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DESALINATION AND DEVELOPMENT:
LOCATING THE MISSING MASSES IN DAKAR'S WATER
NETWORK

by

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SUBMITTED TO SCRIPPS COLLEGE IN PARTIAL FULFILLMENT
OF THE DEGREE OF BACHELOR OF ARTS

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APRIL 21, 2023

Acknowledgments

Je voudrais étendre mes remerciements au Département des Études Françaises et Francophones à Scripps College et toutes les individus qui m'ont guidé. J'aimerais Professeur Curulla, qui a consacré ses temps précieuses à son rôle de lecteur, qui m'a guidée même dans les moments d'incertitude. Ses conseils m'ont aidé à naviguer les difficultés de la projet, et nos discussions ont vraiment amélioré mes études de recherche. Je tiens également à remercier Professeur Everett, qui m'a encouragé à poursuivre mes études au Sénégal, et à Hannah Lebow, ma camarade au cours de notre année terminale à Scripps.

J'aimerais aussi étendre ma gratitude sincère à mon maître de stage à Dakar, Professeur Cheikh Ibrahima Niang, qui m'a soutenue et accueillie dans tous mes travaux à UCAD. Nos conversations riches et son intérêt profond pour ma recherche et mon succès me poussent à vraiment transformer le monde. À l'équipe pédagogique de L'UCAD, aussi, j'étends mes grands remerciements: Mme Ta Oumy Touré, Mme Marie-Ange Gueye, et Abdou et Philomène. Je saisis cette occasion aussi pour adresser mes remerciements à Astou Sagna, qui m'a conseillé et soutenue quand je trouvais ma place au Sénégal. Ma formation à Dakar était une expérience transformative et inestimable grâce à ces mentors. Jërëjëf!

I would like to also thank the STS Department and my fellow STSers for four years of academic growth and (dare I say) development. I am particularly grateful to Professor Gabriela Morales for lending her time and her insight to this project. With her guidance, I was able to see my work in a new and multidimensional light. I would like to thank Professor Marianne de Laet for helping me work through this topic from a Latourian perspective; my final product is all the better because of it. I would also like to extend a thank you to the late Bruno Latour, whose ideas have provided an essential foundation for both this thesis and my study of STS as a whole.

Finally, I would like to thank my family for their continued support for and interest in my studies. Their love, care, and belief in my abilities have been an invaluable source of encouragement for me, and I am immensely grateful to have such a wonderful and supportive family.

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Introduction

On the westernmost coast of the African continent, nestled between two formerly volcanic hills referred to as *Les Mamelles*, or “The Breasts”, a revolutionary technological artifact is waiting to be born. A desalination factory under construction on Mamelles Beach will transform the ocean into drinking water for the growing population of Dakar, Senegal. Posited as a solution to strict infrastructural constraints and a rising demand for water, this technology embodies techno-industrial prowess and African “emergence” in a country striving for global economic development. As the former administrative capital of West Africa and an emergent multinational center of commerce, Dakar has seen many societies construct themselves with and from the land itself. The skyline of the city reflects this dynamic and tumultuous history, and the desalination project will become part of the skyline and history alike.

The site of the future factory is located next to a French colonial lighthouse on one *mamelle*, and a massive 21st-century statue on the other (See Figure 0.1 and Figure 0.2). The Phare des Mamelles is a French colonial construction from 1864, currently serving as a lighthouse and upscale tourist destination (Rowlett and University of North Carolina at Chapel Hill 2005). Meanwhile, the Monument de la Renaissance Africaine is a 50-meter-tall bronze statue of a man, woman, and child commemorating 50 years of independence in Senegal (GEMO Bâtiments et Infrastructures 2011). The factory, like these two monuments, is a monument in itself, representing Dakar as a thriving urban space of technologically mediated development.

Each of the three monumental constructions on the Mamelles Beach represents three different iterations of Dakar – and three different regimes of power – throughout history: one was mobilized for colonial profit, one oriented itself towards economic emergence, and one, the

current Dakar, is hopeful to alleviate resource and infrastructural concerns using technology. Compared to these monuments, each of which represents a regime of power in Dakar, the walled-off¹ construction site of the desalination plant does not seem like much at all. However, as this thesis asserts, the desalination plant will soon become – and already has become, in a way – a new regime of power dominated by technological solutions and socioeconomic emergence. Elements like local environments, colonial agriculture, political narratives, urban hydraulics, and indigenous land rights intertwine and construct ideas of the project as an environmental, colonial, political, infrastructural, or local solution before it is even built. The desalination project represents a monumental solution to fundamental concerns about the future of Dakar.



Figure 0.1: Usine de Dessalement des Mamelles on the Cap-Vert peninsula.
Source: Google Earth

¹ Due to privacy concerns and political sensitivity, the desalination construction project is surrounded by a massive wall and cannot be seen from the ground.



Figure 0.2: Usine de Dessalement des Mamelles relative to Phare des Mamelles and Monument de la Renaissance Africaine. Source: Google Earth

Such a technologically advanced public works project, especially one that addresses chronic water insecurity in an economically disadvantaged area, is largely unprecedented. The engineers and politicians pushing this project forward promote it as a magical paradigm shift in Dakar's resource politics. Using political and technical narratives, these actors circulate ideas of technological power and technological solutions surrounding the factory. However, these lofty narratives tend to obscure physical and material realities, namely, the people and environments affected by this project. This analysis, building from the disciplines of Science, Technology, and Society and French and Francophone Studies, gives a multiplicity of factors – narrative and material alike – equal representation in this analysis.

While the Phare represents an era of colonial dominance and the Monument de la Renaissance embodies one of African emergence, the desalination plant signifies an era of

technological innovation, progress, and magic that liberates Dakar from water scarcity. And certainly, the process of desalination seems magical: it performs a microscopic alchemy that transforms a useless form of water into a vital one. To turn towards such a vast, inaccessible source of water like the sea and successfully mobilize it into fulfilling a fundamental human need would be nothing short of wizardry without industrial technology. Similarly, that a historically impoverished country could build a massive technological monument, previously existing solely in richer countries in the West or Middle East², seems like a fantasy. With foreign investment and public-private partnerships, though, the impossible is achievable – that is, funded and constructed – in areas otherwise incapable of achieving it alone.

In reality, technology is not magic, and investment is not fantastical. The *true* means by which desalination addresses water problems in Dakar is not its technological capacity but rather its power to assuage fears of scarcity and under-development. The desalination project not only depends on local resources like land, water, and energy, but it also depends on people's desires for better water systems and technological development. Dakar's desalination plant needs people to need it, and the many constructions and relations surrounding this project describe how idealization and desire, more than material needs or public support, have pushed this project into existence. In analyzing Dakar's network and unpacking the actors who create the necessary social, environmental, and institutional conditions for the desalination plant to succeed in this network, I aim to understand how desalination is construed as a quasi-magical, technological

² According to a global study by Jones et al (2019), almost half of global desalination capacity is located in the Middle East and North Africa, whereas only about 1.9% occurs in Sub-Saharan Africa. The global proportion of desalination located in low-income countries is “negligible” in this study, at less than 0.1%.

solution to resource insecurity in Dakar and the various ways in which this “solution” affects the public.

Methods and Theory

Within the study of Science, Technology, and Society (STS), one of the most important frameworks for understanding the technological construction of society and the social construction of technologies is called Actor-Network Theory (ANT). In this thesis, I employ ANT to understand and model how this desalination technology fundamentally alters socio-environmental aspects of Dakar, as well as the ways in which Dakar and its specific needs construct desalination technology as necessary and valuable. Because water, humans, and values shift between different contexts and relationships, ANT enables a unique analysis of these relations themselves. Instead of attempting to define and identify the actors in this network, like the factory, the government, or the local autochthonous community, I trace the relationships and actions *between* these actors. It is these relationships that expose how the desalination project promises magical fixes to institutional problems and erases the material consequences of the plant itself.

ANT analyzes relations rather than identities in an effort to detach social and technological analyses from rigid categorization. Specifically, it uses the terminology of actors and networks. Objects and humans are studied equally as *actors*, any entity that exerts an active effect upon an *actant*, or object of action. This analysis of actors does not differentiate between social, technological, ecological, or political actors; actors are defined not by an inherent identity but by their active relations with other actors. Each actor tells a story about another actor, which associates with other actors, each of which has its own stories involving other actors, *ad infinitum*. This precarious yet constantly shifting web of relations is called a *network*. Networks

cannot be defined in their totality; they are fractal, nonphysical entities that can only be explained through the effects of one actor on another. Instead of delineating unidirectional cause-and-effect relationships, ANT relations go both ways – or, perhaps more precisely, all ways. As leading ANT scholar Bruno Latour describes: “Instead of thinking in terms of surfaces –two dimension– or spheres –three dimension– one is asked to think in terms of nodes that have as many dimensions as they have connections” (Latour 1996, 3). The application of ANT to key actors in the desalination project’s network, then, is a means of understanding how this technology plans to enter the complex network of water politics and urban living in Dakar. Actor-Network Theory works for the desalination plant because it refuses to take things as they are, like the desalination plant that exists in blueprints and policies, and instead focuses on the relationships and effects that emanate from and between all things.

Primary Sources

My primary source research on the desalination plant comes from the official study of the project, called the *Étude Préparatoire du Projet de Construction de l’Usine de Dessalement de l’Eau de Mer aux Mamelles*. This study and the larger Mamelles desalination project are headed by the Japanese International Cooperation Agency (JICA), a development and engineering firm geared towards helping Global Southern countries develop technological solutions to economically debilitating problems. For this project, JICA has spearheaded the funding and construction of this desalination project because the Senegalese government alone does not have the resources to construct this Project. Around 27 billion yen, or 145 billion Francs CFA, is on loan to Senegal for the construction of this desalination plant and the renovation of some reservoirs and pipelines (JICA 2015a). This is a profoundly political-economic organization, working towards the technological and socioeconomic development of countries like Senegal.

However, they declined all requests for meetings or information during my field work in Senegal, and the project is considered relatively politically sensitive. In this project, JICA is the main development and engineering operator, providing technical and economic information by way of the *Étude Préparatoire*. The study itself overviews the social, natural, infrastructural, political, and economic factors that bear upon the implementation of this desalination project. In a way, my study complements that of JICA in that it also considers these actors and their roles, but I implement an STS framework to add a critical academic perspective to this monumental project.

Senegal's national water organization, SONES, is another primary source of information on this desalination project. As the main governmental institution tasked with providing water, SONES is a key player in the local implementation of this technology into Dakar's public and administrative systems. While JICA and its study account for the technical and material components of this project, SONES controls the main political and media effort behind the desalination project. SONES is the public component of a Public-Private Partnership (PPP) in the water sector, which was instituted, at least partially, in response to global economic initiatives promoting the economic value of water.³ Since the implementation of the PPP, water access in Senegal has risen from 70% to 98.7%, the vast majority of access being private connections in the urban area (JICA 2015a). However, the cost of water under the PPP is a limiting factor⁴;

³ Specifically, institutions such as the World Bank and the Objectifs du Millénaire pour le développement (OMD) used the economic principles of supply and demand to promote the PPP schema of public water provision (Moussa Diop 2014; Société Nationale Des Eaux Du Sénégal - SONES n.d.). The political context of the PPP is elaborated in *Constructions of Water Relations in the Postcolonial City's* section on *The 21st-Century Economic Renaissance: PPP and PSE*, and the economic context is elaborated more in the desalination context in Chapter 2's section, on the *A Hydro-Social Fix: Discursive*.

⁴ This is an opinion outlined in JICA (2015a), section 3.3.2(1), regarding data on client satisfaction with Dakar's water service, quality, and cost.

some choose to bypass the public water service and pump from contaminated groundwater (Kane 2007; Pouye et al. 2022; 2023). Thus, the PPP and SONES are controversial institutions of state water provision that have both improved and complicated water access in Dakar and across Senegal.

Key Terms and Concepts

Throughout this analysis, I employ some academic terminology that lends nuanced insight into the network of water relations. At face value, this project is a nonexistent building based on blueprints for a well-known technology. My analysis does not always focus on these obvious or concrete understandings of desalination, as a solely material or technological analysis of this project would overlook the relationships that define the function and meaning of desalination in Dakar. Instead, I turn to ANT and STS to inform my analysis of the desalination project as a complex, entangled actor in urban Dakar.

The “Magic Bullet”

One significant idea at the heart of my thesis is the idea of a “magic bullet”, a perfect fix or solution that targets a specific problem without affecting other actors. First coined by Dr. Paul Ehrlich to describe a highly specific antibiotic targeting dangerous microbes, the term “magic bullet” has been used in STS to describe the unrealistic standard by which technologies are expected to target specific problems without bearing on peripheral entities like environments or communities (Vivian 1994; Edwards and Hulme 1995; Baue 1997; Warn 2006). As is evident in the web of relations under ANT, this idea of a magic solution is not realistic, and it erases the realities of collateral damage effected by technological “fixes”. Throughout this study, the idea of a magic bullet informs the construction of this desalination project as a simple fix or solution,

thereby ignoring the material and sociocultural effects of the desalination plant itself on its surroundings.

Co-Construction

The idea of *co-construction* becomes a key factor in understanding just how a technology can pose itself as a solution to environmental and institutional problems in a society. A core component of STS analyses is the question of how things are constructed and the conditions that make them so (Bijker, Hughes, and Pinch 2012; Sismondo 2008). This does not just apply to the ways in which humans construct their surroundings but also applies to how surrounding actors like nature or technologies construct humans. In tracing the flows of water and humans, specifically, the settlements and practices of humans determine how water flows, and the flows of water determine how humans settle and practice. Describing social and natural processes as co-constructive, as opposed to parallel, relational, or symbiotic, emphasizes the dynamic interplay of both systems as *subjects* that build and guide each other.⁵ This idea reinforces the ANT principle of symmetry, in which human and nonhuman actors are analytically equal (Latour 2006). What would normally be considered an object, like a river or street, is actually a subject and actor that influences and is influenced by others in the network across social and material dimensions alike.

