
OUR
SAFE
HAVEN

OUR SEA OF ISLANDS:

A Floating Regenerative Architecture for Tuvaluan Resilience

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A 90-point thesis submitted to the
Auckland University of Technology in partial fulfillment
for the requirements of the degree of Master of
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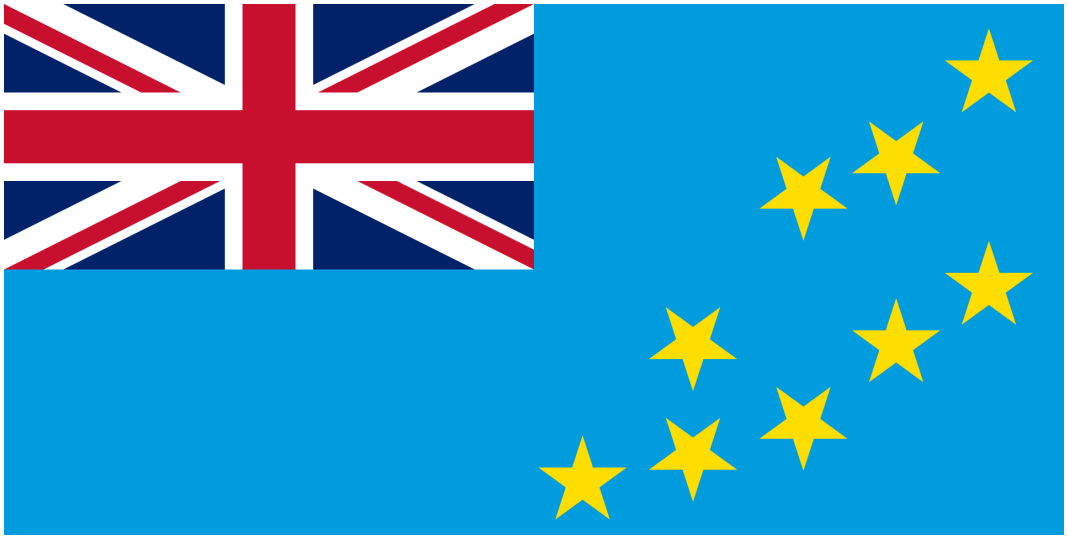

Figure 01
(Flag of Tuvalu, 2022) - The 9 islands(Stars) include 4 reef islands (upright stars) and 5 coral atolls (up-side-down stars).

ABSTRACT

Tuvalu is on the front line of climate change. The rising seas are not just encroaching on land, but also on cultural identity, national sovereignty and continuity. This thesis called Our Sea of Islands: Regenerative Floating Architecture for Tuvaluan Resilience, aims at rethinking urbanism as a floating realm at the heart of Funafuti Lagoon. The project offers a culturally embedded and ecologically restorative design solution for these fast changing times.

The research asks how might a regenerative floating architecture for Funafuti Lagoon enable Tuvaluan resilience and sovereignty in the context of rising seas? Further it questions how might Marine Integrated Regenerative Systems (MIRS) enable a harmonious relationship between the built environment and the ocean?

The project is informed by research-led design. It taps into Oceanic thought, theories of embodied experience, and architectural experimentation. Methods include mapping, modelling, and iterative design. The idea is to create a vision of a floating marine city that can foster community life and ecological regeneration and resilience while cultural traditions thrive.

The thesis references Epeli Hau'ofa's Our Sea of Islands, urban strategies described in SeaCities: Urban Tactics for Sea-Level Rise, as well as architectural case studies like Oceanix City and the Maldives Floating City. These diverse contexts inform the design of a place where the ocean connects people and life. A concept of architecture as a means of invention, regeneration and ongoing cultural development is constructed here in the fluid space of the lagoon. The floating city is portrayed as a resilient response to climate change and as a means for Tuvaluan sovereignty and futurity.

Declaration

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements or cited in the references), nor material which to a substantial extent has been submitted for the award of any other degree or diploma at a university or other institution of higher learning.

I further declare that the research contained in this thesis has been conducted in accordance with the Auckland University of Technology Ethics Committee (AUTEC) guidelines and that the relevant ethical approval has been obtained.

