have beautiful coral formations around there – now if you snorkel around that area, no corals." – *Ewan, Placencia Village resident*

Reef as a Matter of Care

On the landing page for the Fragments of Hope Ltd. website is the statement: more corals = more fish (FOH 2022). Their mantra is more than a simple calculation. It is an appeal to a lively world of biodiversity alongside human activities. The Belize Barrier Reef is home to 65 of the 70 coral species found in the Caribbean as well as sea turtles, hammerhead sharks, upsidedown jellyfish, spotted eagle rays, octopus, conch, lobster, and more than 500 species of fishes. It also is, and has always been, the backbone of coastal livelihoods in Belize

On the peninsula, fishing has been the dominant economic activity at least since Mayan peoples processed shellfish in pots here nearly 2,000 years ago (MacKinnon 1989). At its southernmost tip you will find the Placencia Village fish board. True to its name, it is a flat wooden table next to a water faucet where fishers clean their catches (Figure 31). Placencia Village fishers have been using the more than 400 small Cayes for overnight and multi day trips for more than a century. Similarly, fishing from canoes in the lagoon and nearshore have been a source of subsistence and money since Garifuna peoples settled Seine Bight.

The scope of activity has extended over the past half century as tourism has come to dominate most aspects of economic life in Belize. Islands have become much less accessible for anglers as they become privatized and converted into vacation homes or resorts. Many fishers have adapted by providing sportfishing tours in addition to selling to markets (King 1997; Key 2002; Huitric 2005).

The barrier reef running alongside the coast of Belize supplies other benefits in addition to supporting fishers' livelihoods and tourism products. Coral reefs protect the coast by dramatically slowing down storm surges with their complex architecture of jagged, porous, and diverse benthic structures. Protection from storm surges has become so entangled with the

economics of tourism that just to the north, in Mexico, insurance companies have begun to cover the costs of coral restoration (TNC 2018). Tourism is now Belize's number one foreign exchange earner and supports at least a quarter of all jobs in the country, most concentrated along the coast (BTB 2020). As a matter of care preserving the Mesoamerican reef and the marine life it supports is a crucial part of what life in Belize means, of which wastewater is a recognized threat (Niña and de Molina 2011; Lemay, Rogers, and Martin 2014; Grau et al. 2014).

In contrast to avoiding a disastrous future, prioritizing ecological diversity reflected an idealized entanglement of biodiversity and small-scale tourism. A senior resident of Placencia Village, Hector expressed the need to not only prevent harm to the reefs but emphasized how the local ecology opened up possibilities for ways of being and livelihoods such as fishing more in tune with his perception of Creole heritage:

> "It's what people traditionally use as … their heritage. People who fish[ed] back in the days in a canoe with paddles and a pull, and they utilize[d] the lagoon for these economic benefits for bringing fish and food home. A lot of people still appreciate that mode of living and lifestyle. But now that's changed, people have strayed away those traditional mode of living. I think it still can be captured; you know putting it into heritage tourism. You know a package that [for] people from other parts of the world [so they] can come around and enjoy, but still be able to enjoy what we use to do 10, 20, 50 years ago. Appreciate [the] community a little more. Rather than "oh, I'm going to come to The Placencia, Roberts Grove, and get my food on the platter and it'll cost me $50, $60," I can jump [in] a canoe with somebody with all the experience in the world and paddle in the lagoon or go out … probably five miles out, catch my fish, come back in, clean it, and enjoy. Have somebody show me how to clean fish. A lot of people have no clue [about] the process of being able to fillet a fish, of cleaning and gutting it, and cooking it in a traditional way. It's something that the Placencia Cooperative is working on right now because we believe that the heritage of the Placencia community, as a fishing village needs to hold that. I think if we hold that, the future … is very bright. Because we can show people to appreciate our culture and our heritage and then in turn, the word would be out. So that is the plan for us. – *Hector, Placencia Village resident*

Figure 31. *Fishers processing the days catch at the fish board. June 2019. Photo by Atte Penttila*

Aesthetics and Meeting the Demand of Tourists

Other residents pointing towards a preferred future entanglement, were in-line with what you could call "Mary Douglas classic" (1966). Improving waste management is about cleanliness and order, particularly as it relates to meeting the needs of tourists and presenting a modernized destination. Many residents noted how the smell of urine after heavy rains could ruin visitors' experience or how waste infrastructure might fall short of their expectations:

> *"*No one is going to want to come to a place that's full of garbage, nowhere to wash, no place to eat. The country is beautiful*, l*ike *[the]* jungle, zip lining*,* there are tons of things to do, but no one is going to come if they feel that the infrastructure isn't good. You pay four thousand dollars for that cruise and get off and have to use an outhouse*."* - *Keith, Placencia Village resident*

Scale of Tourism and Size of Waste Management Solutions

The relationship between tourism and waste management prompted divisive visions of scale. How much tourism growth should a human waste system enable? For instance, a quick glance past the fish board on the south of Placencia Village reveals a cruise ship port approximately 3.4 miles offshore.

On any given day of the tourism season, ships will now bring double the population to the area. The cruise ship dock has added new dynamics to Placencia. While most passengers stay within the confines of the island, many visit the mainland. They do so via a local tour operator who secured the exclusive rights to ferry hundreds of tourists a day from Harvest Caye to the Placencia pier for $40BZ a head. The flow of people is unidirectional, however. While tourists can come to Placencia, residents cannot visit Harvest Caye. On ship day, you may find a cluster of tour operators near the Placencia pier, hoping to engage short-term visitors on a tour.

For some local tourism leaders, this arrangement is ideal. It provides the tour guides opportunity for clients without flooding the peninsula with people. Most of the cruise ship visitors stay on Harvest Caye or depart directly to visit one of the popular destinations cayes along the reef. While this reduces the footprint on the peninsula it also places tour guides as economic gatekeepers excluding shopkeepers. It also offloads responsibility for managing human waste to cruise ship and treatment strategies on the Cayes, which contains similar challenges to the peninsula (Webb and Delgado, 2023). Laura, a Placencia Village resident who works for an environmental NGO expressed her concerns about how waste related to mass tourism, particularly cruise ships, would be managed:

> "With cruise ships I haven't done my research on that, to find out what other problems have arose because of sewage waste coming in from cruise tourism. But if you're having 4,000 people coming a day, for maybe 5 days a week…imagine how many times that sewage would be flushed? How much of that waste is being collected? You wonder what would happen to the amount of waste that is being produced." – *Laura, Placencia Village resident*

For instance, Laughing Bird Caye National Park is one of the most popular attractions for tourists visiting the peninsula. Prior to the cruise ship, the small 1.8-acre island could experience anywhere from 6,500 to 10,000 annual visitors (SEA 2010). For other residents, particularly in Placencia Village, not only would mass tourism spoil the vision of healthy ecology and intimate community relations but would create a greater dependency on the industry. At risk within this growing entanglement is a loss of local autonomy and character as well as a diminished ability to engage in alternative livelihoods. Ellie, like many Placencia Village residents, expressed a wariness towards mass tourism. She expressed a concern that a mono-industry on the peninsula would make residents less resilient to economic change and stunt the creative ways livelihoods can be constructed and enacted:

> "I personally hope that we try to remain authentic and stay away from mass tourism. I just don't see the point. If you look around in the Caribbean, there are so many places to have it and there is some value to trying to be different and stay[ing] simple. There are a lot of people that are willing to spend money. Why come to somewhere it's similar to another place? It would be good for people to look outside of tourism too and what kind of other businesses they can put up here. You have freaking cashew trees everywhere and nobody grows cashew seeds. The guy from Guatemala comes in on the boat and sells us cashew nuts from Guatemala. So, I mean, there's a lot of other things that people can do. But a lot of people see tourism as a quick way to make money and frankly just kind of lazy to think out of the box. I think [unless] people here start thinking out of the box, and you're really in tourism completely, you're always gonna be in the service industry. I mean, it's all good but if you want independence, you gotta start thinking in other ways. I'm not saying that I want the tourist industry to disappear, but it would be nice to have balance, and a little distribution of how things work, better than everybody just working for a resort owner." – *Ellie, Placencia Village resident*

Figure 32. *Laughing Bird Caye National Park. Photo by Victor Faux*

Small Growth and Human Waste Management

Several residents articulated a desire for alternative systems on the peninsula. While these systems would allow greater control at the local level, they would also require grant funds, or expenses that would not have to be paid back, as well as greater education. Given the small-scale nature of the alternatives, they would likely exclude those who couldn't afford to install them. An alternative small growth waste management model was presented by Greg, a Placencia Village resident who had worked in sanitation and construction for the past three decades. He expressed the desire for a more locally managed, and ecologically sensitive, model of waste management:

> "The system I thought could make sense is going to involve education. That same amount of money [for centralized system] could build these low-tech systems that can be sited, say…like one system for 4 houses. And again, I go back to the same observation that people don't want to…the average person isn't going to want to put the work in that it requires to run a labor-intensive waste system. But that same amount of money could set up a thing, just like we had our little water board set up, where you could train 20 people, give them their cute little brown t-shirts,

> and pay them and the amount of money, far less, it's going to be, than it would cost to run this high-tech system. That same amount of money could be paying for labor to help run these composting systems and the benefit being: look at the amount of employees you've got, local control, and in the end, we're growing squash in the back yard again. Because you're producing, instead of grey water, you're producing compost." – *Greg, Placencia Village resident*

The desire and entanglements of small growth management invites the question, whose small growth future? Speculations of small-scale tourism were often divided between Seine Bight and Placencia for instance, regarding who is included in this matter of boutique tourism care. For Seine Bight residents, the historic protectionism practiced by Placencia Village left them unsure about their inclusion in expensive small-scale growth. As Marcus, a Garifuna resident of Seine Bight who works on nearby Harvest Caye, expressed pessimism about the likelihood that Seine Bight residents would be included in a small growth model of boutique tourism:

> "[Tourism growth] is still the same thing; nothing's changed. Because [Seine Bight] wasn't a point of interest in the first place. Meaning tourism was never intended for Seine Bight, only Placencia. It's up to the people in Seine Bight to change that and start doing small businesses that will attract tourists." – *Marcus, Seine Bight resident*

Alternatively, mass tourism presents new opportunities for Seine Bight residents both in terms of job creation and production as foreign investors are less likely to exclude them due to pre-existing prejudices (Koenig 2016). Marcus further noted that foreign investment provided learning and skills training opportunities that were often not offered, or not accepted, by Placencia Village and otherwise Belizean owned resorts. For him, foreign investors provided a path forward for Garifuna economic growth:

> "I think [foreign investment] is good because the locals don't have the capital to invest. So, if you want to bring up the tourism, you have to allow international people to come in and invest because that's what's going to bring it up. That's who has the money to build the big resorts, and which are going to provide the

> jobs for locals. The locals that have money are not interested in it. They're interested in flying to the States (laughs). You gotta open the door to anyone that's interested so we can grow. I think it's necessary. It's what makes it grow. Without that, depending on just the locals and the government, you got a lot of ministers opening resorts, but they're not invested in resorts. They're trying to keep their money offshore." – *Marcus, Seine Bight resident*

Additionally, the BWS included Seine Bight within the consultation processes, which had not occurred during the previous formulation and may not be present if smaller systems were adopted. Alicia, a previous member of the Seine Bight village water board and village council member, interpreted BWS's involvement in the project as an opportunity for Seine Bight to be engaged in development processes:

> "Well, I wasn't here in the beginning of everything but when I became chairperson of the water board and we had to start depending on the consultation the whole system. And I understood that Placencia had wanted this water system since 12 to 15 years ago. But I asked the question was Seine Bight included in it? Seine Bight was not included in it. So, 'til when now there haven't it that BWS really means they're coming in now Seine Bight is included." - *Alicia, Seine Bight council member*

Care and Institutional Thought

At the end of each interview or casual conversation with a development consultant working on the centralized proposal, I asked "what do you think the peninsula will look like in ten years?" The responses to this question were much less rich than residents. As Mary Douglas observed, institutional "thought" is induced by the work it produces. Their ethical obligations are embedded within best practices as well as higher order conceptions of how the world does or should work. Approaches to justice for instance, only exist by their everyday fulfillment of institutional needs (Douglas 1986:124). A phenomenon noted in the ways development practitioners often feel ambivalence about their work (Smith and Smith 2018) or how their

positions within the organization precludes considerations of the ethicalness of their tasks (e.g., Groves Williams 2016).

For instance, when I asked an IADB officer familiar with the case what led to the failure of the CReW funding scheme on the peninsula, his answer was succinct: “they did not create an enabling environment.” An “enabling environment” was a key concept within the CReW funding program. It included creating a strong government presence of enforceable regulation and community support as outlined in their retrospective review of the project (GEF-CReW 2017:21). That same CReW document applauded the GOB’s dissolution of local water boards as an important and responsible step towards creating an environment for success. The dissolution was a key driver of distrust and resistance from peninsula residents and therefore its failure to be implemented, however. Despite their praise, BWS and the GOB were seen as failing to create the necessary conditions for success. In this context the CReW’s matters of care – strong governmental regulations, revolving capital for further development, and the sustainability implied in an improved wastewater system - were relatively unassailable, with failure of the program off loaded onto its implementation.

Contrasting the IADB officer, The Caribbean Development Bank (CDB) employees expressed a much more anxious response to their matters of care. The CDB has generally considered itself more a bank and less a development agency (Ingham and Figueroa 2009). Although its project managers are virtually all engineers by training. The officers I spoke with each expressed a certain ambiguity about how projects unfold.

In part, this is because of the bank’s organizational structure in relation to projects. Rather than a single project manager following the life of the project, it goes through a series of handoffs depending on the expertise required (e.g., financing vs design vs implementation).

Consequently, project officers may be working on only a particular part of a dozen projects at any given time. The matters of care they expressed were abstract and in-line with human waste management theory generally – more sustainable tourism growth, healthy ecosystems, and public health. When it came to the minutiae of concerns on the peninsula, they were likely to refer to the people's agency to respond to change or the GOB or BWS's ability to consult with community leaders.

An interesting exchange revealed another potential reason for their hands-off attitude. When I asked if the state did any form of modeling to determine if the increase in tax revenue from tourism growth could justify the centralized system he replied "no." The state, and by extension the bank appealed to what anthropologist Brian Moeran coined, "Magical Capitalism" (Moeran 2017). If you build it, growth, and rewards will come.

Consultants from CBCL Limited, who were contracted to conduct the Nutrient Fate and Transport Study, expressed a narrowed set of concerns based on their findings. Because their role in the process is as a scientific consultant, they were very concerned about the ability to match insights with the needs of the program and the community. For Zach, the utility of their work was a prominent part of his vision of the future of the project. He expressed a concern that all the effort they spend, and knowledge they acquired, would not produce a fruitful outcome:

> "We do [a lot] of these projects. I think the things you see in the communities and people's concerns are similar wherever you go. Personally, it was a great project. It's a complex environment, we were able to give some good recommendations, [the] client was good to work with, people on the ground were very supportive and engaged. But when it comes to the challenges and outcomes, it's pretty similar to what I've experienced in other places. It has the potential to become another report on the shelf, a lot of inaction. People feel good, there's exposure, there's media releases, there's studies being done, "look at this, we're doing stuff" and then nothing happens. I mean, it's a very common story, it's taking this and moving it to the next level." – *Zach, CBCL project manager*

As the executors of the project, the engineers at BWS expressed the greatest range of consideration in relation to the future of the peninsula, albeit parochial ones. The cost of the project is growing but the GOB appears committed to finding the funds. Improving the marine environment is going to involve more than just the system. It is going to require a multi-sector approach with the Departments of Environment and Ministry of Agriculture. Similarly, they noted the need to address all the different desires along the peninsula: shrimp farmers, tour operators and resorts, NGO's, poor residents, and village councils. Moving forward, they saw the biggest challenge as construction, both the technical challenges and disruption to people's lives. Although unsure of the specifics, Jerome expressed not only a willingness but a confidence that they would be ablet to resolve issues related to people having toilets and bathrooms capable of connecting to the centralized system. He had worked on other basic needs projects throughout Belize and was familiar with the routes for accomplishing these kinds of tasks:

> "Well. I can only speak to how we have operated in the past in Belize City. When Belize City first got the sewer system quite a few families could not connect to the sewage system. They did assist families with building bathrooms and buying the sewage and piping and stuff to connect to the system and those were grants. I'm sure some mechanism will be worked on to have people on the peninsula connected." – *Jerome, consulting engineer at BWS*

Ambiguous Futures

Matters of care are speculations, meant to articulate the kinds of uncertainties, anxieties, and hopes people live with. They are not a collection of predictable outcomes. As relations shift so will more opportunities for change. These kinds of negotiations are what archaeologist Ian Hodder refers to as the politics of situated entanglements (Hodder 2012).