The Missing Masses

Bruno Latour's question of the "missing masses" is a foundational concept in STS that lends to my analysis of this desalination plant and its relationships. Using an analogy from

⁵ Some examples of co-construction in STS study include Jasanoff (2010); Oudshoorn and Pinch (2005); Khurshid (2021); and Pinch and Swedberg (2008).

physics, Latour explains, “there is not enough mass in the universe to balance the accounts that cosmologists make of it. They are looking everywhere for the “missing mass” that could add up to the nice expected total. It is the same with sociologists...When adding up social ties, all does not balance,” (Latour 1992b, 227). The “missing masses” in this desalination project are intangible and invisible actors that explain this desalination project’s value and existence. As Chapter 2 explains, the technical and material components do not add up to equal the massive impact and cost of this project. The actors behind this desalination project thus assign it a massive *discursive* value to balance out the discrepancy between its minimal technical impact and its massive sociopolitical impact.

The Hydro-Social Fix and Hydraulic Politics

I use the terms *hydro-social fix* and *hydraulic politics* to identify the two main discursive values that push this project into existence. These terms build on Erik Swyngedouw’s work on water politics and technologies, which describes the ways in which technologies like desalination reflect the values of the contexts and institutions surrounding them. I use the idea of a *A Hydro-Social Fix: Discursive Solutions to Dakar’s Water Insecurities* to understand how the desalination project technologically augments Dakar’s water supply but does not “fix” the structural and infrastructural failures of the water distribution system. This provides the reassurance of a magic-bullet solution but allows the continuation of structural problems like water loss and mismanagement. Meanwhile, I use Swyngedouw’s concept of *A Hydraulic Politics of Desalination: Developing the Future* to explain the effect of political discourse that characterizes this project as a force of development and progress: the hydraulic project is enrolled in the political power structure and reproduces existing political values.

Positionality

In this project, I try my best to represent the actors surrounding this desalination project as accurately and empathetically as possible by bringing documents, rhetoric, and public activism to the forefront of the argument. While I have described the network into which and around which the desalination plant comes into existence, I cannot speak for a technology like the desalination plant, just as I cannot speak for Lébou or Dakarois activists themselves. As postcolonial scholar Nikhil Anand says, “The telling of stories is always a political act. Ethnographers have been famously uneasy with the ways in which our stories silence others.” (Anand 2017, viii). However, in placing the official actors on the same level as subaltern voices, I hope to elevate the discussion of this project past ideas of technological solutions and towards an understanding of its sociocultural ramifications.

Though my methodologies largely relate to STS, this is a Francophone Studies project as well. Most of my main sources – and my lived experiences in Dakar – use the French language. However, it is important to remember that Dakar largely speaks Wolof, and the French language dominates legislation and business. My writing comes from a perspective of Francophone Studies, whereas it is less informed by African Studies, Political Science, or Urban Studies, to name a few disciplines. From this perspective, I synthesize French-language documents and theories, English-language scholarship, and visual media. I have traced the water into and throughout this complicated network, and I have used my languages to understand the ideas that people want to broadcast to the world; however, I cannot step outside of my own perspective as an American scholar of the French language with no cultural heritage in West Africa. I do, however, aim to actively decolonize the academic sphere, and I hope to expand the academic representation of West Africa in STS and French and Francophone studies.

Chapter Overview

In the effort to establish how Dakar's desalination project promises magical fixes while erasing its material harm to its surroundings, I have divided the analysis into three chapters that address different areas of the network: Constructions of Water Relations in the Postcolonial City; Desalination as a Solution to Material and Cultural Insecurities; and "Public" Works and Working Publics. Ultimately, the relationships in this network indicate two conflicting visions of the desalination factory: one in which it technologically fixes material constraints in Dakar's urban space, and one in which technologies and development disenfranchise less powerful individuals and communities.

In Chapter 1, I argue that the ways in which different societies use, manipulate, and define water are key components of the current desalination project because they create the ecological, narrative, and cultural conditions from which the desalination plant derives value and power. Histories of resources, engineering, and human needs reveal the co-constitution of water and culture throughout history. This co-constitutive aspect of water and culture means that a desalination plant aiming to change the flows of water in a society will ultimately also change its culture. Those who bring this desalination project into existence, however, largely disregard the cultural understanding of technology in favor of economic, technical, and political considerations.

Chapter 2 pivots towards the cultural sphere, as the desalination plant relies upon cultural values and discourse to give it meaning and purpose. Technically speaking, the project only addresses water service in a small portion of Dakar's population. Such a small-scale impact does not outweigh the social and environmental tolls of this desalination plant, plus the political push to develop it. This chapter aims to find the "missing masses" that discursively elevate the

sociopolitical significance of this project. Ultimately, the project represents hydrological solutions and sociopolitical development. Subjecting these two terms to scrutiny by analyzing their actions in the network surrounding the desalination factory, the chapter reveals the disconnect between the weight of these discursive values and the material realities of this desalination project outlined in Chapters 1 and 3. People are afraid of running out of water and they are hopeful for progress; addressing these emotions with ideas of solutions and development vastly outweighs any concrete fixes surrounding the desalination project.

Chapter 3 shifts away from overall cultural values addressed by the desalination plant and instead aims to represent the different publics actively enrolling themselves in the discourse surrounding desalination in Dakar. Namely, locals and activists have pointed out the significant offenses posed to members of the public by the construction of the desalination plant. Here, the project no longer exists only in discourse and politics and is held accountable for the structural violence inherent to its physical existence. This chapter shines a light on the structural violence inherent to the desalination project, including the displacement of locals and the severing of spiritual relationships with the environment. The activist counternarratives introduced to the desalination plant's discursive role in Dakar serve as a reminder that development and technological fixes should not come at the expense of local communities and their ways of life.

Chapter 1. Constructions of Water Relations in the Postcolonial City

The historical context of Dakar itself creates the specific conditions from which desalination has emerged as a technological fix to water problems. Specifically, a historical analysis reveals that water and culture have, across history, been *co-constitutive*: within the network of water relations throughout history, humans have constructed the ways in which water flows, and water has constructed the ways in which humans flow. The existence of water in its various forms on the Dakar peninsula is constituted by humans, just as Dakar itself is constituted by the existence of water.

There is no singular form of water, and the liquid takes on many forms and roles throughout history. Similarly, there is no one group of humans, and different groups of people create unique social and institutional contexts that shape how they view and treat water. To identify these contexts and the people behind them, one can look no further than Mamelles beach. The first context observed on Mamelles Beach is the first documented proprietors of the land, the Lébou community, who constructed cities and cultural practices on the beach itself. Tellingly, many of these constructions are no longer present in the area, but the Lébous maintain a special relationship with both land and sea. The next context is embodied in the lighthouse that sits atop one of the Mamelles, constructed by the French colonial regime. The colonial era marked the introduction of industrial agriculture and irrigation practices that have irreparably shaped the distribution of water in Dakar today. Two centuries later, the Monument de la Renaissance was built on top of the other Mamelle, coming from an era of hope through economic emergence. The neoliberal context under which this monument was built indicates the extent to which the Senegalese government maintained colonial economics and settlement beyond colonialism and into a globalized 21st-century context. Finally, we turn to the nascent

desalination plant, which occupies both land and sea. This history of monuments and eras recounts the multiplicity of co-constitutive relationships shaping humans and water throughout the year. Past relationships between humans and their environments provide the unique context under which the desalination plant has been construed as a technical fix.

Lébou Ontologies of Land and Sea

The story of Dakar's water network begins with the Lébou ethnic group, who arrived on the Cap-Vert peninsula around the early 15th century. The land and water of the Cap-Vert peninsula have an intimate relationship with the Lébou, and Lébou ontology is shaped by the complex and symbiotic relations of the environment and its residents. Though Mamelles Beach has been a part of ritual, mythological, and sociocultural Lébou history for 600 years, the desalination plant denies Lébou people access to this area. Following a long tradition of occupation in the Cap-Vert peninsula, the desalination plant fundamentally violates Lébou land ontologies in the quest to "solve" water problems.

The Lébou community, officially recognized as the Lébou Collectivity⁶, settled around the coasts of Ouakam, Yoff, and Ngor and have developed a robust fishing culture that continues today. Unlike settlers of today's Dakar, the Lébou ethnic group developed a lifestyle, language, and ontology particular to the environment of the Cap-Vert peninsula. Specifically, in the network surrounding the desalination plant, Lébou land relations and urbanism are significant yet underrepresented factors in the function and value of this project.

Spiritual-Material Land Relations in Lébou Tradition

In Lébou land relations, the proprietors of the land are the *rab*, spirits tied to the land or sea. When the first Lébou community migrated to the Peninsula, they formed a pact with these local spirits and entered a continued relationship of cohabitation with them. However, this is not

⁶ The Lébou Collectivity is also called the Lébou Republic, a title originating in designations by French officials. The colonial administration and current government recognize the community's structure despite occupying and developing their land (Sidibé 2013)

a transactional exchange but a symbiotic relationship. Scholar Sarah Buchanan (2018) describes the relationship of mutual respect as follows:

une fois qu'on respecte leurs désirs, vivre avec les rabs est aisé et permet aux Lébous d'avoir une compréhension profonde du monde naturel. Ces rapports créent ainsi une éthique communautaire liée à la fois au monde naturel et mystique, car les Lébous évoluent dans un système de réciprocité entre les gens, les esprits et la nature composée d'une multitude d'êtres conscients (Buchanan 2018, 149)

This network of *êtres conscients*, grounded in the physical environment, shapes Dakar's Lébou culture through cultural-religious practices. The beach, in particular, occupies a special place in Lébou metaphysics as the intersection between land and sea, outlined further in the section on The Lébou Significance of Mamelles Beach and its Occupation. However, occupation of the Lébou littoral is approaching the aquatic domain: "pieds-dans-l'eau" tourist destinations⁷, international and en-masse fishing industries, and industrial pollution from the new desalination plant encroach upon Lébou waters. Thus, development interests have superseded (and largely succeeded in) the occupation of Lébou land. A new paradigm of sea occupation has begun.

Urban Placemaking in Lébou Tradition

The centuries-old Lébou culture built a civilization both on and with the Cap-Vert environment, and the environment still bears traces of Lébou urban logic today. Urbanity in itself is a dynamic network co-constructed by past flows of people and resources. Postcolonial urban Dakar has inherited an environment altered by many iterations of human-resource organizational

⁷ This term refers to the trend of coastal development in tourism that advertises ocean views but privatizes the littoral environment. See Nikolli (2020) and Tinorua and Merceron (2005).

logic, which includes Lébou city planning. The urban network into which the desalination plant emerges is profoundly influenced by past and current Lébou understandings of urbanity and placemaking.

Cities orient the flows of people toward the actors it values the most. Cities oriented around water sources, then, indicate an institutional value of water imbued within the built environment. Conversely, communities where water is not central do not prioritize people's needs as highly. The original Lébou villages in Dakar centered around a public square of sociopolitical significance called a *pénc*. This central park, usually marked by a monumental tree⁸, embodied physical and institutional centrality (Ross 2008; Bigon and Ross 2020). A grid of roads and neighborhoods often surrounded the *pénc*, directing the flows of people towards and around it. Powerful members of a community, like aristocrats and political figures, lived in city centers surrounding the *pénc*; while it was a public space, the central *pénc* also represented an exclusionary space delineating power and authority (Bigon and Ross 2020). Though Lébou villages themselves were violated and often displaced throughout Dakar's urbanization, the layouts of past grid-and-*pénc* systems survive today. Figure 1.1 and 1.2 show a side-by-side comparison of the grid-and-*pénc* layout in Yoff, a historically Lébou area in Dakar that will soon be served by the desalination project, between 1940 and 2023.

⁸ *Arbres à palabre* (from Portuguese *palavra*, meaning speech or discussion) are trees which serve “public, social, and political functions” in West Africa (Ross 2008, 136). Ross (2008) theorizes that the *arbre à palabre* predates the town square.

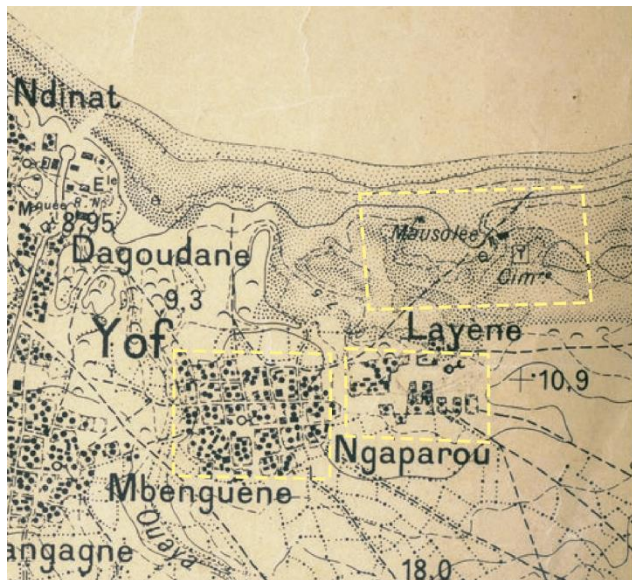


Figure 1.1: 1940 colonial map showing the gridded neighborhoods of Yoff (Scale 1:10,000). From Bigon and Ross (2020), via Archives Nationales du Sénégal (1940), rectangles added.



Figure 1.2: Present-day map showing the gridded neighborhoods of Yoff superimposed onto modern streets (Scale: 1:7,874). From Google Earth (2023), rectangles added.

The centers of power and the organization of communities around them have remained despite urbanization, indicating the entanglement of Lébou placemaking in the fabric of modern Dakar. Understanding Lébou urbanism as history and as modernity lends a more profound vision to Dakar's urban space, which is both shaped by Lébou placemaking and actively disavows Lébou spaces.

The Lébou *pénc* was a local monument to sociopolitical values around which an entire community was oriented. Dakar, which also follows the grid-and-*pénc* logic, orients the urban space around constructions of commerce and state power. The *centre-ville* is oriented around the Place de l'Indépendance which, ironically, centers pre-independence colonial buildings like the Gouvernance and the Chambre de Commerce.⁹ The desalination plant, notably, is not located in the downtown hub of sociopolitical significance but is rather largely sectioned off from the city

⁹ The convergent grid layout evokes, in dominant urban scholarship, Haussmann's grid design that reconfigured Paris in the mid-1800s. While the Lébou grid-and-*pénc* system existed on the Cap-Vert peninsula for two centuries before Haussmann's Paris, Dakar's grid layout actually *was* engineered by Haussmannian architects in the colonial period. The centralization of institutional values, however, is common to both layouts.

by the massive Mamelles and the monuments that dominate their space. While it could have been located on the other coast, near the industrial zone, or farther north along the Grand Côte, this desalination plant was placed next to monuments and beaches instead of other factories. Social values are just as visible in this space of monuments at Mamelles Beach as they are in the heart of the *centre-ville*.

Loci of power, like the historic *pénc* or today's monumental Mamelles Beach, delineate centralized organization and power in urban areas. Specifically, institutional water provision is a function of urban planning, and water accessibility is often shaped by these loci of power and their values. For instance, some Lébou central planning initiatives provided public water access in or around the *pénc*. The dominant institution of the *pénc* thus became the sole access point for freshwater. The desalination plant today follows this tradition, as it makes the desalination plant the sole solution to the supply of freshwater needed to sustain a growing Dakar¹⁰. In this way, urban planners can guarantee that water is provided according to specific socioeconomic values when they make an institution the sole access point for water. Water access in the Lébou *pénc* was mediated by sociopolitical status, which determined how far away individuals were placed from water. In fact, colonized Lébou communities were actively displaced away from centralized, colonial public works¹¹; instead, non-governmental town services like collective action or cultural leaders acted as the *pénc* and provided water to a community (Fourchard 2004;

¹⁰ The desalination plant as a sole solution and “magic bullet” is outlined in Chapter 2 as the “A Hydro-Social Fix: Discursive Solutions to Dakar’s Water Insecurities”.

¹¹ Especially around the turn of the 20th century, Lébou villages were displaced to more distant and inhospitable areas like the Médina, located away from *centre-ville* public works facilities. See Nelson (2007) for more on early colonial displacement.

Diouf 1998).¹² Water access from the desalination plant, meanwhile, is mediated by today's public-private economic values, which construct pipelines primarily oriented towards private, metered water connections.¹³ For the urban planning of resources like water, the grid-and-*pénc* system indicates how people distribute themselves around resources or distribute resources around themselves. Lébou histories of urban planning indicate the degree to which, historically and currently, institutions that control the primary access point for freshwater have the power to control flows of people.

Today, Lébou homes are often expropriated to make way for urban development projects in today's Dakar. However, the ways in which people construct their living spaces have meaning, and that meaning is thrown away when people are displaced for development purposes. Many Lébou and Dakarois families live on one property, and they construct living quarters based on the size of their families (Mbow 1983). Many of these homes are located near or facing the sea where most people fish (Mbow 1983); however, many have left the coast (Sidibé 2013). The area's development projects and price inflation¹⁴, in addition to local environmental dangers like development-related pollution and landslides¹⁵, have caused many Lébou individuals to leave the coastal areas where they were raised. Lébou homes reflect the value of land and sea in a community, and the razing of these homes is a violence against these core Lébou institutions.

¹² One instance of community water provision under colonial rule is the case of El Hadji Malick Sy's backyard well in Tivouane, outlined in Bigon and Ross (2020). For more on non-colonial "town services", see Fourchard (2004).

¹³ 96% of Dakar has access to water through a private connection; despite acknowledging that "les personnes les plus démunies, ne [peuvent] pas bénéficier de branchement privé", the Mamelles desalination project has no plans to install public fountains JICA (2015a, 3-53).

¹⁴ The prices of land in historically Lébou areas have increased rapidly in the 21st century. Specifically, for Lébou littoral housing, the price of land in the 2010s increased three times since the 2000s (Sidibé 2015).

¹⁵ See Sidibé (2015; 2013) and Paskoff 1998) for more on environmental reasons for Lébou coastal displacement.

The Lébou Significance of Mamelles Beach and its Occupation

Many Lébou people live and work in the Mamelles area, where construction is currently underway for the desalination plant. While Chapter 3's section on Property and Ownership in Dakar outlines the desalination project's legal transgressions and limitations, it is first important to establish here the cultural context and significance of Mamelles Beach. Of course, this area is home to a primary fishing spot and marketplace as well as a thriving community beach organization (JICA 2015a; Sidibé 2013; "Plage des Mamelles - Tefesu bir" n.d.). However, the beach environment occupies a particularly special place in Lébou metaphysics as the intersection between land and sea. The Lébou fishing tradition is strong because of their spiritual connection with the sea, and this fishing expertise embodies both a technical and spiritual knowledge¹⁶; as the often cited saying explains, "les Lébous sont pêcheurs et les pêcheurs sont Lébous." According to Omar Ndoye, scholar of psycho-spiritual traditions in Lébou culture, spiritual-cultural practices and knowledges "utilise[nt] la matérialité normale du quotidien (vêtements, accessoires, certains lieux du village : maisons, quartiers, mer,...)" (Ndoye 2010, 5-6). Thus, the realization of the Lébou property agreement is neither transactional nor solely spiritual, and it is in fact profoundly material and local. Specifically at the Mamelles site, this materiality manifests in animist celebrations and regular sacrifices.¹⁷ In addition to being a site of culture and recreation, there is an autochthonous cosmology and history surrounding the Mamelles and their spiritual significance. The Mamelles site is not just Lébou property; rather, it is home to a

¹⁶ Technical knowledges include apprehensions of the sea state from the moon, waves, groundwater, animal behavior, and wind patterns. See Mbaye et al. (2020) and the interview in Ndiaye (2012) for more on the complex spiritual-technical significance of fishing knowledge.

¹⁷ Though it is outside the scope of this analysis to characterize the animist practices integral to Lébou culture, I have elected to list some here. The *ndeup* is a psychological healing practice whereby evil possessions are banished, involving songs and offerings. The *ndawrabigne* is a dance inspired by movements of fishers that takes place at the beginning of the *navet* rains to galvanize the spirits (Sidibé 2015; Moustapha Diop 1999; Ndoye 2010).

metaphysical and material relationship of *rab* and Lébou that precedes Dakar itself. To violate Lébou land, then, is to violate Lébou ways of living.

People and places – and people *in* places – construct meaning. The spaces in which people form cultures and communities are themselves actors in that culture or community, having just as much of a bearing on the overall culture as any individual. Building the desalination project on sacred land severs the co-constitutive relationship between the Lébou people and the Mamelles site; it is an affront to the Lébou self as equally as it is an affront to Lébou land. The willingness of development projects like the desalination plant to ignore certain actors, like marginalized groups or spiritual locales, reflects the ways in which such projects deprive individuals of power and agency.

Colonial Constructions of Power in Dakar

The French colonial regime instituted a monocultural-industrial agro-economy that extracted value from the land without regard for its negative environmental and sociocultural tolls. The Phare des Mamelles represents this extractive relationship in that it was built on top of the Mamelles landmark to facilitate large-scale, French-dominated trade. In the same sense, the colonial regime desecrated existing relationships of arable land, water, and labor in Senegal for French economic benefit. The desalination project, too, ruins terrestrial and aquatic environments for the benefit of very few Dakarois. Ecological and individual violence, here, forms the basis for significant sociopolitical changes and can usher in monumental eras like that of the Phare or the desalination plant. This section aims to understand the colonial dynamics at play in the construction of desalination as a “fix” to water insecurity. Although the current displacement, disenfranchisement, and disavowal of locals are in no way comparable to the large-scale colonial

exploitation of Senegal, both contain an underlying dynamic whereby technologies and ideologies often obscure negative consequences.

The source of environmental and economic exploitation in the colonial era can be found in the implementation of monoculture plantations, which necessitated massive amounts of land and labor on a scale well beyond that of pre-colonial Senegal. Two main results of this colonial land reconstruction bear upon the desalination project today. First, the French re-engineered water sources towards profitable plantations and the colonial metropolis of Dakar built with these profits. These prioritized flows of water are significant sources of Dakar's water today, implying a lasting colonial influence on Senegal's waterworks. Second, the widespread monoculture set in motion the current priorities and conditions of agriculture in Senegal. Colonial plantations and hydraulics are largely invisible in Dakar today, but their impacts can be traced across the modern network of actors. Plantation agriculture began a tradition of large-scale resource consumption that shaped how Dakar and Senegal interact with flows of water.

Plantation Monoculture

The French colonial regime used plantations and monoculture to reengineer the land for its own benefit. Plantations, first, provided the means for large-scale, industrial agriculture focused on French profit rather than Senegalese subsistence. In the early 19th century, the French colonial administration implemented a "colonisation agricole", which relied on large-scale agricultural production on colonial lands using the colonial labor force (Diouf 1980; Villard 1943).¹⁸ The French began agricultural colonization with the acquisition of all territory in the

¹⁸ See the 1816 Rapport au roi proposant l'envoi dans les Établissements français d'Afrique d'un ingénieur géographe, d'un minéralogiste et d'un agriculteur botaniste, d'un lieutenant-colonel du Génie comme commandant de Gorée (Ministère des Colonies Actes du pouvoir central 1816).

Djolof State of Waalo (Barry 2017).¹⁹ French occupation eventually expanded to encompass much of Senegal, shown as the orange territory in Figure 1.3.

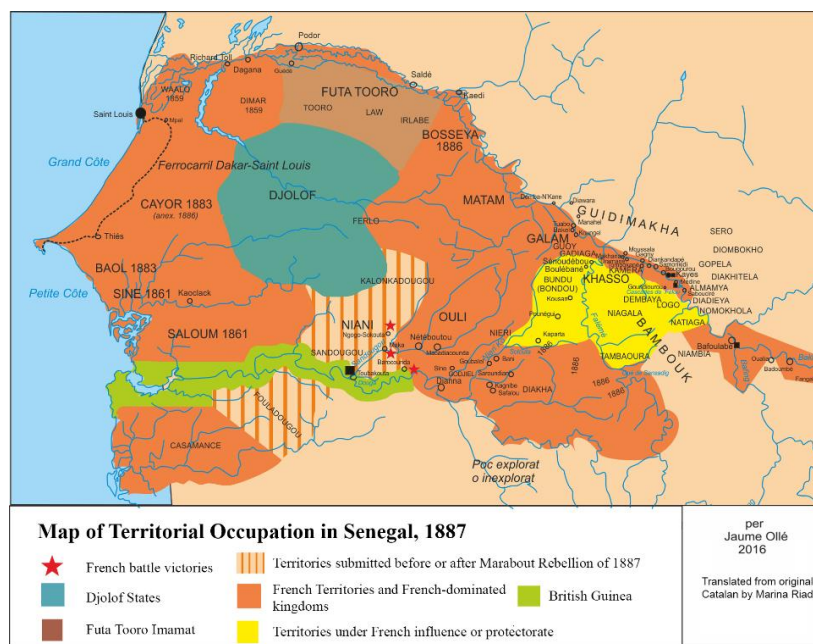


Figure 1.3: Map of Territorial Occupation in Senegal, 1887, from Ollé (2016).

Progressively phasing out slave labor near the mid-19th century, France increased the scale and intensity of agriculture in Senegal. This ultimately manifested in massive plantations of peanut *monoculture*, whereby Senegalese land and labor were organized solely around peanut production and exportation. Figure 1.4 shows the exponential increase in peanut exports in the century following the abolition of slavery (marked in red):

¹⁹ In the 1819 *Traité de Ndiaw*, the Waalo inhabitants paid the French around 11,000 francs annually for French military “protection” (Barry 2017). 11,715.70 francs in 1819 is equivalent to about 443,563.14 francs and \$75,005.73 USD in 2015, according to pre-Euro currency exchanges in the Historical currency converter from economic historian Dr. Rodney Edvinsson (n.d.). This is equivalent to around €87,490.60 EUR and \$95,202.99 USD today (XE 2023)

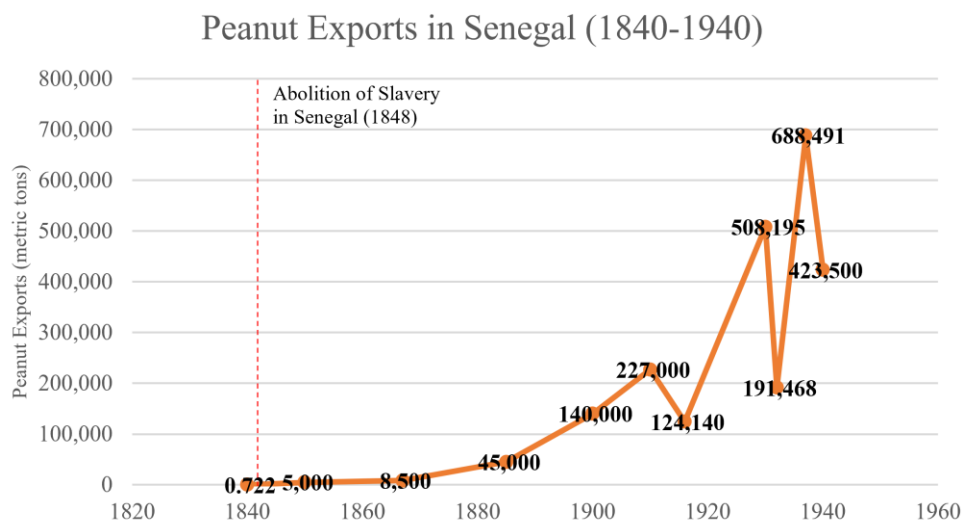


Figure 1.4: Peanut Exports in Senegal. Archival data sourced by Moitt (2001).

Following the institutional abolition of slavery, Senegal's peanut industry jumped from 722kg to 5,000 metric tons, nearly 700 times the original quantity exported. This massive increase in production in plantation agriculture is a function of an equally massive mobilization of land and labor. The French colonial regime transformed the landscape of inland Senegal, engineering nature to maximize colonial profit. However, this new landscape would pose problems of water service and resource dependency that exist today in Dakar's network of environmental relations.