There was nearly perfect uniformity in certain matters of care when it came to human waste management. Most residents expressed some form of eco-commoning, or the practice of

imaging more-than-human worlds (Papadopoulos 2018; Tacchetti et al. 2022). Most significantly, these worlds involved the animated lives along the Belize Barrier Reef. The future of the reef was not only an ecological entanglement of non-human life but one that included the livelihoods and central identity of the people on the peninsula. This extended into a composition which included the reef within the economy and local culture. Other compositions were more focused on the avoidance of harm to the reef than its entanglements with livelihoods and culture.

Conflicts, to the degree that they could be characterized that way, were prompted by the imagined ramifications of the size of development. For many in Placencia Village, the magnitude of development the system was meant to enable, was out of scale for their ethical imaginations (Zylinska 2014). They instead appealed to compositions which included local ownerships, local employment, low populations, and overnight eco-tourism engaging with the village's historic culture.

Appeals to more-than-human worlds are still bogged down by ethnic and racial discrimination in the just-human worlds however (Jackson 2015). In Seine Bight, after a decade of alienation from the luxury eco-tourism incubating to the south, foreign investment meant inclusion. To its residents, specifically some Garifuna residents, the opportunity to participate in the centralized project and, potentially, in the growth spurred by outsiders, led to a future composition more amenable to mass economic growth compared to their established counterparts in Placencia Village.

Amongst the consultants and BWS the frame of their composition was different. They, like others in development spaces, interpreted their ethics and compositions through the lens of their organizations (Douglas 1986; Groves Williams 2016). Their bird's eye view of events was more likely to "common" other institutions. The banks expressed concerns about "sustainability"

vaguely defined, similarly for prosperity and ecological health. In addition to similar appeal by CBCL, they also commoned the distribution of knowledge and its ability to influence matters in a positive way. In this regard the institutional composition of consultants tended to be process oriented, vague and relational.

The distinction was BWS, who were engaged in every aspect of the project and had a broader view of who was included. They expressed concern for the multi-sectorial aims of the project, the health of the lagoon and reef, the function of the infrastructure, and the people of Seine Bight.

Generally, speculations fell across relatively predictable lines. Those who enjoyed the economic status quo wanted to preserve the familiar rhythms, the everyday culture, of their lives and those around them. Growth should be composed slowly and be easily navigable. For those who have not benefited from the current status quo, the possible compositions of new people, organizations, and activities associated with growth presented a hopeful future. Economic change brings opportunity and risks, depending on where you are situated.

In 2021, I presented at an environmental panel for the Caribbean Studies Association annual conference. The title was “Managing Waste as a Wicked Problem.” After detailing the complex dynamics, visions, and problems of Placencia’s centralized wastewater, project an audience member clicked the little hand button on the bottom of his zoom screen to ask a question. He wondered if I thought that further tourism growth and expansion on the peninsula was “right.” “Morally, right?” I asked. From within his little square on zoom he nodded yes. “I don’t know, I don’t think that is something I can answer” was the only response I could think of. My answer hasn’t changed.

Chapter Eight: Managing Messes

Human waste occupies a curious space in social life. Producing bodily substances is generally considered banal and perfunctory, although sometimes thrilling, and often disgusting (van der Geest 2007a). Its management is unglamorous, and, in most circumstances, preferably invisible (e.g., Hawkins 2004; Morales, Harris, and Öberg 2014). Yet it is an inevitable part of the public sphere. We all do it, and must do it, somewhere, somehow.

It is that *everywhere-ness* of human waste, its non-stop presence, that entangles it with so many different kinds problems across the globe (Black and Fawcett 2010; WHO and UNICEF 2019). Left to its own devices, human waste can make people sick, destroy ecologies, and disrupt the momentum of social activities. Consequently, the norms around its organization, always imbued with social meaning, aid in structuring the possibilities of everyday life.

The management challenges are a collection of words starting with "W." What is being managed? Where is it being managed? Why is it being managed that way? And, most troubling, when is it being managed for? These questions illustrate the complicated nature of *context* when pursuing resolutions to excremental problems (e.g., Mihelcic et al. 2017; Workman et al. 2021; Wells et al. 2022). In short, managing human waste is a "mess" (Ackoff 1979).

The Placencia Peninsula case study began with an "event" (Hoffman and Lubkemann 2005) and ended in ambiguity. Their story of waste management challenges and opportunities in the face of rapid economic and environmental change is a shared Caribbean one (e.g., Nurse, Cashman, and Mwansa 2012; Peters 2015). Despite concerns about the inadequacy of the

peninsula's current waste management strategies, economic development has persisted. In the pursuit of a resolution to this emerging problem, over a dozen institutions have been involved in waste management. Each has struggled to construct workable entanglements satisfying the political, economic, and ecological needs of the project. Resolutions are still in limbo, leaving residents anxious and hopeful, imagining potential futures.

It is my contention that the messes of human waste management are best understood through a rather contemporary anthropological insight. Humans and the worlds we find ourselves in are not distinct from each other. Our lives are enmeshed with materials and other beings with presence beyond strict subjectivities or ideologies (e.g., Ingold 2011a; Latour 1991). The agency to influence their arrangements are distributed and contingent on the practices people are engaged in (Bennett 2010; Pickering 1995). Within this view, a lively relational world of people and things comes into focus when we attempt to understand how and why human waste is managed (Higgin 2016).

Holding these relations together are entanglements, or complicated interdependencies producing and restricting behaviors (Latour 2004a; Hodder 2012). This dissertation explored three focal scales, or emphases, for navigating management's vibrant entanglements. The first, *non-humans*, is comprised of the materials, ecologies, and technologies which condition and give shape to goals and human action (Hoskins 2006; Tilley 2007). In this research they encompassed septic tanks, water tables, nutrients, pathogens, pipes, scientific tools, and, of course, human waste. The second is the conflicting and collaborating *social institutions* engaged in "sensemaking" about descriptions and potential resolutions to management problems, which included development banks, governmental agencies, engineering consultancies, a public utility, local governance, and residents (Weick 1995). The final emphasis was the *matters of care*, or the

ethical speculations that people engage in when imagining desirable and undesirable future entanglements (de la Bellacasa 2017).

Following these scales across management processes and desires revealed a truism of many process-oriented theorists: if you go looking for heterogeneity, you will find it (e.g., Law 2004). The challenge is determining which processes, concepts, and *things* to include in the analysis (Jensen 2014). The results of this dissertation uncovered rich entanglements between environments, technologies, scientific and bureaucratic institutions, and ideations of the future. But there is always more just outside of view (What are the inner workings of different development banks? The departments within the Government of Belize? How might the internal politics of village councils influence outcomes?)

Consequently, my recommendations for human waste management on the peninsula follows along two lines: small-world insights, derived from the immediate entanglements analyzed, and long-term possibilities, with the acknowledgement that significant change will involve more entangled relations not yet entirely understood. The remainder of this chapter will explore the results in the context of the primary research questions, followed by a short discussion of theoretical and methodological limitations and applied recommendations.

What is the Role of Non-Humans in Human Waste Management?

Turning attention to the non-humans of waste management on the peninsula revealed the primacy of *things* as inseparable aspects of how management is enacted. After all, there is nothing to manage without "human waste" as a physical substance. Acknowledging the power of matter in the world invites anthropological explanations that include objects as existing beyond just human perception (e.g., Meillassoux 2008; Ingold 2011a).

For instance, the non-human entanglements of management on the peninsula enriches its perspective beyond a culturally invented system of symbols (e.g., Douglas 1966; van der Geest 1998). It also requires, and responds to, the translation of *things* into objects (Harman 2011; Miller 2005). In contemporary technoscientific management, the objects of human waste are *wastewater, nutrients,* and *pathogens* (Mihelcic and Zimmerman 2014; Thompson and Beck 2017).

A complete understanding of their meanings requires even more matter to be objectified into water, sand, algae, bacteria, concrete, and plastic entangled in processes like consumption, flooding, hurricanes, eutrophication, and chemical transformation. Each object is imbued with a "small agency" as it is entangled in management processes (Bennett 2010). In practice, human actions appear tame compared to the diverse and dynamic interactions of non-human entanglements (Haraway 1991).

Management mediates alongside or against non-human processes through technologies struggling to secure new entanglements (Hodder 2012). However, the intended performance of technologies greatly depends on the conditions of their use (Pfaffenberger 1992b; Spicer 1952). The challenge for human waste management technologies is the invisibility of its behaviors. Like other infrastructures, its entangled relations fade out of consciousness until a problem presents itself (e.g., Star 1999).