French Colonial Agriculture: Engineering a Senegal that Works for France

The peanut monoculture plantations, upon which Senegal's state and economy wholly depended, necessitated a large-scale irrigation system to maintain and expand production. However, water scarcity was hardly a problem before large-scale agriculture; the region's seasonal rains, natural water reserves, and freshwater lakes sufficed for precolonial systems of

agriculture. For instance, Lébou agriculture used a small-scale *maraîchage-bocage*²⁰ technique in the Cap-Vert peninsula using dune reservoirs and vegetation to irrigate their fields (Dumez and Kâ 2000). French occupation, on the other hand, encountered a lack of water resources for irrigation and urban settlers. The French sought the environmental freshwater sources of the Fleuve Sénégal and its distributary, the Lac de Guiers, to aliment agriculture in the Peanut Basin. However, the rapid production of agricultural profit enabled France to set its sights on a new institutional priority: urbanization in Dakar. Like with the Lébou *pénc* or Dakar's desalination plant, institutional priorities often engineer the flows of water in an ecosystem.

With its plantation profits, the colonial administration concentrated its resources in Dakar, where more French immigrants were settling in the rapidly urbanizing area. However, narratives of scarcity soon appeared as there had thus far been no large-scale water distribution network for settlers or for the Cap-Vert peninsula in general. French colonial waterworks began in the 1860s, when colonists like Claude Faure constructed a massive reservoir “au milieu des dunes où les indigènes [Lébous] creusent leurs fontaines” (Faure 1914, 147). Unsurprisingly, Dakar's water system was founded upon the theft of Lébou resources and violence towards Lébou lifestyles. These first waterworks, engineered specifically for French settlers, were “le premier système technique introduit pour régler les problèmes de la vie quotidienne des populations résidant dans les centres où vivent de fortes communautés d'expatriés européens durant cette période,” according to urban scholar Salif Diedhiou's review of colonial hydraulics and public works. In these early stages of city-building and place-making, hydrants, underground pipelines, and wells extracted Lébou groundwater reserved for the French public (Betts 1971;

²⁰ *Maraîchage* refers to market-based agricultural practices, and *bocage* connotes fields surrounded by vegetation that limits land degradation and water waste. See Amin (1969); Dumez and Kâ (2000)

Harris 2011). Far from coincidentally, the Phare des Mamelles was also constructed on Lébou land during this era to facilitate the growing trade industry.

The lasting impacts of plantation colonialism and irrigation, explained further in the section on Freshwater Resources in Dakar, continue to damage urban Dakar's relationship to its environment. The colonial era was marked by a land politics of occupation, in which colonial agriculture occupied Senegal's fertile Peanut Basin and the colonial Phare des Mamelles occupied the Mamelles land. Today, the agricultural and public works domains continually suffer from the lasting effects of colonial exploitation. For instance, because agriculture was almost entirely confined to groundnuts, dietary staples like rice were eliminated from domestic agriculture and compose a significant portion of imports today (Jarret 1996); once a main producer of rice, Senegal has become the 18th largest importer of rice in the world (OEC 2021). Moreover, around one-third of Dakar's current pipes and reservoirs were originally designed in the colonial era (JICA 2015a). The colonial system designed to serve wealthy colonists – and *only* wealthy colonists – through the irresponsible exploitation of Dakar's local water resources is not confined to history. Colonial Dakar exists today, not just in the Phare des Mamelles but in the lasting colonial systems of environmental and economic exploitation. The desalination project mirrors this exploitation in that it interrupts Lébou land, community, and environment to construct this public works service.

Monument de la Renaissance Africaine: Economic Émergence in the 21st Century

The globalized, emergent Senegal manifested in the triumphant Monument de la Renaissance Africaine represents an era of hope and global relationships for Senegal that has directly shaped Dakar's relationships with land and resources today. Nearly two centuries after the Phare's construction and exactly 50 years after Senegal's independence, the Abdoulaye Wade administration constructed this massive bronze statue in 2010. This administration prioritized economic liberalism and a politics of *Sopi* ("change" in Wolof), which shifted away from post-independence socialist politics and the maintenance of colonial political-economic structures. The monument comes from this paradigm of change, and so does the desalination plant.

Like the desalination plant, this statue certainly *represents* a strong, positive force of change; however, both transgress social boundaries of property and respect in occupying the Mamelles Beach, a Lébou and Dakarois monument in itself. This transgression, whether by the statue or by the desalination plant, enacts a material and social violence on the land and people surrounding the statue. While Chapter 2's section, Developing the Future, investigates the discursive and material functions of futurism today, this analysis focuses on the ideological backdrop underlying the Monument de la Renaissance Africaine and the desalination project. The meaning assigned to this statue, and the desalination project today, obscures the transgressive reality of constructing monuments to progress and development that actively disenfranchise minorities.

The Monument de la Renaissance's Land Occupation

The Monument itself is a massive bronze figure of a man holding a woman and child, all three of whom look towards the sky. Imbued within the very idea that the Monument would be a national and Pan-African symbol is the idea that it must stand tall as a beacon to the city. And, at around 50 meters tall, it is the tallest statue in Africa (GEMO Bâtiments et Infrastructures 2011). Adding to its height, the Mamelle gives the statue an overall height of around 100m and enables it to be seen across the Peninsula.²¹ It dwarfs the Phare in both size and grandeur, but the price of this size and grandeur was that it occupied Dakar's remaining Mamelle. In attempting to, quite literally, reach for the sky, the actors behind this monument replicated the colonial dynamics of disrespecting lands and cultures in the pursuit of success and grandeur.

Like the desalination project, the Monument de la Renaissance also acquired the historically Lébou Mamelles through the Domaine Nationale. Many criticized the monument for its high price tag at a time when many Senegalese were struggling financially, but Président Wade contested that “le coût du monument est zero franc” (Wade 2011, 12).²² Instead, the State repossessed around 27 hectares of land in the majority Lébou Yoff arrondissement and gave the land to the construction group Mansudae Overseas Projects as payment (GEMO Bâtiments et Infrastructures 2011; Wade 2011). Interestingly, Wade explains in the official brochure for the Monument that “la valeur du terrain avant l'opération était très faible” but that the land would pay the 12 billion CFA price of the Monument (Wade 2011, 13-14).²³ According to Wade, “la

²¹ Ironically, due to massive development projects constructed under the paradigm of economic emergence embodied in this statue, the statue in fact cannot be seen from many areas where buildings stand tall.

²² Wade uses a metaphor in his official publication about the Monument, in which a child finds a rock only to discover that it is a diamond worth 5 million francs. Wade asks, “Combien le caillou lui a couté? Réponse: 0 franc... Quelle est la valeur du caillou? Réponse: à ce stade 5 millions” (Wade 2011, 13).

²³ Sources at the time projected the value to be around \$27 million USD (T. Sy 2009).

seule présence du monument dans la zone élèverait automatiquement le prix des terrains alentours” (Wade 2011, 14). In the era of emergence, land is worthless when belonging to the Lébou but, when in the mere presence of a monument to emergence, the land is worth billions.

The 21st-Century Economic Renaissance: PPP and PSE

The commodification of resources like land comes from turn-of-the-century neoliberal rhetoric that applies equally to water. Engineer and water theorist Gérard Payen explains the relationship between free water and costly operations as such: “l’eau elle-même, bien sûr, [elle] est gratuite dans la nature comme le poisson dans la mer. Mais il faut la pomper, la purifier et la transporter jusqu’à son lieu d’utilisation avec une organisation industrielle qui doit fonctionner sans faille 24 heures sur 24. Tout ceci a un coût qui est celui d’un service, celui de livrer de l’eau saine à domicile.” (Payen 2013). It is these costs that led to the partial privatization of water in Senegal with Senegal’s Public-Private Partnership (PPP), which focuses on funding public water services with public and private money. This partnership distributes the costs of water among consumers, municipal and State governments, donors, and non-governmental organizations (Ahouandjinou, Niang, and Sene 2020). However, the economic principles underlying the PPP reflect a history of global economics defined by Western institutions. At the turn of the century, largely Western²⁴ water experts, government officials, and United Nations committees produced the “Dublin Principles”, which largely emphasize the economic value of water as a function of supply, demand, and regulations. This economic framing proved a core tenet of future UN and

²⁴ The Project’s financial contributors are listed as Australia, Canada, Commission of European Communities, Finland, France, Germany, Ireland, Netherlands, Norway, Sweden, Switzerland, United Kingdom, and United States Of America. Other notable contributors include the US’s Food and Agriculture Organization (FAO), the World Health Organization, and the World Bank. Though Sub-Saharan Africa was not represented in the major organizers of this Project, the Dublin principles of water and the PPP solution have been implemented in countries like Senegal who are struggling to finance water distribution (ICWE 1992).

intergovernmental publications on the universal right to water and the crisis of water scarcity around the world (Savenije and van der Zaag 2002; De Stefano 2010; Keulertz and Riddell 2022).

The tradition of this 2000s notion of economic change continues today in the current administration's Plan Sénégal Émergent (PSE) as in the desalination plant. The PSE details a roadmap towards economic "emergence" and aims to advance Senegal as a key player in the global economy. Its values of development, international relations, and human capital reflect the neoliberal economics dominating the international financial network and the ideology of emergence symbolized in the Monument de la Renaissance. In fact, the desalination plant is explicitly mentioned in the PSE as a primary project for infrastructure development under a public-private partnership. The continuation and exponential development of Senegal as an "emerging" country has historically proven detrimental to communities marginalized by dominant institutions, and the desalination project is one of many envisioned development projects under the ideology of emergence.

The story of dominant institutions thriving at the expense of marginalized groups has been told before, both in Senegal and worldwide. My analysis, though critical of the narratives and effects of this project, is not a critique of the desalination plant itself, nor should it be interpreted as a political stance against certain administrations. This is a pattern of relationships that exist independently of regimes, eras, and cultures. In fact, if the desalination plant were not built, there would have been another project to arise and feed from these generations-old relationships between peoples, land, and ideologies. The historical trend of oppression, under which the environment and marginalized people are sacrificed for ideals like economic success or glory, produces and feeds the dominance of projects like the desalination plant.

Water Relations Today

The preceding eras of placemaking in Dakar culminate in the current material and cultural conditions that shape desalination as the solution to Dakar's water problems. This final section establishes the material environment in which Dakar's desalination plant emerges and gives a general overview of the relationship between desalination and its ecological surroundings. In my investigation of how desalination came to be considered the fix for Dakar's insufficient water provision system, it is necessary to establish the material and environmental processes that already exist in Dakar's water network. This section contains two main components that are key to understanding the relationship between desalination and its place in Dakar: first, I outline the existing sources of freshwater in the Dakar peninsula that the desalination project plans to supplement; second, I explain the relationship between desalination technology and the environment, which includes aquatic and atmospheric pollution. Ultimately, this chapter reveals that Dakar's environmental problems are profoundly human and cannot be solved with the "magic bullet" of desalination.

Freshwater Resources in Dakar

There are many sources of water in and around Dakar, and water as a resource is by no means scarce. Seawater desalination is just one technology that joins a legacy of natural engineering projects designed to meet a community's needs across history. This section elaborates upon three different water resources in the peninsula: rainwater, groundwater, and surface water. Potable water sources abound in Dakar, but the city still finds it difficult to provide for the ever-changing population. Rain, surface, and ground water, as well as the urban byproduct of wastewater, prove difficult to capture on a large scale, and they suffer from the structural effects of water mismanagement in the past and present. What makes the desalination

plant different from these other sources is that it promises (theoretically) unlimited water production that aligns with Dakar's vision of unlimited urban growth.

Rain has historically been a source of irrigation for Senegal's rich agricultural history as well as feeding terrestrial freshwater reserves like lakes and groundwater, but the rain itself has not played a significant role in drinking water in Dakar. The seasonal rains, called *navet* in Wolof and *hivernage* in French, can deposit massive volumes of water to the Dakar area, up to 100mm of rainwater in one day (C. Diop, Sagna, and Sambou 2014). While this natural form of irrigation sustained agriculture in Senegal for centuries, the colonial institution of large-scale plantation agriculture could not subsist off rain alone (A. Ndiaye 2013). Similarly, rain has historically supported household water harvesting practices²⁵, but rain capture alone has not been able to meet the city's needs, even with the massive *zone de captage* in Grand-Yoff (See Figure 1.5).

²⁵ Notably, the West African *impluvium* design was designed to architecturally navigate the alternating wet and dry seasons: it drains rainwater into a central courtyard while dispersing the stress of heavy rainfall on buildings and their residents (Sagna 2019; Nevadomsky, Lawson, and Hazlett 2014).



Figure 1.5: Zone de Captage relative to the Mamelles Beach site

Today, Dakar cannot adequately manage the immense volume of rain deposited in the area annually. The lack of adequate drainage is certainly an issue in that it causes frequent floods that can incapacitate the city²⁶, but it also precludes the possibility of implementing a large-scale rainwater collection system.

Sources of potable freshwater, like the Thiaroye aquifer and Lac de Guiers, rely on the annual rainfall as a source of recharge. Dakar's Thiaroye aquifer is the only groundwater reservoir on the Cap-Vert peninsula and has provided potable water in the area since Lébou settlement. Here, sand dunes filter the seasonal rainwater into the subterranean aquifer, which provides the only source of groundwater on the peninsula itself (Kane 2007; S. C. Faye et al. 2019; Pouye et al. 2022). Recently, urban Dakar has seen that this precious, annually replenished

²⁶ Based on personal experience and research, heavy rains are a significant problem in Dakar and can nearly shut down the city on some days. For more, see (C. Diop, Sagna, and Sambou 2014).

reservoir of potable water cannot provide for the city's water needs. However, the problem is not that Dakar's groundwater is scarce; in fact, water recharge in the Thiaroye aquifer has *increased* by 125% relative to its natural recharge (Comte et al. 2012). In fact, many subterranean aquifers have been discontinued due to seawater and wastewater²⁷ infiltration (S. C. Faye et al. 2019; Kane 2007; Comte et al. 2012). The problem of groundwater in Dakar is thus not one of resource *scarcity*; rather, Dakar's water problem is a product of the human interactions – like extraction, pollution, and irrigation – that render water dangerous and undrinkable.