Many of the potential "effects" of these invisible processes are perceived as risks if management does not perform as intended. Qualifying, understanding, and decision making about these risk is inherently political, making knowledge about them both a scientific and a public problem (Douglas and Wildavsky 1983). It in this regard that technologies can act as important brokers within entanglements of practice and their social organization (Meehan 2014)

On the Placencia Peninsula the dynamics between objectification, technology, and management are caught in the throes of population and economic growth. Historically, people relied on night buckets and latrines to organize waste away from human contact. In recent decades most households have transitioned to various forms of septic tanks and cesspits.

Septic tanks, like other public infrastructures, require both appropriate design (Libby, Wells, and Mihelcic 2020) and repair and maintenance (Graham and Thrift 2007). Residents increasingly viewed their systems as inadequate. They either fail to perform as expected, are inappropriately designed, or require frequent pumping. There is also the question of where waste is deposited after it is pumped out of septic tanks. The sunken costs of these systems as well as their heterogeneous arrangements have created an entanglement that is difficult to transition out of, however. Reinterpretations of the adequacy of management processes highlights how entanglements between humans and non-humans condition its meanings.

Exploring the dynamics of waste management on the peninsula was framed by its three key objects: what I refer to as its "wetness", its nutrients, and pathogens. There was no shortage of stories regarding the difficulty in containing waste's wetness. Septic tanks were frequently submerged under the water table and prone to being flooded, occasionally backing up into the household. Many residents noted they could often smell sewage after a heavy rain. The notion that wastes were traveling beyond the septic tanks out to the sea and lagoon was nearly uniformly agreed.

Some residents attempted to avoid overwhelming their systems by excluding their 'gray water', or domestic non-toilet water, from the septic. Others bore the cost of frequent pumping. Many of the tanks lacked bottoms altogether, resulting in perceptions of consistently contaminated ground water.

The struggle to manage waste was driven by the small agency of materials and objects. In the context of the peninsula, the small agency of the water table and loose soil "makes more of a difference than the grand agency of humans" (Bennett 2010:98). Similarly, most tanks are made of concrete, which when submerged under water slowly corroded, eventually disintegrating. These dynamics are not only barriers to management they also give it definition.

The second two objects of wastewater reveal the limitations of a strictly non-human interpretation of waste management. The microscopic qualities of nutrients and pathogens, and their complex relations with surrounding ecologies, are difficult to "know." Concerns about them were largely speculative, and only occasionally empirical or experiential. In this regard, management is a knowledge practice as much as it is a material one.

The categories of nutrients and pathogens in human waste are historical and techno-scientific (Barnes 2006; Douglas 1966; Hamlin 1988). Knowing about them requires either experiential evidence, such as observations of eutrophication or public health outbreaks, or empirical technoscientific evidence. Technoscientific practices invariably include technologies as well as institutional expertise (Latour and Woolgar 1979), unavailable to the average resident.

Thus, while tracing the non-human dimensions of managing waste on the peninsula reveal the complicated entanglements of technology and environment, they leave unaccounted the cultural practices leading people to know about these relations. Management knowledge about non-human dynamics is not as much a striving for "accurate representations" as it the successful accomplishment of practice, which can only be understood within the context it occurs in (Blosch 2001).

Studying the non-human entanglements of waste management provides a few valuable highlights. While no anthropologist would disagree that the relations between people, waste, and

their technologies is highly contextual (Mihelcic et al. 2017; Wells and Whiteford 2021), attention to non-human processes, including how they come to be known or perceived, adds a textured analysis acknowledging the agency of the world around us. Pursuit of more achievable, effective, and sustainable solutions should be sensitive to these complex dynamics.

How And Why Do Social Institutions Collaborate?

The peninsula's everyday management institutions are few. Night buckets are dumped in the sea or lagoon in the early morning hours. Cesspits and septic tanks are periodically pumped out by companies from nearby cities. Occasionally, their arrival to the peninsula is coordinated by either village council to reduce individual costs. Sometimes, like in the case of Awala, the councils aid in upgrading treatment practices. Otherwise, treatment systems are largely left alone.

As is common with decentralized treatment systems, there is no formal accountability for their performance (Fizer et al. 2018; Gorman and Halvorsen 2006; Withers et al. 2014). Concerns about the growing population and economic development, particularly the number of tourist arrivals, have forced questions and anxieties about the adequacy of these systems. Institutions have been attempting to create a centralized treatment system, and thus centralize accountability, for over 17 years.

The emerging concerns about waste management in the face of growing tourism, have produced a "public" (Dewey 1927). In Dewey's formulation of liberal democratic societies, the publics are drawn in by problems impacting different parties. The state is comprised of those entities who gain authority to resolve public problems. On the peninsula the problem is a confluence of managing waste, rapid growth, and environmental health. The activity and

institutions attempting to resolve these problems, including the public, create what I referred to as the "state-gap" of which multiple institutions attempt to fill.

It is a state-gap, rather than just "the state", because the notion of a universal or natural "state" is a myth (Abrams 1988; Bodirsky 2016; Dewey 1927). It's legitimacy, and authority is always "unsettled" (Bonilla 2017; Jobson 2018). In democratic sites institutions may act antagonistically and subversively against the populace experiencing problems (Escobar 1995; Trouillot 1990), fail to address the state-gap altogether (Chalfin 2014; Drew et al. 2021), or be characterized as multi-sited institutions achieving authoritative power through logistical problem solving against coercive powers (Joyce and Mukerji 2017).

This is to say, how institutions attempt to fill the state-gap through Problem-solving is not natural or universal either. The construction of knowledge about problems, and struggles for legitimacy, are enmeshed in institutional practices (Dewey 1927; Latour 2007). They also vary depending on their social relations (e.g., Hetherington 2014; Workman 2019).

The story of the proposal for a centralized wastewater system illustrates the sometimes-capricious nature of state activity, as it has gone through several stages over the years. Acting as what Carse and Kneas (2019) referred to as an "unbuilt infrastructure of the suspended present", the proposal has drawn in actors seeking to solve problems through legitimized practices. Along the way it has been embroiled in conflict, engaged in redundant studies, experienced information loss, and struggled to attain the resources necessary to keep up with its growing list of concerns.

The project, like most post-colonial state developments, has been entangled with global assemblages of finance and "expertise" (Giddens 1991; Ong and Collier 2005). In its lifetime it is has been funded by three different banking agencies and involved reports written by four

different international engineering consulting groups. They have quibbled with each other over the validity of data and the possibilities of management.

BWS and the consulting agencies drew their authority in transactional ways, through expert reports and presentations aimed at solving the public problem (e.g., Carr 2010). Their role was not deterministic, however. Their work was slowly situated within the needs and expectations of peninsula residents, the Government of Belize, and their funders (Dickson 2013; Tsing 2005). They constructed reports, maps, and presentations as both "boundary objects", or prompts for collective imagining (Star and Griesemer 1989), and to provide *evidence* as decision making infrastructure (Calkins and Rottenburg 2016). Through these processes stakeholders were able to articulate disagreements and push back on expert results, demand more information, and criticize designs. BWS was forced each time to conduct more studies and rethink aspects of the design. Although in the case of dissolving the water boards, their logic and financial entanglements prevailed over local protests, constraining the possibility of an entirely locally financed solution (Wells et al. 2019).

Conjoint Actions & Response-ability

The many processes bringing the state into focus are driven through *conjoint action, w*herein people affectively experience public problems through their material and social enmeshments. Which is to say publics are embodied collectivities thrust into problems by their non-human entanglements (Bennett 2010). For instance, the initiation of the problem on the peninsula was not entirely human. It was, depending on narrator, either the devastation of a Hurricane or the inadequacy of collective treatment technologies and the risks they pose to local ecologies.

Further, each expert is embroiled in attempts to understand, and respond to, the non-human dynamics of waste management on the peninsula. As Hernes (2007) notes, organizations, as collections of processes, are always making decisions within "tangled perspectives", representing the possibilities for how to think and act. The many institutions intervening in public concerns did so alongside "vibrant matter" informing the problem itself (Bennett 2010).

Thus, actions by the public, its non-human entanglements, and social institutions were always in response to problems within complex intertwined relations. The challenge with action within interrelated dynamic problem spaces, is that they will invariably produce other responsive actions. Responses may be intentional or unintentional, expected or surprising. Not only is this perspective non-Machiavellian, but it also deploys a certain sympathy for those engaged in resolving problems in public spaces. Responses to public harms are a form of "response-ability' (Haraway 2008; Lau 2022) as opposed to strictly self-interested biopolitics (c.f., Foucault 1978).

The centralized proposal was full of people striving for "response-ability." Development banks, which are mission driven more than profit driven, have provided free funds in the form of grants as well as low interest loans. In the case of IDB their lending scheme resulted in unintended consequences. The scheme was the primary justification for dissolution of the water boards, the blowback of which contributed to their withdrawal from the project.

Similarly, the consultants and engineers at BWS engaged in a sincere use of technoscientific practices. Each institution attempted to produce useful information for the design of the system and the public's evaluation. Their expertise unfolded as learning-through-doing rather than prefixed solutions (Lave and Wenger 1991). Although their ability to learn was certainly constrained by the terms of their contracts and their organizational capacities (Weick 2016). In the way of unintended consequences, the order of operations for conducting studies, or

perhaps poor communication during community outreach, lead to confusion and conflict about what information was required during which part of the decision-making process. These conflicts ultimately resulted in costly and redundant delays.

The conception of a state-gap as an arena wherein actors struggle for legitimacy also helpfully sheds insight into the abundance of redundant studies. Because knowledge was being produced for particular aims, it was not created for institutional knowledge as such. Each of the proposal's studies were commissioned in response to a specific situation, the creation of a design for the village council, the justification for funding, the justification for the siting of the treatment lagoon, etc.

Most reports referenced old reports although they recontextualized, or reconducted, their processes to suit the aims of their TOR. Once finished much of the information quickly became irrelevant. In fact, when I asked the lead engineer at BWS for a copy of the AECOM report, he told me it didn't exist because the study was never finished. A helpful resident in Placencia Village, however, had somehow secured a copy along the way.

The social processes within the state-gap were a fluctuating and confounding series of processes. Multiple actors entered the project struggling for legitimacy, authority, and understanding. The possible resolutions evolved in response to changing problem definitions. As Clifford Geertz wryly noted, understanding state processes is a matter of paying attention to "the confusion that surrounds it, the confusion it confronts, the confusion it causes, the confusion it responds to" (Geertz 2004:580).

What are the Matters of Care Surrounding Human Waste?

The evaluation of waste management inspires appraisals of the worlds people currently inhabit and how they might change in the future. Management change, particularly in relation to infrastructure, is "always about the future, or different futures" (Hetherington and Campbell 2014:193). Speculating about these futures includes entanglements with the past and present (Abram 2014). Who and what people conceptualize and prioritize within these future spaces can be thought of as "matters of care" (de la Bellacasa 2017).

Matters of care are an extension of matters of concern, Latour's articulation of the technoscientific practices drawing people to engage with issues (e.g., Latour 2004a). Rather than just include the technoscientific *interests* of people, however, matters of care open the door for considerations of other lives for their own sake. Within the analytic frame for exploring matters of care I distinguished between two processes: commoning and composing. Commoning, drawn from de la Bellacasa (2017), is the process of imagining what and who is important to include in our ethical imaginations. Composing, adopted from Latour (2010) , is the process for imaging the arrangement of commoned entities and processes.

Virtually all residents interviewed moved beyond entirely singular or self-interested "matters of concern" to a process of eco-commoning. The lives along and within the Belize Barrier Reef were considered alongside neighbors, friends, and strangers. For some, the inclusion of the reef in their future entanglement was characterized by an absence of algae or human waste. Pursuing improved management was motivated by the avoidance of an undesirable future. Others appealed to an "ecology of support" (Duclos and Criado 2019), including a rich composition of mutually supportive livelihoods along the reef. In their vision, the economy was

not exclusively tourism based. The reef was composed as a source of alternative employment and sense of place.

For some, appeals to a healthy reef entangled with livelihoods was associated with slow growth tourism. Their compositions were tightly entangled with the specific practices of eco-tourism, as a form of "eco-commoning" (Papadopoulos 2018). They suggested alternative small scale waste treatment systems as the preferred resolution moving forward. In their conceptualization, this would limit tourism to overnight guests, staying at locally owned hotels, going on eco-tours run by local people.

Their small-scale future was seen as maintaining the exclusion of Seine Bight however, for whom "tourism was never intended" (Marcus, Seine Bight resident). Consequently, commoning for Seine Bight residents, particularly some Garifuna residents, involved a world inclusive of foreign investors offering training, job creation, and economic development. These distinctions represents what archaeologist Ian Hodder referred to as the politics of situated entanglements (Hodder 2012).

Differences in visions of non-human futures brought to the fore the limitations of the "matters of care" concept. It is implicitly environmental, meant to consider ways of incorporating ecologies into our ethical imaginations. Hence, as noted, in the chapter "Thinking Shit Through", the tendency for the ethical matters of care to come from the researcher paying close attention to a more-than-human practices. As Jackson (2015) points out however, there are plenty of ethical problems in our just-human worlds.

The decades-long discrimination against Seine Bight by Placencia Village, and the uneven participation in capitalist tourism, influenced how some residents interpreted foreign investment and tourism growth. For instance, several of the Garifuna residents interviewed

viewed foreign investment less cynically than local investment. They were also less likely to assume a tradeoff between ecological care and economic growth. In fact, beyond subtle difference in the specific detail of eco-commoning (the inclusion of the reef, mangrove lagoon, etc.) between those interviewed, the only major differences were the compositions of economic growth. Those who were well served by the current circumstances were skeptical if not hostile towards rapid growth. Those struggling were much more likely to take the risk.

Resolving long standing ethnic, political, and socio-economic tensions may be outside of possibilities for human waste management. However, exploring ethical imaginations reveals how social relations influence the appraisal and evaluation of management designs.

Theoretical and Methodological Limitations

Research projects are small windows into the world. They are always entangled with the temperament of the researcher, the discipline – both its theories, and methods. This dissertation had two primary limitations which should be addressed in future explorations.

Management and entanglement theory are both process oriented. Their focus on interdependent relations produces a particular view of agency as defined by the restrictions of an entanglement (e.g., Weick 1995; Hodder 2012). Agency is also democratically distributed between the people, things, and biota involved (e.g., Ingold 2012). Further, my underlying pragmatic approach leaves the question of human motivation wide-open. The world is full of acts of care, grace, and generosity, at least as often as self-interest and subversion.

What entangled views of agency and open-ended motivations gains in fine grain understanding of real world relations, they sacrificed in myopic structural insights and visions of change (e.g., Roberts 2017). The lack of structuralist insights is a familiar criticism to process

oriented small-world research (e.g., Weber and Glynn 2006). I attempted to blunt them by contextualizing both the history of the development in the area and the matters of care which gave rise to management interpretations. But there are always more questions to be asked about how these agencies came to be in the first place.

Perhaps the biggest research limitation was data collection. Many of the interviews used in this work were recorded and transcribed by someone else. I acted as the analyst but lacked, at times, a full understanding of the context of the interview. However, many of the interviewers left detailed notes which helped alleviate this shortcoming.

Additionally, primarily due to COVID-19, much of my primary fieldwork was done remotely through zoom. They were some perks from this circumstance. People had a lot of free time trapped in their home and interviews were easy to record. However, while the interviews were rich, management practices went largely unobserved. Consequently, it was difficult to discern between performance and narrative. Future research should include a better understanding of the everyday political dynamics within the Government of Belize and development banking institutions. Finally, much of my knowledge of the Garifuna perspective was derived from my engagements with activists. More interviews with residents and the village council in Seine Bight would have further sharpened some of the insights.

Contributions and Recommendations

This dissertation contributes to the minor but growing anthropological literature on human waste management (e.g., Wells and Whiteford 2021; Wells, Wakhungu, and Webb 2021; Wells et al. 2022; Workman et al. 2021). More specifically, it is situated within the exciting dynamics of waste management in a Caribbean community experiencing rapid tourism growth

(e.g., Nurse, Cashman, and Mwansa 2012; Wells et al. 2016). What this work brings to these literatures is a process-oriented approach drawing attention to the critical, and messy, entanglements of management practices.

Focusing on entanglements responds to anthropologist Kim Fortun's call to "think about determinism, but without the straightforward directives of teleology" (2012:450). By opening the "black box" (Latour 1987) of waste management processes, rather than their effects, our perspective shifts from culpability to possibility. Using the three-prong analytic frame – non-humans, social institutions, and matters of care – presents opportunities for further research in these contexts, both applied and academic.