The major freshwater source for Dakar is currently the Lac de Guiers, a freshwater lake located around 250km from Dakar that currently provides around half of the city's potable water (JICA 2015a; Niasse et al. 2004). Historically supplemented by river water but commonly contaminated by saltwater, the Lac de Guiers has been reshaped and redirected to maximize its potable water production by colonial and independent hydraulic projects alike (Gac et al. 1992; C. Faye 2009). This impressive hydraulic system, which spans nearly the entire Grand Côte from St-Louis to Dakar, has structural limitations that prove difficult for Dakar's expanding urban population: in 2013, the pipeline between Guiers and Dakar burst²⁸, and the city suffered from three weeks of water suspension and restrictions (JICA 2015a). In fact, industrial water transport itself is a significant source of water loss due to deteriorating infrastructure. Around 30% of Dakar's water reservoirs and 25.5% of Dakar's pipelines date back to the colonial period (JICA 2015a). Hence, the Dakar region lost around 27%, or 42,000 m³ per day, of its potable water to

²⁷ Wastewater not only includes the often-mismanaged septic waste from urban Dakar (see Re et al. 2011) but also the industrial application of fertilizer and pesticides used to sustain farming on the post-plantation, nutrient-exhausted arable land used in colonial mass production (Pouye et al. 2022; Kane 2007).

²⁸ The burst was caused by a power cut that stopped the flow of water and increased the pressure on corroded steel pipes that date back to the 1970s (JICA 2015a). This was an infrastructural failure and not a complete accident; however, pipe replacement is too expensive for Senegal to carry out on a large scale and the infrastructure cannot be so easily replaced.

infrastructural leakages. The smaller Guiers treatment plant, for comparison, produces 40,000 m³ per day; deteriorating pipelines thus cause an entire factory's worth of water loss daily (JICA 2015a). Again, it becomes clear that infrastructural failures, not water resources, lie at the heart of Dakar's water problem. The desalination plant addresses technical failures in its plan for "Travaux d'Amélioration du Réseau de Distribution Existant", which is elaborated in Chapter 2's section on A Hydraulic Politics of Desalination: Developing the Future. The magic-bullet solution of desalination technology introduces a new source of water to supplement Thiaroye and Guiers, but it does not fully address the infrastructural needs of Dakar.

Urban water distribution is more complex – and more technological – than the sum of its water resources. The vast array of freshwater sources on Dakar's peninsula – rain, ground, and lake water – cannot provide for the city on a large scale because the current infrastructure cannot handle them. Drainage and capture systems cannot adequately utilize rainwater, pollution and exploitation render groundwater useless, and hydraulic systems cannot reliably transport large volumes of lake water. Though these complications might make the desalination project seem like an easy and novel fix, the desalination plant has its own relations with the environment, as explained in the section on Desalination's Exploitation and Contamination of Local Ecosystems, and with people, as explained in Chapter 3. Technologies and infrastructures are not just conduits from point A to point B – they are complex actors and mediators in a network of water sources, urban growth, and material constraints.

Desalination's Exploitation and Contamination of Local Ecosystems

The desalination plant itself has a particular relationship with the environment surrounding it. Not only does desalination pump in seawater, but it also pumps out wastewater. In fact, desalination produces *more* waste than product water. However, desalination technology

promises such a direct fix to Dakar's water supply that administrators are willing to overlook unsustainable fuel practices in the interest of necessity. The need for water in Dakar thus takes precedence over the problem of pollution from fuel and brine.

Desalination is a major source of local pollution due to the concentrated wastewater, or brine. For every liter of saltwater, Dakar's plant will produce less than one standard half-liter bottle of drinkable water per liter of feedwater: 55% of what the plant produces is unusable brine that is discharged back into the sea (JICA 2015a). This rejected fluid contains salts, disinfectants, coagulants, antiscalants, and heavy metals, and it enters the ocean at a much higher temperature and pressure than the surrounding environment (Kress 2019).²⁹ While brine discharge practices take into account ocean currents to maximize dilution, the brine creates a zone of physio-chemically altered water in its surrounding marine environment. In, Figure 1.6, the radius of brine discharge is shown relative to the discharge point, with ΔS as the increase in salinity in the zone.

²⁹ The high-temperature and high-pressure discharge reflects the large quantity of energy required to remove salt and waste from seawater. In Dakar's desalination plant, most of the 100,000 kg of CO₂ and its equivalents emitted each day are retained in the brine (JICA 2015a; Elsaid et al. 2020)

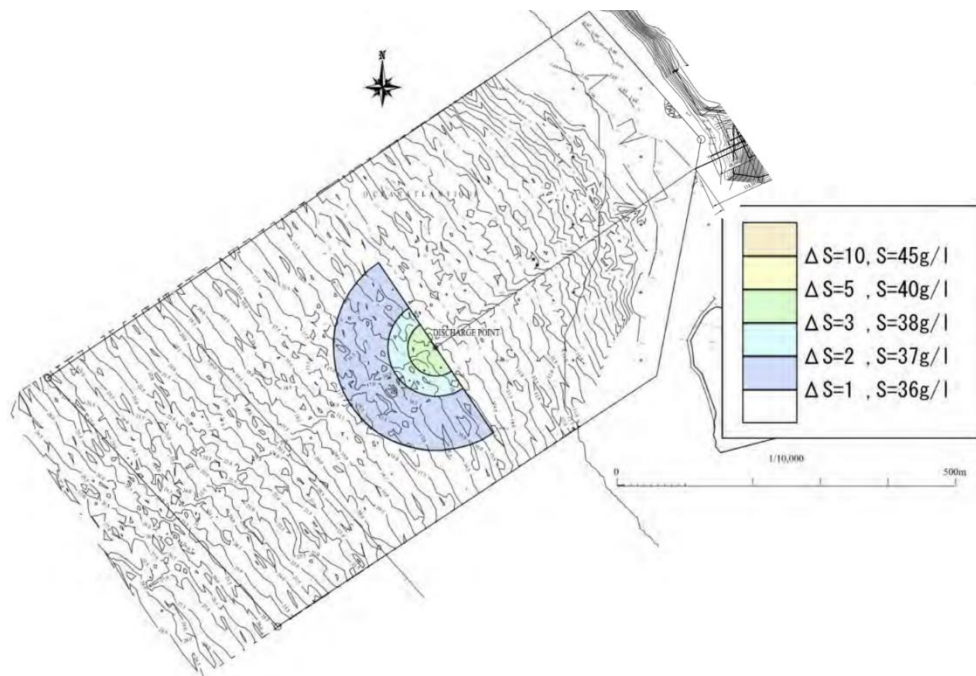


Figure 1.6: Radius of brine discharge at the factory's discharge point in the Mer des Mamelles

This radius of polluted water creates extreme living conditions and ecological imbalance for the marine ecosystem. Highly saline environments surrounding brine discharge points increase mortality rates in algae and plankton³⁰, meiofauna³¹, seagrasses³², and fish³³.

Institutions, as explained in Chapter 2's section on A Hydraulic Politics of Desalination:

Developing the Future, tend to overlook the environmental consequences of this desalination plant to push it forward as a solution to water problems. Despite the demonstrable negative effects of brine discharge on the aquatic environment, the desalination plant is prioritized over ecological preservation.

³⁰ See Yoon and Park (2011) for an eco-toxicology of phytoplankton, macroalgae, zooplankton, and fish.

³¹ Though meiofauna (small benthic organisms) are sometimes attributed little to no effect of brine on the system, Roberts, Johnston, and Knott (2010), Gacia et al. (2007), and Riera et al. (2011) conclude that benthic organisms are more impacted as dense discharge affects the seafloor first.

³² Seagrasses play a key role in biodiversity and underwater habitats. See Cambridge et al. (2017) for brine-induced salinity stress on seagrass *P. australis* and Pagès, Pérez, and Romero (2010) on *C. nodosa*.

³³ See Iso, Suizu, and Maejima (1994) on brine effects on development in fish and a bivalve and Dupavillon and Gillanders (2009) on the giant Australian cuttlefish.

Desalination is not just a technology whereby seawater magically becomes drinking water. The process of removing salt from water creates a significant amount of waste that physically and chemically alters the seawater surrounding a desalination plant. The desalination plant, in a way, makes the sea its own by offloading its waste into the Mamelles sea. STS sociologist Michel Serres theorizes that waste itself is a territorial claim. According to Serres, just like the lion urinates on a tree to mark its territory, “les émetteurs correspondants prennent, par ces odeurs, ces souillures et ces sons, possession de l’espace qu’ils habitent ou traversent” (Serres 2015).³⁴ The ecological violence of brine discharge into the aquatic ecosystem is not *just* an ecological violence; it also marks a territorial claim to the Mamelles sea and overrides the existing relationships between locals and the sea.

Conclusion

The emergence of desalination technology in response to Dakar’s water issues is rooted in the shifting relationships between water, land, and humans across time. In fact, the history of water relations is not confined to the past, and it exists in the form of monuments and lasting structural inequalities. Yesterday’s water use exists today in the form of Lébou cultural-environmental relations, colonial systems of land exploitation, 21st-century priorities of economics over development, and the water sources suffering from anthropic exploitation and pollution today. This environmental history demonstrates that we are not immune to past configurations of water and people, whose relationships shape the network of water and people today.

³⁴ Serres titles his book *Le Mal Propre*, signifying both the *malpropre*, or dirty, and the *mal propre*, or badly/wrongly owned.

Chapter 2. Desalination as a Solution to Material and Cultural Insecurities

Desalination technology promises to transform the ocean into drinking water for ever-growing populations as groundwater resources become scarce. As global water networks work to expand capacity and anticipate demand growth, desalinating seawater appears most sustainable in the long term. Dakar's desalination plant is an undeniable solution to the want of water, but it is not an all-encompassing, magic-bullet solution. This chapter explores the ways in which desalination is discursively framed as a solution to fundamental problems and anxieties in Dakar. Ultimately, this framing distracts from the fact that the desalination plant threatens the existence of communities and ecosystems in the Dakar area.

Chapter 1 explored the eras of Dakar's history and the social, material, and ideological values embodied in the monuments to these eras. The Lébou era valued land and sea as active participants in Lébou society, the colonial era emphasized land and its resources as a means of large-scale exploitation, and the Wade era of African Renaissance saw land development as a means towards socioeconomic emergence. Each of these eras of land and resource use bears on Dakar's current relationships with its human and nonhuman surroundings. Chapter 1 also established the current context of water relations in Dakar and the context in which the desalination plant plans to embody a new era of technology and development. In this chapter, I aim to understand the values that push the current desalination project into existence and justify its role in Dakar's water relations.

In Dakar, the technical fixes that address the local water problem only impact around 5% of the greater Dakar region (ANSD 2021).³⁵ Given the 137 billion FCFA mobilized to fund this project and the massive political campaign behind it, 5% does not seem proportionate to the project's massive sociopolitical role. Where, then, are the "missing masses" in this massive project? What balances out the large-scale financial, political, and technological mobilization behind this project, if not its utility to the public? If the project itself has such a limited scope, how could it herald a new era of Dakar comparable to that of the colonial Phare or post-Independence Monument?

In this investigation of how the desalination plant creates meaning in the cultural context of Dakar, two main ideas emerge as cultural counterweights that balance out the high profile of this project with its small-scale material effect on the city. Water supply and futurism arise as the "missing masses"; they are assigned so much weight in Dakar's network of water relations that they alone justify the high-stakes circumstances of this project. First, the primary issue targeted by the desalination project is the insufficient water supply. Ideas of supply and demand focus on the economic identity of water and erase the structural relationships that govern *how* water is distributed and consumed in Dakar. In addressing the issue of water scarcity with water production, the desalination project ignores the structural barriers that cause water to be scarce in some faucets and not others. In the second section, I bring into question the rhetoric of futurism in the project's plans to renovate the existing water network. In billing the project as a monument to the future, publications surrounding the project justify its construction by associating it with

³⁵ As of the Agence Nationale de la Statistique et de la Démographie de Dakar's latest full report from 2018, the populations of the desalination plant's target distribution areas, Sicap Liberté, Grand Dakar, and Yoff, respectively, were 54,578, 54,402, and 103,501. Of the 1,326,197 people in Dakar at the time, this constitutes around 16% of Dakar proper and 5.8% of the greater Dakar area (ANSD 2021).

the upward movement and development valued in the PSE. While the project itself will culminate physically in the form of a factory, the construction process entails much more than physicality. This desalination project constructs new meanings and solutions concerning water resource distribution and futurist technological rhetoric. Specifically, publications from institutions like JICA, SONES, and funding entities like the World Bank, promote the ideas of water supply-demand rhetoric and futurism to push the desalination plant into existence. These large-scale, high-profile ideas imply that the project is an equally large-scale, high-profile improvement in public works, but the scale of the actual technological fix is negligible in comparison to the massive hydraulic network of Dakar. These two ideas are the “missing masses” that justify the desalination project’s significance in Dakar’s network of social, economic, political, and cultural discourse.

A Hydro-Social Fix: Discursive Solutions to Dakar’s Water Insecurities

Dakar’s insufficient water supply is the primary socio-ecological problem presented in the discourse surrounding desalination in Dakar. Throughout publications by institutions like JICA, SONES, the World Bank³⁶, and the Agence Française de Développement³⁷, the dominant belief is that a greater supply of water will enable growth and development in Dakar and Senegal overall. And, certainly, Dakar cannot rely upon existing freshwater sources to feed a growing population. It needs to increase its supply of potable water to decrease dependence upon overexploited freshwater and hydraulic inconveniences in urban water use.

³⁶ The World Bank has spearheaded studies and conferences concerning water scarcity in Senegal and West Africa, such as the Déclaration de Dakar concerning Sahelian irrigation.

³⁷ The AFD has contributed multiple studies and loans to Senegal, often working with the EU or international governments, towards “developing” agricultural and water management.

The problem with the rhetoric surrounding a scarce water supply is that it frames the power of desalination to technologically augment Dakar's water supply as a magic-bullet solution to Dakar's water problem. The discursive focus on water supply, rather than water distribution, implies that addressing the problem of water supply would solve the entire water problem in Dakar. As seen in Chapter 1, Dakar is home to a multiplicity of water sources; however, much of this water does not make it into Dakar's faucets due to infrastructural constraints like water collection and pipeline deterioration. Even with more water flowing through Dakar's pipes and faucets, the city's faulty system of water provision will remain.