For instance, the findings highlighted the primacy of the non-human dimensions of waste management (soil, water, technologies, ecologies) as well as their contingency. Managing human waste is a process of objectifying what human waste is and how it is entangled in the world around us. To that end, future research should pay close attention to both the material dimensions of management *and* how they are perceived and enacted. The particulars of the Placencia case, such as coral reef conservation, tourism pressure, and distributed economic power, are likely to be mirrored elsewhere in the Caribbean. Without considering their crucial material underpinnings, research on human waste management risks missing key entanglements determining how resolutions are formulated and considered.

The social institutions of managing waste were similarly contingent. Their entanglements shifted as their relationships did (e.g., from fundings sources, from consultancies, from changes in community leadership). Caribbean communities endeavoring to construct large scale projects under similar economic pressures will need to engage with funding banks and consultancies.

Although as this research noted, it would be a mistake to consider foreign consultants or development banks as homogenous.

Rather this work suggests the concept of a "state-gap", in which state processes are enacted by various institutions striving for legitimacy over public problems. As a research program, the state-gap is oriented around public problem-solving as a process in-itself. Doing so highlights the kinds of contextual interdependencies giving the problem definition and conditioning how institutions can act. Within the Placencia case study for instance, the ways these organizations shaped the project were heterogeneous. Future research into the inner working of these types of institutions – e.g., differing banking or scientific practices – may reveal unintuitive understandings of where and when processes are flexible…and when they are entrapped.

This project also highlighted the inevitable politics of public projects through speculative and relational futures. Residents, government departments, and consultants each interpreted the project through the lens of their social and ecological relations. In this regard politics is a feature of public life, not a bug. However, the lack of consensus building and outreach left those politics unexamined until problems emerged. Future research can expand on this framing by exploring how matters of care are reflected onto projects, and how they may be used to creatively consider resolutions.

Finally, the impetus for this project emerged from a particular institutional partnership. The individuals who have carried out this research - student and faculty researchers from the USF departments of anthropology and environmental engineering - have set their aspirations on exploring how social context can inform, must inform, technological resolutions to everyday problems (e.g., Mihelcic et al. 2017). This work is a continued pursuit of this aspiration.

What this dissertation shows, at a minimum, is that waste management in context is multi-layered and perceptional. It is all at once, social, material, political, spatial, temporal, and relational. The results illustrate how entanglements shift with their circumstances. If we wish to manage them well, we must shift our perceptions along with them (e.g., Ingold 2008; Van Assche, Duineveld, Gruezmacher, et al. 2022).

This insight is a source of optimism. If the world is open-ended, and the sticky relations people are enmeshed in always evolving, how might they imagine a better future? To find out, anthropologists must continue running headfirst into these messes. Like a spider reimagining its web after a rain, the entanglements we find ourselves in can be reinvented. One strand at a time.

Recommendations

The recommendations for waste management on the peninsula are organized into two groups: a) *organizational recommendations* related to observed challenges to processes as they unfolded during the intervention and b) *infrastructures-in-the-meantime*, which refer to improving existing management practices. It is understood each of these recommendations requires greater understanding of even more entanglements and as such, are modestly presented.

Organizational Recommendations

#1: **Dedicated Outreach Processes**

Maintaining relationships and institutional trust throughout the project was an ongoing challenge for the centralized project. Two ways these challenges could be resolved are through 1) building a platform for dedicated outreach processes and teams, whether inside BWS, within a governmental body which can aid in various state projects across the country, or funded on a per

project basis (e.g., from representative communities themselves) and 2) Developing outreach templates to be articulated in RFP's and TORs which can ensure measurable expectations and outcomes.

For instance, within the CReW funding scheme, the GOB was required to get consensus from the village councils regarding the centralization project. These types of requirements could be broadened to include *comprehensive outreach* for any state funded or public project. Outreach from a social scientific standpoint would involve conducting a stakeholder analysis – including but beyond local power dynamics related to ethnicity and gender - to better understand project risks and rewards as distributed across participating and impacted communities (e.g., Prouty et al. 2017; Reed et al. 2009).

Conducting stakeholder analysis is intensive and will likely require more than a public meeting or single workshop. Rather time-in-community, using core anthropological approaches such as participant observation, ethnographic interviews, and network analysis, should be used to illicit the social complexity increasingly recognized as part of public projects (e.g., Harvey, Jensen, and Morita 2016; Hetherington 2019). Once these complexities are understood, workshops can then be customized to include the situated dynamics of the project rather than beginning from scratch.

The need for more intensive outreach and consultative processes prior to project commitments is not strictly idealistic. As this research has shown, the entanglements of management are relational, and rely on the flow of information and trust. The history of public projects, particularly when resources are scarce, is filled with stories of unnecessary delays, public protests, and stalled progress. To create smoother transitions from one infrastructural form

to another, better communication, and thus better understanding, of the entanglements faced by various stakeholders related to these projects is needed.

Given that outreach processes require time and expertise, they should be articulated within RFP's and project bids. In addition to dedicated funding, outreach processes would be aided by templates from which the implementation processes can be evaluated, and expectations can be set. Templates should refer to sampling strategies, engagement methods, and expected outcomes as they relate to the anticipated project (e.g., # of interviews/surveys, workshop designs/consultative interventions, types of analysis, etc.).

What is often termed "outreach" is typically ill-defined, making the responsibility for enacting it uncertain. Creating either ongoing nationwide teams (where the opportunity for institutional learning and knowledge stewardship are possible) or hiring on-demand experts (which requires less funding, but potentially more information loss) would allow for a consistent expectation of what outreach is and how it is conducted. Broad frameworks and templates, agreed upon by funders, operators, and communities, would further enhance the legitimacy and consistency of outreach efforts. Templates would also help create a roadmap for local institutions and community groups to bid on conducting outreach efforts.

#2: **Data Management**

Responding to a presentation on this work at a Caribbean conference, Ulric Trotz, the Deputy Director of the Caribbean Community Climate Change Center, lamented, "We are tired of writing reports and policy documents that sit on shelves, we need to dust them off and move to action." His sentiment was mirrored by consultants who worked on the project only to find there were significant amounts of existing data which could have aided in their work, as well as

my own experience tracking down reports related to the centralized project. Moving towards the future, a digitized data repository of knowledge produced with public funds could benefit and expedite projects.

I would suggest a neutral body, such as the Belize Statistical Institute, which already contains the capacity for a public portal to access information as well as the ability to input and sort data types. Of course, creating a repository would require a champion to oversee its implementation as well as a model to secure funds for its maintenance. But as-is, information is not easily available even to those working on related projects. Considering the dynamics of recommendation #1, a source of information related to outreach and lessons learned could be incredibly valuable for projects as they shuffle between consultancies, community leaders, banks, and operators.

#3: **Institutional Collaboration for Training/Retaining Skilled Employees**

One of engineering's "Grand Challenges" is the ability to contextualize resolutions to water/wastewater challenges (Mihelcic et al. 2017). While it is common practice to source consultants outside of the institutions who will be implementing and operating the project, they tend to be hired from distant countries. As this worked showed, distance is not only expensive but can impede communication and therefore lead to less contextualized results. Distance also continues to foster the problems of outreach as different consultants with different functions have led outreach efforts through the years.

The findings of this work suggest creating more in-country expertise may improve the flow of information and, potentially, continuity in relationships. The hurdles to localized expertise are significant but not insurmountable. For instance, as part of the private/public

partnership for a LIDAR equipped plane between the 5C's and Maya Air, staff were trained by NOAA on how to process, analyze, and visualize the data they receive. Similarly, a sponsored relationship between BWS and a US university (like USF) to train Belizean students, community members, and governmental or utility staff on how to collect and process complex data is possible.

Looking towards the future, TORs for state-sponsored projects should include a training component from any consultants with expertise unavailable in the country. These expectations should be included in RFPs and TORs, with budgets adjusted accordingly. Whether this includes hiring local labor to help collect and process data or coordinating projects with students at local universities would depend on the circumstance. The details of who and what would be involved in training activities could be explored during the consultative phase of the project (see recommendation #1).

These recommendations are rather rosy. As observed throughout this work, acquiring funds is not always easy or guaranteed. The success of these recommendations will likely rely on a common understanding between state actors, community leaders, and financial institutions. However, creating an intentional vision of the development process that includes community dynamics may lead to less delays, more cohesion and trust, and, hopefully, more creative and contextualized resolutions.

Infrastructures-in-the-Meantime

#1: **Leach Fields**

As this dissertation demonstrated, many of the existing treatment systems on the peninsula are performing poorly due to the silty soil and high-water table. Their performance

could be improved, albeit likely with mixed results, through the continued adoption of leach fields. A leach field involves connecting a perforated pipe to the effluent outlet hose of a septic tank. The perforations in the pipe broaden the distribution of the effluent in a horizontal manner, theoretically leading to less contamination of the water table. Further, planting vegetation across the leach field can help uptake nutrients from the effluent before they percolates through the soil.

#2: **Vault Toilets**

It was reported that in both Placencia Village and Seine Bight some households still rely on open defecation, overhung latrines, or night buckets. Continuing the recommendations from the EWB report in 2006, the installation of a few vault latrines might provide an alternative option for containing human waste. These vault latrines could also be used as public toilets for tourists who currently must primarily rely on options from local businesses.

Conclusion

In 2019 I returned to the peninsula for a second time. The six-hour bus ride from Belize City to Placencia Village turned into seven-hours after the bus broke down north of the peninsula. Just as I stepped off the bus - dirty, sweaty, and tired - Jeff walked by.

He and Aayisha were no longer working together. He had no hard feelings, "she would rather do it without me, but it’s all love, man." A few days later I got chicken with rice at the shack. It was only open a couple days a week, but Aayisha seemed happy, if uncertain, about her future.

Two years later I was back on the peninsula, dreaming of BBQ chicken with hot pepper sauce. That first evening I went to the fish board to have homemade blackberry wine with some

of the Placencia Village fishers. The shack which had been less than ten feet away, was completely gone, including the recently built patio. People had nearly forgotten about it when I asked. It was old and run down, they said. Jeff's provocation of life as defined by change, holds true.

Similarly, except for a few of the village council members, the centralized wastewater system was all but forgotten. The circumstance reminded me of a statement pragmatist philosopher John Dewey wrote nearly 100 years ago: "the history of municipal politics shows in most cases a flare-up of intense interest followed by a period of indifference" (Dewey 1927:137). Given its long and fraught journey, who could blame the public for dismissing its possibilities.

While the shack is gone, the problems of human waste management on the peninsula have persisted. Some things change, others stay the same. The wheels of management are still turning. A few residents continue to plant trees and herbs around septic tanks to take up nutrients. The Caribbean Development Bank is in the process of financing a detailed design of the centralized project. BWS is still looking for funding as they explore other, cheaper, projects along the coast. CBCL Limited is engaged in new contracts with new clients in other parts of the world.

Whatever questions arise as the project continues to develop will be met with more conflict, questions, and hopefully, eventually, "good enough" resolutions. The dream of a healthy ecosystem, safe citizens, and the pride of well managed human waste is not dead yet. "In the final analysis everything is suspended in motion" (Ingold 1993:164). There is still always tomorrow.

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Appendices

Appendix A: PIRE Interview Guide

"Following Up (Part II)" Phase Semi-Structured Key Stakeholder Interview Guide
(Version I)
PIRE Placencia Peninsula, Belize – May 2017
MRC, ESK, LW, RKZ, ECW, AV 5.14.2017

Semi-structured interviews will target Belize Water Service Limited local water / wastewater system managers, local Norwegian Cruise Line (NCL) cruise tourism representatives, local business and tourism organizations, environmental / civil NGOs, among other sectors this season, with a focus on institutional relationships and responses to recent cruise ship arrivals on Harvest Caye, other mass tourism development, and water and wastewater access / management. The following are possible questions we may ask the interviewees, organized by theme.

Opening:
- What is your occupation and title?
- For what organization do you work?
-How many years have you worked at your organization? In this field?
- (For expats) Why did you move down here?

[For NCL Cruise Tourism Representatives]

Can you tell me about the Norwegian Cruise Lines project on Harvest Caye?

- When did the project start? When did the first ships will be arriving to Harvest Caye?
- About how many passengers visit the Caye weekly? How often do cruise ships arrive?
- What is planned for Havest Caye in the future?

Water supply:

-What do you think about water issues on the peninsula?
-Can you tell me a little bit about how water is supplied to the peninsula? (types of collection) - Who manages (is in charge of) the water supply for the peninsula?
-How is the water supply managed here on the peninsula? (e.g. costs, pipes, distribution, etc.)-
[For BWSL water management workers / personnel] Can you explain how the existing water system works (pipes, distribution, chlorination, etc.)?

<> What is / are the current (monthly) rate(s) for tap / pipe water use on the peninsula?
-What concerns do you have about water supply?
-How do you feel about the recent changes for water supply management (to BWS)?

Sewage and wastewater:
-Is conserving water something that people think about on the peninsula?
<> Could you tell us a little bit about the ways that people conserve water?

-Is reusing water (grey water/shower and kitchen water something that is done on the peninsula?
<> Could you tell us a little bit about how people reuse this shower and kitchen water? -How do people feel about reusing water (grey water/shower and kitchen water)?
-What are the different ways that sewage is handled on the peninsula (how do people dispose of human waste)?
-What concerns do you have about sewage or sewage treatment on the peninsula? -Who manages (takes care of) sewage removal on the peninsula?

- (*) Is sewage here treated at all to remove contaminants? If so, how?
- Do people currently use treated wastewater (poop and pee water) for any purposes on the peninsula?
- Do you think people would be okay with reusing safely treated wastewater (poop and pee water)? If so, for what?

- Have you heard about the proposed BWSL integrated sewage collection and treatment system on the peninsula? [If they have, ask them to explain it. / If they haven't, explain it to them]. *Can you share with me any information you might have received about the proposed IaDB water and sanitation system? (Planning, infrastructure, services, costs, maintenance, etc.)* (note terminology you collect).
    - What forms of information have you received about the project, if any? (pamphlets, notices, etc.)
    - What do you think are some of the benefits and risks of the project on the peninsula?
        - To local livelihoods?
        - For the agricultural industry?
        - To human health?
        - For the environment (coastal, lagoon, sea-side, and reef)?
        - For the tourism industry / tourism development?
        - What challenges do you think will be presented as the new system is developed and implemented? What opportunities do you think will be opened up?
    - Do you participate in any of the following: surveys, focus groups, individual meetings, public hearings, negotiations, media development, voting, protects, etc. related to the proposed sewage project?
        - If so, how often?
        - When?
        - How do you feel about the proposed project?

- [For BWSL water management workers / personnel] Can you explain how the proposed centralized wastewater treatment / collection system is going to work (pipes, distribution, etc.)?

- Do you know of any examples of centralized or de-centralized wastewater collection and treatment systems that you have seen work in the past here or in other areas?

[For NCL representatives]

Does NCL have any plans for water reuse on Harvest Caye?

- Do you have any concerns about sewage or sewage treatment on the peninsula?

- How is sewage removed from Harvest Caye? Is it treated on-site?
- Does NCL have any plans for wastewater reuse on Harvest Caye that you know of? If so, what systems are they using?

Health

- How would you describe the connection between water and health here?

-How do you decide if water is safe to drink?

-Could you tell me a little bit about any concern's community members might have about health and water?

-Are there any common illnesses that are waterborne?

- What health issues and illness have community members reported or identified with regard to sewage (pooling or contamination) in the past? (e.g., prominent pathogens, rashes, etc.)

- Have you heard any concerns about the impacts of cruise development on Harvest Caye on community health? [If so, what concerns have you heard]?

Energy, Waste, and Reuse

-How do you think people on the peninsula would feel about using safely treated wastewater for irrigation?

<> For instance, there is a way to use sludge for irrigation, how would you feel about that?

<> In your view, what are the benefits and risks of using safely treated wastewater for irrigation?-How do you think people on the peninsula would feel about using safely treated wastewater for energy? Is there a need for this?

<> For instance, there is a way to get energy from algae that grows on wastewater treatment lagoons. How would you feel about that?

<> In your view, what are the benefits and risks of using safely treated wastewater for as a biofuel for electricity / power? (costs, coverage, etc.)

- What do you think are the benefits and risks of using reclaimed wastewater on environmental health? (lagoon, seaside, algae, etc.)

Tourism industry and Water and Sanitation:

-How do resorts in the area handle water supply?

-How do resorts in the area handle sewage removal?

-What differences exist between the local policies for community members vs. the policies for resorts related to water and sanitation?

[For NCL representatives]

- Do you know if the Government of Belize has any special policies for cruise ship water management? What about for sewage and sanitation management?

Local Coastal Water Use/Coastal Health:

-Has the health of the coastal waters changed over the past 15 years? (Since Hurricane Iris?) - What kinds of activities do local community members participate in in the coastal waters near the peninsula? (fishing, diving, etc.)