Water Insecurity: Questions of Supply and Demand in the Desalination Fix

To first investigate the shaky foundation of water scarcity that constructs the need for desalination, we must understand how institutions view the current situation of water use in Dakar. One government- and World Bank-sponsored report on water resources in Senegal and the greater Dakar area concludes that Senegal must work towards water security, defined as:

la disponibilité d'une quantité et d'une qualité d'eau acceptables pour satisfaire les besoins de la santé, des moyens de subsistance, des écosystèmes et de la production, associées à un niveau acceptable de risques liés à l'eau pour les personnes, l'environnement et l'économie (Grey and Sadoff 2007, via World Bank 2022).

Water insecurity in Senegal, then, is a relationship between a country's water supply and a population's demand; in fact, this publication states that Senegal's problem is that "la disponibilité en eau ne coïncide pas nécessairement avec la demande" (World Bank 2022). This relation reflects a disconnect, or insecurity, between water resources and the society that uses them.

Establishing that current groundwater and surface water sources are insufficient to provide for a growing Dakar, JICA and SONES specifically focus on population growth and its consequent demand for water. In fact, the JICA preparatory survey for the desalination plant links the collective role of population demand and the natural role of water availability on the first page of the report: “les pénuries récurrentes d’eau ont été une préoccupation sociale *en raison de la croissance rapide de la population* dans la région de Dakar et *de la capacité limitée des ouvrages d’eau potable existants*” (JICA 2015a, 1-1, emphasis added). The reports and institutions behind the desalination project largely rely on graphics and numbers to visualize the projected (that is, not-yet-existent) population of Dakar in the coming years (See Figure 2.1). While the following section, A Hydraulic Politics of Desalination: Developing the Future, focuses particularly on the futurist rhetoric behind the project, the analysis of water demand also lends towards a futurist lens, characterizing the desalination plant as a technology that will enable the arrival of the future. Emphasizing an idea of inevitable, predictable growth in water demand, these visualizations of a future Dakar characterize the desalination project as a necessary point of passage to urban growth and development.

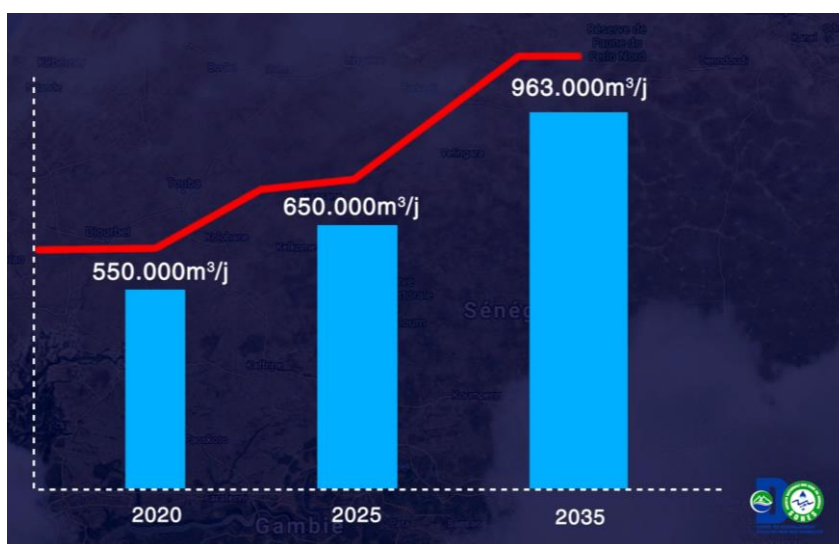


Figure 2.1: Projected water demand in Dakar in the decades after the desalination plant’s implementation. From Facebook, Société Nationale Des Eaux Du Sénégal - SONES (2022)

Opening the Floodgates to Economic Emergence

Building from the relationship between Dakar’s water supply and population demand, many sources promote the idea that *socioeconomic* growth, like the economic emergence envisioned by the PSE, depends upon the availability of potable water. This idea goes beyond population growth: it implies that if Dakar wants to develop as it plans to under the PSE, it must secure a water supply that can satisfy a growing population. In the words of the World Bank, “[le] stress hydrique... menaç[e] l’ambition du pays de devenir un pays émergent” (World Bank 2022). SONES contends that “les changements climatiques et la transformation structurelle de notre économie amorcé dans le cadre du Plan Sénégal Émergent ont fini de convaincre sur l’impérieuse nécessité de développer des stratégies nouvelles de renforcement et de sécurisation des systèmes d’alimentation en eau potable de l’agglomération dakaroise” (Société Nationale Des Eaux Du Sénégal - SONES 2022, 0:30). Limited water sources, according to the institutions evaluating Dakar’s water resources, stagnate growth, thereby becoming an enemy of Senegalese emergence and development.

The institutions supporting the desalination plant use the idea of a dwindling water supply to assert the necessity of this project in Dakar’s era of development. Characterizing water availability as the limiting factor of urban and population growth allows them to define desalination technology as the key to growth and development, values that are at the heart of Senegal’s current PSE paradigm. However, this focus on increasing supply in response to demand entirely erases the mechanisms of water distribution and the institutional priorities that govern water access.

The solution to water scarcity is, simply, water provision. The desalination plant provides water from the inexhaustible ocean, promising a magic-bullet solution to Dakar's water problems. Scholar Erik Swyngedouw calls this the "hydro-social fix" of desalination. According to Swyngedouw, "the desalination fix inscribes itself in a reworked, expansionary, developmental logic, in which water transfers combine with other modes of water management to produce more water," (Swyngedouw 2013, 268). Desalination's ability to provide water, according to Swyngedouw, "generated a sense of unlimited potential availability. A 'natural' limit, therefore, became interpreted and 'scientifically' defined as a 'deficit' between the regionally desired volumes and the nationally available quantities," (Swyngedouw 2007). Desalination's solution to water problems is surface level: it produces a larger water supply while entirely ignoring the (infra)structural barriers to water access. The rhetoric of supply and, in the next section, the rhetoric of improvement, frame desalination as a "fix" whereby technological provision can bring about the cultural desires for water security and socio-economic emergence.

A Hydraulic Politics of Desalination: Developing the Future

Why does Dakar prioritize water scarcity and desalination if there are viable sources of water for the peninsula? It is not the supply that poses a significant problem, but rather the demand. A growing population demanding water is a consequence of Sénégal Émergent and its focus on development and growth. Official publications surrounding the desalination project, like the *Étude Préparatoire* and studies by the Banque Mondiale, unequivocally cite the "croissance rapide", "besoins", and "demande" of the Dakarois public as the main reasons behind the scarcity of water in Dakar (JICA 2015a; World Bank 2022). Within the political context of the Plan Senegal Émergent (PSE), minds and resources aim to maximize the nation's

“croissance”, “développement” and “émergence” (PSE). However, one consequence of development is an increased consumption of resources like water. Instead of questioning whether development is feasible or sustainable under Senegal’s current resource constraints, and instead of questioning the cost of growth to local communities and environments, official discourse surrounding the desalination plant focuses on how to produce enough water to sustain growth.

Official Values of the Desalination Project

The desalination plant enables development, according to official rhetoric. In fact, the country’s president and sponsor of the PSE has been a major promotor of the desalination plant’s technological and economic benefits towards development. In the inaugural ceremony marking the laying of this project’s first brick, President Sall called this desalination project “une étape majeure dans la matérialisation du Plan Sénégal Émergent” (FRANCE 24 2022, 0:45). He also announced that “elle est d'autant plus vitale, cette usine... la situation démographique, combinée à une forte poussée immobilière, un développement fulgurant des activités économiques, ont engendrée une surexploitation des ressources hydriques locales” (VOA Afrique 2022, 0:30). Similarly, the Ministre de l’Eau et de l’Assainissement calls the project “un choix technologique inédit et une solution du futur”, adding that “C’est un choix qui permet de réduire la dépendance de notre pays vis-à-vis du Lac de Guiers. C’est aussi un choix qui permet de réduire la vulnérabilité de l’alimentation en eau de Dakar” (“Cérémonie de Lancement Des Travaux Du Lot 2 Du Projet de Construction de l’usine de Dessalement de l’eau de Mer Aux Mamelles” 2020; A. Sy and Amani 2020). Sponsored and bolstered by government approval, the desalination project is directly characterized as a step forward towards sustaining development in Dakar.

The institutions trusted with conserving Senegal’s environment tend to focus on the project’s “vital” ability to produce water, and they largely dismiss accusations of environmental harm. The negative impact of pollution, outlined in *Constructions of Water Relations in the Postcolonial City* section on the plant’s Desalination’s Exploitation and Contamination of Local Ecosystems, is largely missing from official speeches and documents surrounding the desalination project. President Sall alleges that the Senegalese Government “a pris toutes les dispositions nécessaires à la maîtrise optimale des impacts environnementaux et sociaux de ce projet dans l'esprit des objectifs de développement durable” (VOA Afrique 2022, 1:17). However, the State’s actions demonstrate the opposite. For instance, the Ministère de la Pêche “a confié à l'Équipe d'Étude de la JICA que les zones de conservation des espèces de poissons ne constitueront pas une entrave aux travaux de construction dans et autour de la zone du Projet, y compris celle choisie pour la construction des ouvrage de prise d'eau de mer et de rejet de saumure” (JICA 2015a, 6-47, 6-48). This seemingly contradicts with the Ministère’s existing plan for a marine life conservation zone along the Mamelles coast (JICA 2015a). Thus, the future benefit of the project supersedes conservation efforts. While official narratives proclaim that this project poses no environmental danger, science³⁸ and locals³⁹ indicate that the desalination plant will be harmful to the Mamelles ecology and culture.

Publicizing Ideas of Infrastructural Development

The Dakarais public is dissatisfied with the current state of water provision. The desalination project has not only promoted ideas of economic development; it has also promised

³⁸ For evidence that the Project is environmentally dangerous, refer to Chapter 1’s section on ecosystem contamination.

³⁹ For evidence that locals consider this Project harmful to their livelihoods and culture, refer to Chapter 3’s section on public activism.

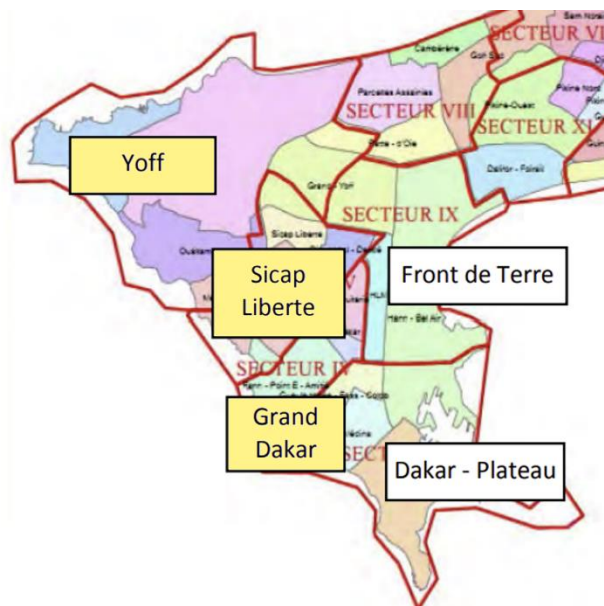
developments in the distribution network in response to public discontent with water provision. More than 15.3% of surveyed Dakarais attested to a water availability of fewer than 18 hours per day, and around 19.6% consider their water pressure “habituuellement [sic] ou toujours faible” (JICA 2015a).⁴⁰ Thus, to “fix” Dakar’s water problem, the desalination project must develop solutions to the Dakar that compromise water access in Dakar. Part of the desalination plant’s value to Dakar as a whole, then, lies in its ability to convince the public that it is developing and improving the current system.

The problem with the desalination project’s ability to address the public is the narrow scope of its distribution network. The desalination plant will only serve the areas of Grand Dakar, Sicap-Liberté, and Yoff (See Figure 2.2). The public served by this project constitutes only around 5% of Greater Dakar in terms of population (JICA 2015a). Furthermore, only around 41% of pipe length in this zone will be replaced, composing only 11.6% of all pipes in Dakar (JICA 2015a).⁴¹ However, most communication to the public concerning the desalination plant does not mention this: the President and Ministre de la Pêche do not specify the specific boundaries of this project, instead focusing on the desalination project’s ability to supplement Dakar’s total water supply (FRANCE 24 2022; “Cérémonie de Lancement Des Travaux Du Lot 2 Du Projet de Construction de l’usine de Dessalement de l’eau de Mer Aux Mamelles” 2020; A. Sy and Amani 2020). The JICA report, tellingly, does not mention the project’s “zone de distribution” until the third chapter, some 70 pages in to the 430-page report, after having

⁴⁰ This survey includes the communities of Yoff, Sicap Liberté, Grand Dakar, Dakar-Plateau, and Front de Terre. The latter two, which represent the centre-ville and industrial area respectively, are not within the distribution area for the desalination plant. Notably, Front de Terre reports the lowest scores in water availability and pressure out of all of the neighborhoods in Greater Dakar.

⁴¹ There are 1064.9km of pipeline in the target zone and 3806km in Dakar overall, and the Project plans to replace 442km of these pipes (JICA 2015a).

discussed the results of the aforementioned survey (JICA 2015a, 3-22). The beneficiary of this desalination project is not the public itself, and those involved in making this project a reality focus more on the developmental value of this project than on its limited scope. Though development rhetoric promises an overall solution to Dakar's capacity to adequately provide water to the public, the actual technical fixes in this plan are relatively small. In order to assert its value as a public works project, the desalination plant's discursive role imparts an overall message of development despite only serving 5% of the public.



Source: SDE

Figure 2.2: Areas served by the Desalination Project: Yoff, Sicap Liberté, and Grand Dakar.