-What changes have you seen in these activities over the past 15 years? (Since Hurricane Iris?) - Do you know who manages the coastal environment? (reefs, mangroves?) How is that going? - Who does local Environmental Impact Assessments (EIAs) for development projects on the peninsula, if any?

- How is having to provide water and sewage for the tourists on the peninsula and keys influencing the coastal environment? Do you think things will change in the future?

-How would you describe the worth of coastal waters and water sources in the area?

<> What benefits do they have beyond economic value?

- [For fishing guides] What do local fisherman catch or produce on coastal waters? Where are major fishing stocks around the peninsula?
- Do you know of any existing sustainability plans / initiatives related to coastal health?

<> (If the respondent knows) Can you explain them?

[For NCL representatives]

- What activities and tours do cruise ship passengers have the option to do in coastal waters around Harvest Caye?

<> Do you know of any regulations governing tourist flows and / or activities in coastal Belizean waters? (If so, how is NCL working to meet these regulations?)

- Can you describe the environmental impact assessment (EIA) that was done for NCL's project on Harvest Caye?
- How do you think providing water and sewage for tourists on Harvest Caye will influence the coastal environment? Do you think things will change in the future?

- Do you know where NCL gets most of its food for cruise ship passengers from?

<> Have you heard of the initiative to declare the Placencia Lagoon a national protected area? (Type II Wildlife Sanctuary; initiative led by Friends of Placencia Lagoon) [If so] Is NCL taking any measures to minimize possible environmental impacts from tourism activities in the lagoon?

Sewage and Coastal Health

- Have you seen any connections between sewage removal/effluents and the health of the coastal environment? What kinds?

Institutional Strategies / Relationships

[For BWSL water management workers / personnel] What kinds of personnel and how many do you have working on management, repair, and service of the existing water system on the peninsula?

- [For BWSL (waste)water system management workers / personnel] What kinds of personnel and how many are / will be working on the proposed centralized wastewater treatment / collection system?

<> Is BWSL bringing in contract workers to work on the project? Local Peninsula community members?

- [For BWSL water management workers / personnel] In what ways / media is BWSL communicating information about the project to the villages of Placencia, Seine Bight, and elsewhere on the peninsula?

<> What specific mediums are being used? (pamphlets, community meetings, etc.) - [For BWSL water management workers / personnel] How would you describe BWSL's relationship with the Placencia and Seine Bight village councils?

<> What role, if any, do the local village councils play in management, oversight, or public relations of the centralized sewage collection / treatment system project?

- **Have you attended any public or private meetings about the BWS proposed integrated water and sewage system on the peninsula?**
  - Which other individuals / groups are involved in the events / meetings that you attend?
    - [For Placencia of Seine Bight village councils] How would you describe your village council's relationship with the BWSL?
    - What role, if any do the local village councils play in management, oversight, or public relations of the centralized sewage collection / treatment system project?
  - [For other stakeholder sector interviewees besides the BWSL] Describe your organization's relationship with BWSL on the peninsula.
    - What services does your organization receive from BWSL, if any?
    - What kinds of interactions has your organization had with BSWL since the project was originally proposed?
    - Has / is your organization partnered(ing) or coordinated(ing) with BWSL on any plans, projects, or initiatives on the peninsula?
    - Have you discussed your thoughts about the project with other stakeholders before? What was the topic?
    - Do you have the ability to voice your opinions / concerns in these meetings / discussions?
      - Do you?
    - Do you feel that your participation in decision-making for the project is limited by other groups? How so?

[For NCL representatives]

<> Is NCL bringing in contract workers to work on the cruise ship project? What about hiring local Peninsula community members?

- In what ways / media is NCL communicating information about the project to the villages of Placencia, Seine Bight, and elsewhere on the peninsula?

<> What specific mediums are being used? (pamphlets, community meetings, etc.)

- How would you describe NCL's relationship with the Placencia and Seine Bight Village Councils?

<> What role, if any, do the local Village Councils of population centers around Harvest Caye play in management, oversight, or public relations of the NCL project?

<> [For other stakeholder sector interviewees besides the BWSL] Does NCL interact at all with the local BWS office? If so, describe NCL's relationship with BWS on the peninsula.

- ➢ What services does your organization receive from BWSL, if any?
- ➢ What kinds of interactions has your organization had with BSWL since the project was originally proposed?
- ➢ Is your organization partnering or coordinating with BWSL on any plans, projects or initiatives on the peninsula?
- ➢ Is NCL involved in decision-making processes about the proposed centralized sewage system? (If so) How?

Tourism Industry

- [Generally, who would you say makes decisions about tourism development on the peninsula?] - How do you feel about foreign funding for tourism development here on the peninsula?

- Have you heard about the NCL project on Harvest Caye? (If so) What do you think about the project?
- Can you tell me a little bit about if and how the NCL project is impacting the people on the peninsula?
  - What forms of information have you received about the NCL project? Have you attended any meetings about the cruise tourism project?

- What do you think are some of the benefits and risks of having NCL cruise ship tourism around the peninsula?
  - To local livelihoods?
  - To human health?

- For the environment (coastal, lagoon, sea-side, reef)?
- For the tourism industry / tourism development?
- Other potential economic opportunities

- What kinds of impacts, if any, do you think cruise ship tourism may have on existing (waste)water management infrastructure? Have you seen any changes to local waste(water) management infrastructure since the NCL Harvest Caye project started operating? (If so, what changes have you heard about / seen?)

-What draws tourists to the Placencia Peninsula?
-How would you characterize the relationship between tourists and residents?
-What benefits and risk that you see with continued tourism development?
- Have you been personally affected by tourism?
- What do you think a "sustainable" tourism industry look like? - What do you see as the future of tourism on the peninsula?

- [For Seine Bight residents and interviewees] Why is Seine Bight often passed over by tourists as a destination?

[For NCL representatives]
- In what ways, if any, has NCL worked to engage local tour guide operators and associations on the Placencia Peninsula?

- What do you think are some of the socio-economic benefits of the NCL project on Harvest Caye for surrounding communities?

- Do you see any socio-economic risks? [If so, what are they?]

Heritage and Culture

- What do you consider part of your cultural and environmental identity, history, and legacy on the peninsula?

- How would you explain local heritage to a tourist?

- How do you think culture on the peninsula is portrayed by advertisements, online, in the media, or to foreign tourists?

- Do you think people around the peninsula are interested in constructing a local culture and history museum?

Demographics:
-What is your nationality?
- What do you consider your ethnicity / ethnic group to be?
-What is your age?

-What is your gender?
-How long have you lived in/worked in/been affiliated with the peninsula?

Closing
-Is there anything else you would like to add?
-Is there anything that you wish I had asked that I did not?
-Do you have any questions for me?
- Thank them for their time and participation in the study

Thank the interviewee for their time and participation in the study.

Provide them with contact information for the interviewer (email and / or mobile phone number), and the "Following Up (part II)" season PI, E. Christian Wells (ecwells@usf.edu))

Appendix B: IRB Exempt Letter

UNIVERSITY OF SOUTH FLORIDA

EXEMPT DETERMINATION

April 7, 2020

[redacted]

Dear Mr. William Webb:

On 4/6/2020, the IRB reviewed and approved the following protocol:

Application Type:	Initial Study
IRB ID:	STUDY000570
Review Type:	Exempt 2
Title:	The Anatomy of a Wastewater Development Project
Funding:	None
Protocol:	• The Anatomy of a Wastewater Development Project

The IRB determined that this protocol meets the criteria for exemption from IRB review.

In conducting this protocol, you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Please note, as per USF policy, once the exempt determination is made, the application is closed in BullsIRB. This does not limit your ability to conduct the research. Any proposed or anticipated change to the study design that was previously declared exempt from IRB oversight must be submitted to the IRB as a new study prior to initiation of the change. However, administrative changes, including changes in research personnel, do not warrant a modification or new application.

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a new request to the IRB for a determination.

Institutional Review Boards / Research Integrity & Compliance
FWA No. 00001669
University of South Florida / 3702 Spectrum Blvd., Suite 165 / Tampa, FL 33612 / 813974-5638

Sincerely,

Amanda Shelley
IRB Research Compliance Administrator

A PREEMINENT RESEARCH UNIVERSITY

Institutional Review Boards / Research Integrity & Compliance
FWA No. 00001669
University of South Florida / 3702 Spectrum Blvd., Suite 165 / Tampa, FL 33612 / 813974-5638