The desalination plant is a monument of development that promises not only to provide a novel, technological water source but also to improve the water distribution system. The large-scale improvement embodied in the Amélioration du Réseau de Distribution Existant aims to address public discontent with the ways in which water is distributed. The solutions inscribed within this plan address the most statistically disadvantaged locations in the water system,

thereby improving overall water quantity and distribution; however, this does not address a *public* so much as it addresses the 5% of Greater Dakar served within these areas. Seemingly, in this way, the water – its losses, its pressure, its flows – is more highly valued to the desalination project than the public set to consume the water. The act of proclaiming improvement, in itself, generates an idea of progress and development independent of any technical fixes taking place. In this way, the desalination project does address the public, not by providing water but by providing a monument to the desalination project's techno-social power.

Erik Swyngedouw coins the term “hydraulic politics” to reflect how political actors use policies and technologies of water to address social and economic tensions. This term emphasizes that technologies designed to reshape the distribution of resources, like desalination technology reshaping water flows, “express and re-constitute physical, social, cultural, economic or political power relations,” (Swyngedouw 2007, 10). Hydraulic politics thus mobilize water resources to promote institutional values, and Dakar's desalination project uses this water technology to promote the value of development. Desalination's hydraulic politics publicize the 21st-century economic value of development in Dakar, giving the desalination project a sociocultural significance that far outweighs the small-scale technical fixes enacted by this technology.

Conclusion

Desalination expands Dakar's water network beyond its terrestrial boundaries, including the entire ocean in its network of water provision. This network entwines technology, nature, culture, and political power within the structure of society. We have seen that it is not just a lack of ecological resources or the demands of the population that animate this project, nor is it the individual technologies that comprise the desalination plant itself. In Dakar, the factors that truly

animate the project, that push for its existence and influence public approval, are the discursive actors of water scarcity and development. The discursive weight of this project makes up for the “missing mass”, the discrepancy between the desalination project’s high profile and its limited scope. The Dakar public thirsts for change, and the actors behind this project assign it discursive value in the context of water solutions and urban development.

Desalination promises a fix to social, environmental, economic, and political problems. However, despite the image of paradigmatic change imbued within desalination and its magical transformation of seawater into drinking water, desalination reproduces existing structural dynamics and enacts little physical change. This aspect of the desalination project, in which complex consequences are hidden behind a facade of value-neutral technology, points to the ANT theory of the “black box.” That is, technologies and systems “draw a little box about which they need to know nothing but its input and output” (Latour 1987, 3). Looking solely at the inputs and the outputs of the discursive network of development and the technological network of desalination, the project seems like a perfect fix to Dakar’s water problems. Money from investors produces an output of technological advancement by way of development, and seawater produces an output of potable water by way of desalination. For the desalination factory in particular, the black box is physical. Neither black nor a box, this project black-boxes its mechanisms in the construction period with a concrete wall surrounding the construction site. This wall hides the mechanisms by which this plant is being realized, but it is obvious that this wall obscures heavy equipment moving around dirt, concrete, and steel on a larger scale than any individual could.

Desalination in Dakar and across the world promotes economic and sociopolitical growth, but its only claim to sustainability is that it aims to reduce stress on terrestrial freshwater

sources. The discursive values of technological water fixes and urban development, assigned to this desalination plant by the political and economic agents pushing it into existence, make this project larger than life. This new desalination plant represents a hydro-social re-engineering of water in that it produces a new source of potable water while also producing narratives of technological progress and development in emergent Senegal.

Though the factory itself has not yet taken its full shape, it stands on Mamelles Beach with a colonial lighthouse on one side and the massive African Renaissance Monument on the other. With these two artifacts symbolizing the past and present, Dakar's desalination plant offers a glimpse into the future.

Chapter 3. “Public” Works and Working Publics

In mobilizing the sea, a seemingly infinite global water resource, the discourse surrounding desalination technology distracts from the land occupation politics of the desalination project itself. Of course, the *principle* of desalination involves only seawater (for which there is no question of scarcity) and human demand (projected to indefinitely increase). However, Dakar’s desalination project does not exist only in principle. In order to realize desalination, the factory itself must occupy some physical space in the community it plans to serve. How, then, did it come to occupy this physical space?

As Chapters 1 and 2 described, Dakar’s desalination project lies at the core of a constantly evolving network of environmental, cultural, and political factors. Desalination cannot function without elements like seawater and industrial factory systems, but it also depends upon the existing urban network to accommodate it. Specifically, the project necessitates a physical space in which the aquatic, hydraulic, and systemic functions of desalination can work together. This chapter, then, aims to ground the previous chapters’ ecological and institutional factors in the public meant to be served by the desalination factory.

The developers’ and engineers’ idea of the public, largely outlined in Chapter 2, are not the only actors in the network surrounding this desalination plant. Certainly, they define the technology’s functions and services to others, but their lives are not impacted by the material and environmental reality of the desalination plant. These practical impacts largely bear upon the public – or, rather, publics – that see more value in the Mamelles communal space than in the desalination plant. This group consists of groups and individuals enrolled in the desalination project’s network by proximity, identity, ideology, or need. Understanding these publics’

perspectives and role in the realization of desalination in Dakar first necessitates an understanding of why the construction of this project is transgressive to local livelihoods. Thus, I begin with the politics of property and ownership specific to the Dakar area. The final section attempts to spotlight the voices and discourse representing the “public” in this network. While locals are wholly unable to override the project’s occupation of their land, their strength lies in their voices. Counteracting the dominant characterization of this project as purely hydrological and technological, these voices undermine the very narratives that give the desalination project its power.

Ultimately, this chapter reveals the tension between public works and the publics they work for. A highly prioritized project that overrides existing property relations by virtue of its public value should equally value the public. However, questions of *what* public is served by this factory. Especially in a country where the public has historically been subject to colonial exploitation, where the Senegalese public was devalued compared to the European elite, the desalination plant’s selective definition of what constitutes a public follows the colonial tradition of valuing land and profit over people.

Property and Ownership in Dakar’s Desalination Project

The location of the desalination plant is a deliberate choice made by experts who calculated the oceanic and structural factors necessary to connect the factory to its seawater input and hydraulic output. Figure 3.1 outlines the property acquired for the construction of the desalination plant, which occupies 4.97 hectares, or around 12 acres, on Mamelles Beach.

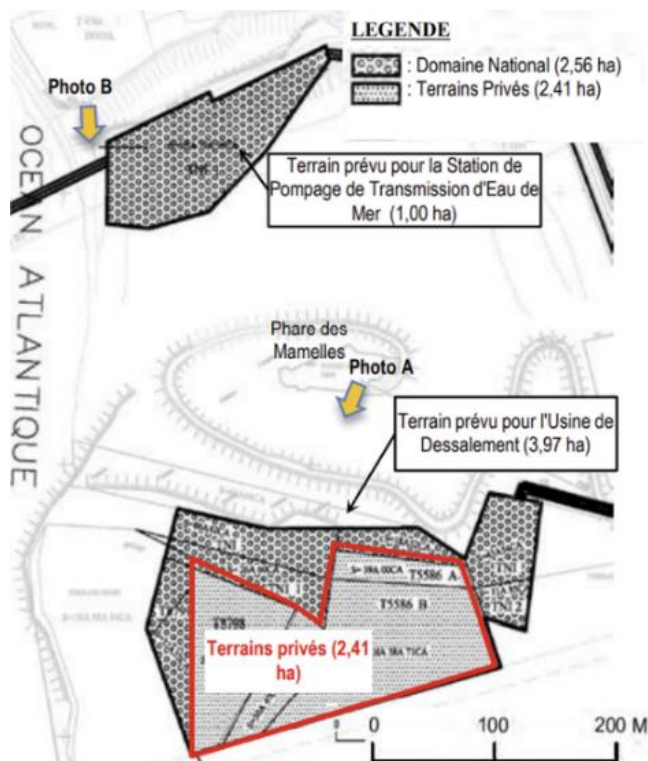


Figure 3.1: Property acquired for the desalination project. From JICA (2015).

The scientists and researchers behind the project largely chose Mamelles Beach for its strong marine currents to aid in dispersing brine, its high elevation to improve water pressure, and its proximity to existing electric and water infrastructure (SONES 2023; JICA 2015). As established in Chapter 2's section on The Lébou Significance of Mamelles, the Mamelles Beach is not officially recognized as Lébou land. While around half of this land belongs to private landowners (outlined in red in Figure 3.1), the other half belongs to the State under the *Domaine Nationale*. Technically, all property considered unregistered or unoccupied belongs to the *Domaine Nationale*⁴², and Lébou property rights are not registered within the current legal

⁴² The 1964 *Loi sur le Domaine Nationale* nationalized unregistered and unoccupied lands following independence to promote the "mise en valeur" of lands and protect the monopolization of farmland by large landowners following the era of colonial plantation farming. See *Loi n° 76-67 du 02 juillet 1976 (Code du domaine de l'Etat)*, *loi n° 2008-43 du 20 août 2008 (Code de l'Urbanisme)*, and *loi n° 83-05 du 28 Janvier 1983 (Code de l'environnement)*. See

framework. Under the *Domaine Nationale*, the state can repossess land for purposes of “utilité publique” and “mise en valeur” (*Loi sur le Domaine Nationale* 1964; *Code de l’Urbanisme* 2008). In this way, people living on a property can live there for generations but have no legal right to the land; their property can be revoked at any time if the government deems it more publicly useful or valuable for other purposes. To build the desalination plant, President Macky Sall decreed the public utility of the Mamelles site and permitted construction on both private properties and on the legally public Lébou property (Sall and Dionne 2015). Thus, based on how the government values an area of land, it could belong to the government, or it could belong to the land’s residents. Under the *The 21st-Century Economic Renaissance: PPP and PSE of development and Sénégal Émergent*, the State’s idea of public utility prioritizes development projects over individuals. The boundaries of this construction site thus explicitly rely on pseudo-colonial arguments as to who “deserves” the land most, and the government is the ultimate authority on who deserves land.

Local Actors Steamrolled by the Desalination Project

This project does not only displace local landowners, however; it also impedes cultural and economic activity in the area. The Mamelles area’s local fishing cooperative⁴³ particularly takes issue with the desalination project and its claims to Mamelles land and water. The project’s pumping station is located on a private beach with a thriving local market and frequent fishing activity, and the *Comité Local des Pêches* has established that the desalination project infringes upon their fishing rights (JICA 2015). However, the project does not consider these fishers

also Décret n° 2015-1146 en date du 03 août 2015 déclarant d’utilité publique le projet de construction par la SONES d’une usine de dessalement d’eau de mer dans la zone des Mamelles à Ouakam.

⁴³ This cooperative, the *Comité Local des Pêches* (CLP), is a tax beneficiary of the Ouakam district. Most fishers in the Comité cannot live near the beach where they work due to development projects. For firsthand testimonies and more on Lébou land appropriation, see Sidibé (2013).

“Personnes Affectées par le Projet” : “ces pêcheurs ne courent pas le risque de perdre les avantages liées à leurs zone de pêche *exclusive*... [et] *le droit de pêcher* n’existe pas dans encore pour les pêcheurs dans cette zone » (JICA 2015, 6-46, emphasis added). Although the Comité is a legally recognized tax beneficiary of the Ouakam district government, their claims to water rights are invalid compared to the development project. Because this organization does not participate in exclusive, authorized political and economic practices, it is not legally recognized; although around 97% of Senegal’s population is involved with the informal sector⁴⁴, this demographic is not represented in Dakar’s legal framework. Furthermore, the language of rights and exclusivity used to shrug off the fishers’ concerns obscures the fact that the main violence enacted here is the pollution that occupies the water and severely harms fishing efforts.

Local Actors Steamrolling the Desalination Project

While local organizations were unable to interrupt the steamrolling force of the desalination project, one obstacle did prove a limiting factor to construction plans. This obstacle was, tellingly, a commercial development project. The desalination project planned to acquire 6 hectares of Mamelles territory, but it had to entirely rethink its plans when informed that the government had already annexed parts of this area for the implantation of hotels (JICA 2015). Faced with only 3.9 hectares of available real estate, the project had to address “la question de savoir si la superficie de 3,9 ha pourra abriter les équipements de l’usine de dessalement d’eau de mer d’une capacité maximale de 100 000 m³/jour.” (JICA 2015, 4-46). Here, commercial projects take precedence over even highly prioritized public utility projects.

⁴⁴ 97% of economic activity in Senegal is informal, according to the ANSD, and 96.4% of the population is active in the informal sector. The PSE and the Ministre de l’Artisanat et de la Transformation du Secteur Informel have sponsored a national plan to formalize the economy (SNIEFI) as advised by the UN’s Organisation Internationale du Travail (SNIFEI 2022).

Conclusion: This is Not a Game!

From the relationships between the local public, the desalination project, and the hotel project, a hierarchy emerges: hotel development takes priority over the desalination project, which takes priority over the locals. While this dynamic might seem like a simple game of rock-paper-scissors, the rules in this relationship are not fair: the local actors always lose. This is not a fair game but rather a structural injustice. The ultimate actor deciding who and what wins the right to a property is not entirely the government, nor is it entirely commercial interests; rather, the driving force behind both boils down to the ways in which state and commercial interests mobilize ideologies of development.

The prioritization of commercial development projects over public utilities such as the desalination project in Dakar raises questions about the definition of "public" and who ultimately benefits from development projects. Displaced local residents and water pollution seems an acceptable sacrifice for developers to make in the pursuit of public benefit, but the lack of structural agency and self-representation in this network discount the overall benefits of such projects. While the economic benefits of large-scale private interests are quantifiably valuable, cases like the desalination plant suggest that such investments are not unilaterally positive. The people living and working near the Mamelles area are part of the 200,000 Dakarais set to allegedly benefit from the desalination plant, but they actively speak out *against* this project. Given that these intended beneficiaries of this project see no benefit in the desalination plant whatsoever, it seems as if the "public" in "public works" and "utilité publique" does not accurately reflect the publics affected by projects like the desalination plant. For whom, then, does this land exist? For which public(s) does this "public work" actually work?

“Ce Terrain N’est Pas à Vendre”: Public Activism Resisting the Desalination Project



Figure 3.2: Graffiti on a wall in the Corniche des Almadies, around 4km from the desalination site: “Ce terrain n’est pas à vendre”. Author photo, July 12, 2022.

While the discourse surrounding ecology, technology, and government often revolves around cause-and-effect and solution-oriented relationships, individuals materially affected by the desalination factory have contributed to public narratives surrounding this project. These are the dynamic, multifaceted *publics* who shine a light on their underrepresented struggles and needs.

Conflicts of Land and Water Valuations in Lébou Authority

The Collectivité Lébou has been politically advocating against land occupation for years, but the current desalination project reveals that some Lébou advocates value their right to land whereas some prioritize desalination’s promise of clean water. For instance, one cultural-

spiritual leader in Dakar’s Collectivité Lébou, the Ndey Ji Reew⁴⁵, has publicly and politically denounced the unjust occupation of Lébou land: “l’occupation de ces sites [est de] profaner des places sacrées” (S. Ndiaye 2012). The Lébou culture does not have much institutional power, and it relies on the discursive power of authorities like the Ndey Ji Reew.⁴⁶ In the context of the desalination project, however, the Jaraaf, or Lébou dignitary to the state, publicly supports the desalination project despite its land occupation. Jaraaf Youssou Ndoye contends that opponents of the desalination project do not understand the difficulties locals experience in relation to water (Sakho 2017). While the desalination plant aims to address issues of water quality and sanitation, it is important to remember that locals displaced by the desalination project no longer have access to this water⁴⁷ and will not benefit from the desalination plant’s effects on water and sanitation. While no Lébou individuals have yet publicly commented on the Lébou public perspective, the internal conflicts between the Ndey Ji Reew and the Jaraaf reflect a social conflict in which Lébou people must decide whether to prioritize land rights or access to drinking water. These two resources have historically belonged to Lébou people by virtue of their contract with the *rab* of the land; however, Lébou people, land, and water have been historically dominated and exploited to the extent that Lébou communities must choose between these life-sustaining and (culture-sustaining) resources. Under colonial and developmental paradigms alike, the Lébou public as a whole has had to fight to protect their cultural heritage centered around Dakar’s land and water.

⁴⁵ The Ndey Ji Reew, literally meaning “mother of the land” in Wolof, has been described as the République Lébou’s equivalent to the Ministre de l’Intérieur (Gueye 1977).

⁴⁶ According to scholar Isabelle Sidibé, “Les autorités coutumières léboues sont toujours conviées par les nouvelles structures développementistes à présider des réunions, mais tant leur présence que leur parole restent symboliques en termes de gestion” (Sidibé 2013).

⁴⁷ 96% of Dakarois access their potable water from private service connections, so displaced individuals cannot access water until they take up a new residence. See Tableau 4.2.9 in the *Étude Préparatoire pour le Projet de Construction de l’Usine de Dessalement de l’Eau de Mer aux Mamelles* (JICA 2015b)

The Mamelles Public

Public groups have assembled on social media as well as Mamelles Beach to spread awareness of the fight to protect the Mamelles area. Tefesu Bir, for instance, is a group formed in response to construction and pollution on the beach. This assemblage of locals and restaurant owners on Mamelles Beach has grouped together in the interest of “transformer la plage et son accès près de la rue en un refuge pour la communauté, en diffusant des valeurs éducatives, agricoles, environnementales et artistiques.” (“Plage des Mamelles - Tefesu bir” n.d.). The group has organized talks, trash collection events, and community gatherings to spread awareness and respect for the beach. One activist, the owner of popular beachside restaurant Chez Max, has spoken out against the desalination plant in the interest of protecting the environment and the community spirit of the Mamelles. For instance, Max’s restaurant has used its property to publicly denounce the desalination project, as seen in Figure 3.3.



Figure 3.3: Public sign near Chez Max reading “Non à l’Usine de Dessalement de l’Eau de Mer”
Source : “Plage des Mamelles - Tefesu bir”, Facebook).

Though these individuals have little political sway as members of the public, they embody a strong collective effort to inspire community action. As a public force, they resist the occupation of their community in ways that the administration cannot ignore.

The most vocal activist group that has spoken out against the desalination project is Y'en a Marre, a collective of cultural and political leaders that has protested antidemocratic governance in Senegal since 2011. Founded by local rappers and journalists, “yenamarrisme” has become a major ideology that consistently mobilizes young Senegalese people to hold civil leaders accountable.⁴⁸ The early group mobilized to protest the presidency of Abdoulaye Wade and largely contributed to Wade’s fall from power after 12 years (Lafitte 2011). Now, Y'en a Marre reaches its audience through social media like Facebook, conveying their ideas largely in Wolof instead of French, the dominant language in government. Yenamarrisme encourages – and has largely produced – a “Nouveau type de Sénégalais”, who according to the founders is formed on the axes of citizen action, leadership and entrepreneurialism, environmentalism, and urban culture and sport (Barro and Y'en a Marre 2013).

Y'en a Marre has established itself as categorically against the construction of the Mamelles desalination plant. On social media, the group posted an official condemnation of the desalination project as “une bombe écologique à retardement” on its high-profile Facebook page (Y en a Marre 2022). Founding member Fou Malade and Saint-Louisian rapper Niagass collaborated in 2018 on a song and video called Tefes (“Beach” in Wolof) denouncing the

⁴⁸ In a 2013 manifesto by Fadel Barro, a lead coordinator of the group, Y'en a Marre explains its choice of words: “Nous avons dit Y'en a marre, pas juste pour un mouvement d'humeur comme l'expression peut le laisser croire, mais pour forger un état d'esprit. Celle de la conscience de sa force individuelle, la volonté de la mutualiser avec d'autres et le courage d'en faire une action citoyenne au service de la communauté.” (Barro and Y'en a Marre 2013)

privatization of Dakar’s beaches. Over shots of Mamelles Beach, pirogues, and coastal construction sites, the rappers declare “Je veux voir la plage, la classe populaire en est privée, c’est notre bien public” (0:09). The activism is not subtle, and the messaging is not vague: the music video shows groups of young protestors with shirts saying “Non à l’occupation du littoral” and cites coastal developments like the Radisson Blu hotel and Seaplaza mall as transgressive (Fou Malade and Niagass 2018). This imagery is paired with lyrics like “le gouvernement accapare nos terres, notre bien commun, et le vend aux occidentaux et les nantis” (2:39). Yemarriste music is, visually and lyrically, a representation of public sentiment. Rather than focusing on the natural environment, the video populates beaches like the Mamelles with recreational and cultural activities (See Figure 3.4, Figure 3.5). Many shots directly reference landmarks near the beach, like the Monument de la Renaissance Africaine or the Mosquée de la Divinité, to explicitly denote which beaches are the subject of this piece (See Figure 3.6, Figure 3.7).



Figure 3.4: Young people in the video protesting land occupation. (“Tefes”, 2:40)



Figure 3.5: Beach featuring pirogues and recreation. (“Tefes”, 1:51)



Figure 3.6: Mosquée de la Divinité behind the Plage des Mamelles. (“Tefes”, 0:52)



Figure 3.7: Monument de la Renaissance Africaine behind a construction site. (“Tefes”, 1:10)

The profound familiarity evoked in the video, featuring communities and landmarks that have shaped the living culture of Dakar, is a call to activism. It calls on those willing to stand up and say “y’en a marre” to the continued exploitation and occupation of their home. Dakar, the city itself, is a living network animated by culture and community— in other words, the city is animated by the public. The real Dakar does not exist in buildings or statistics, after all; instead, it is built by those who know and love it.

The factory, being animated by an institutional value of development, fundamentally opposes the collective cultural values animating the social fabric of Dakar. Activists like the Lébou, Tefesu Bir, and the Yenamarristes assert the sociocultural importance of community, environmental justice, and democratic decision-making in Dakar. While the desalination project can certainly force its way into existence with property laws and promises of a hydro-social solution, it cannot force harmony with those it plans to serve. This project is not just a desalination factory, and “Y’en a Marre” is not just a phrase. The desalination project has explicitly aligned itself with the structural violence of development at the price of land occupation and ecological destruction. The public is the main – and perhaps the only – recipient of this violence, and their agency lies in denying desalination a forced, fabricated existence in the public network.

Conclusion

The lack of institutional agency among actors to effect change in the network surrounding this desalination plant reveals a largely unresolved tension in ANT. In traditional ANT, developers, policymakers, and activists occupy symmetrical roles in the network. Bruno Latour contends that ANT “makes absolutely no assumption whether a specific locus is macro-

or micro- and does not modify the tools to study the element 'a' or the element 'b'." (Latour 1996b). The theory explicitly frames every actor by their action to preserve the material-semiotic nature of the theory and to avoid "global concepts like those of institutions, organizations, states and nations" (Latour 1996, 2). ANT does not, then, account for the limitations placed on certain actors based on their identity, there is no structural difference between power dynamics and institutional authority. However, it is clear that the desalination project embodies structural inequalities that grant agency to institutions promoting development and not to local individuals or groups. The publics outlined in this chapter complicate the simplified narrative whereby desalination produces seawater and development produces progress. The success of the desalination project is neither easy nor inevitable, and it comes at the price of publics and environments.

Problems of water and technology can be easily defined in theory by their constitutive parts; rainwater, groundwater, hydraulic pumps, and RO membranes are all relatively easily defined within the network by their relatively specific and predictable actions. Until now, the desalination project has defined these specific components within the context of desalination: water is scarce and technology is a fix. However, the public is a major actor in this project, insofar as the project derives its utility and value from its service to the public. Ultimately, the public is not as neat and predictable as ecology and technology because it can speak up for itself, and this unpredictability is a powerful force in a network where the realization of this project has faced very few obstacles. The activism component of the public is an inseparable part of the desalination network because it delineates the extent and limitations of public agency in the network. The project cannot force itself into existence on ecological and technological principles alone, and its structural violence defines its relationship with the public it serves.

Conclusion

In the 1980s, Paris began the development of a Personal Rapid Transit system called *Aramis* that planned to automate public transportation for individuals. Engineers, designers, and management struggled to realize the project in both a technical sense and a sociopolitical sense: the technology itself was difficult to develop and maintain, the public and media did not support the project, and internal disagreements surrounding the project's implementation ultimately contributed to its failure. Bruno Latour, the late ANT pioneer, conducted an ethnographic study of *Aramis* and its ultimate death in his book *Aramis, ou l'amour des techniques*. Investigating its "death", he found that those involved in the realization of *Aramis* failed to account for the social, cultural, and political forces surrounding the project. Instead, he observed a *technological imperative*, whereby the project would somehow be realized as long as people fulfilled their specific roles. This narrow view of technology ultimately brought about *Aramis*' failure because there was no effort to fit the project into the existing network of human and nonhuman actors. The culmination of Latour's research, which he presented to a group of engineers and urban planners, is a monologue on behalf of *Aramis*. From this monologue, I have extracted the following:

À plus tard les problèmes de foule, à plus tard les problèmes humains, pour plus tard les problèmes d'exploitation... Ils voulaient se concentrer sur les composants, le moteur, la caisse, un mobile, puis deux, puis trois. Mais ce n'est pas ainsi que nous existons, nous, les êtres faits de choses... Nous ne sommes pas des petits bouts ajoutés les uns aux autres en l'attente d'une totalité venue d'ailleurs. Nous ne sommes pas sans humanité. Nous ne sommes pas. Nous sommes, ah ! Que sommes nous ? Des tourbillons, des grandes boucles de rétroactions, des foules inquiètes, en recherche, des cheminements critiques,

instables, complexes, oui, de vastes collectifs. Ils voulaient des solutions techniques, simples, claires. Mais nous, les objets techniques, nous ne sommes rien de technique. (Latour 1992, 237)

Latour's subject was dead, and his eulogy to Aramis speaks for something that does not exist, and it never will exist within the same complex network of social, institutional, and technical actors. My subject has yet to come into existence, and it occupies a curiously liminal existential sphere: the technology is fully envisioned but not yet operational, and the project's existence has already enacted structural violences. Following Latour's tradition, I believe the framing of this desalination plant as a technical fix fails to disclose the weight of its *social* impact on Dakar.

This thesis first deals with the relation between humans and their nonhuman surroundings, mapping out the flows of water among the socio-ecological actors enrolled in the desalination plant's coming into existence. The second chapter shifts towards analyzing the cultural values that push this project forward as a solution to existing problems and emphasize that the massive significance of this project is not a function of its technological effects but rather the ways in which it addresses cultural anxieties about Dakar's metropolis. Then, Chapter 3 adds the voices of non-dominant groups who reveal the undesirable realities often eclipsed by the magical ideals put forth by this project. All three of these actors are enrolled in a complex network surrounding this desalination project.

There are stories yet to be told about this network and others, and there are many unresolved questions in this network. The notion of sustainability, for instance, is a massive topic. As the necessity for ethical and equitable resource distribution becomes more pressing, and technological solutions become more advanced or accessible, people must understand the powers technologies have to uphold or dismantle existing social, political, and ecological

systems. These powers are not limited by national or regional boundaries, either: unsustainable practices like plastic waste or greenhouse emissions often disproportionately affect those less equipped to deal with them. Similarly, the impact of foreign technology investments in countries unable to otherwise afford these technologies is a significant dynamic in the Dakar network which I have left unexplored. Of course, the colonial effects on agriculture, resources, and socioeconomics are also historically significant factors largely set aside in this project. The entangled, multidimensional nature of the network approach opens countless future pathways for scholarship and social change.

The construction of a new technological monument on Mamelles Beach appears to usher in a new era of Dakar's future. A shiny new factory sitting beneath the two largest monuments in Dakar is certainly symbolic in appearance, and its promise to solve the largest resource crisis in Dakar with modern technology connotes a more secure and abundant future. This is a monument of development, progress, and improvement; these ideas in themselves are anything but negative. However, the overwhelmingly positive image and narrative surrounding this desalination project distracts from its negative effects on people and the environment. In using an Actor-Network approach, I expose the complicated, gritty details of the desalination plant's existence. In between the seawater input and potable water output lies a host of injustices and structural violences, like the project's occupation of land and sea and its negative environmental impact. My investigation of this project's "missing masses" – both discursive values and Dakarois publics – ultimately aims to represent the role of people in a project that has been largely decontextualized and de-peopled by the institutional power surrounding it.

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