Signed:

Date: 28/05/2025

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Lastly, I give credit to my heritage of Tuvaluan, Tokelauan, with New Zealand European. Each of them has influenced my views and process in a unique manner, including but not limited to: my identity as a Tuvaluan individual has been particularly influential on this research, shaping it to be what it is

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INTRODUCTION

A Nation on the Brink

Over the past 150 years, certain actions by humans, such as burning coal, oil and natural gas, have caused atmospheric concentrations of carbon dioxide to increase from about 280 parts per million to more than 430 parts per million today (IPCC, 2021). That has driven global warming and rising sea levels. These, in turn, are endangering the very survival of low-lying countries such as Tuvalu (McIver et al., 2015; Kelman & West, 2009). We find ourselves in the era of what some call the Anthropocene. This is an era in which humans exert an outsize influence on the climate and upon the ecosystems we inhabit (Crutzen & Stoermer, 2000; Steffen et al., 2011). The case of Tuvalu is an illustration of how pressing it is to invent new ways of living with the sea. This research investigates how a floating city in Funafuti Lagoon could respond to these shifts. It also asks how such a city might afford a better life and a sustained culture. By integrating new marine systems such as Marine Integrated Regenerative Systems (MIRS) with the construction techniques that have been passed down, this project will preserve nature. It will support the local economy and ensure Tuvaluan traditions are carried into the future.

The Challenge of Rising Seas

Tuvalu's unstable state underscores the need for innovative solutions to rising sea levels. This research aims to address these challenges confronting its future city. It does so not merely to keep the city afloat, but rather to challenge it to thrive amidst its difficulties. The project integrates regenerative systems, such as Marine Integrated Regenerative Systems (MIRS), with traditional Tuvaluan building practices. These aim to enhance biodiversity, safeguard livelihoods, and foster cultural continuity.

A Blend of Tradition and Innovation

A core principle of this project is Tuvaluan culture, which is based on strong community life, respect for the environment, and shared responsibility. These values guide how people live, build, and care for one another. In Tuvalu, families often live together across multiple generations, and important activities like fishing, farming, and gathering take place as a group venture. The nurture of land and sea is not only practical but also spiritual and cultural and is consistent around the Pacific. (Pollock, 1992; Tekinene & Crocombe, 1990; Hau'ofa, 1993).

Epeli Hau'ofa's re-evaluation of the Pacific Islands as a collective sea of islands rather than "islands in a far sea" has been critical for reorienting Indigenous interpretations of place, connectivity, and culture in Oceania. Hauofa describes in Our Sea of Islands that the western perspective can see Pacific nations as "tiny, isolated dots in a vast ocean," and this limited perception is associated with feelings of inadequacy and deference (Hau'ofa, 1994). He counters that notion by highlighting the extensive tradition of travel, trade, and relationships over and across the ocean. These long predated the erection of colonial borders in the region. Rather than isolated or disentangled islands, he writes, "Oceania is us. We are the sea, we are the ocean, we must wake up to this ancient truth and together use it to overturn all hegemonic views that aim to confine us again, physically, and psychologically" (Hau'ofa, 1994). This vision serves to reframe the Funafuti lagoon in the design. It is seen not as a distant and fragile place, but as a living and connected place that has cultural, environmental, and social significance.

Hau'ofa's idea of the ocean as a connector not just of people but also of ideas, knowledge, and ways of life is not symbolic. It is deeply real and lived. He writes that Pacific communities "moved and mingled unhindered by boundaries of the kind erected much later by imperial powers" (Hau'ofa, 1994). This serves to make a point that identity in the Pacific area has never been fixed or associated with distinct pieces of land. It is instead one dictated by mobility, exchange, and common relationships. This mode of thinking is, in turn, directly reflected in the conception of the floating city on the Funafuti Lagoon. And instead of treating the ocean as a problem to solve, they treat it as a living component of the project. Rather than designing private, enclosed dwellings, the city includes shared open spaces, flexible buildings, and strong links to the sea and to each other. Hau'ofa's vision of openness and connection is reflected in how spaces are planned for communal life, shared resources, and collective care.

In this sense, Hau'ofa's concept of the "sea of islands" serves as both a guide and a design principle. It challenges a familiar architectural convention. This is one that sees the earth but not the sea. The project does not view the ocean as empty, or dangerous, but as something that can be filled with possibilities. The floating city is designed as a collection of platforms, buildings, and ecosystems. These can adapt and respond together. It offers infinitely small installations, each connected but varied in use and size. These can change with the tides, the climate, and the community's needs. Hau'ofa's ideas of mobility, kinship, and the vastness of the sea shape the project's values. The result is a design that encourages new ways of living together. These occur not within fixed borders, but within the openness of the ocean itself.

Vision for the Future

This research uses a design-led approach supported by context analysis, philosophical thinking, and repeated

testing through drawings and models. According to Groat and Wang, "design as research can employ a wide variety of strategies, including the development and testing of design proposals, and the use of visual media and artefacts as both process and product" (Groat & Wang, 2013). To fully answer the research questions, the project looks far into the future. It projects seven generations ahead, to the year 2200. By this time, Tuvalu may face complete flooding. Sea level rise predictions are inconsistent and have been estimated from 0.3 metres to 2 metres. Some scenarios estimate 5 metres or more in extreme cases. The IPCC states that "global mean sea level rise for 2100 is projected to be 0.29–1.1 m depending on emissions scenario, but values above this range are possible due to deeply uncertain ice-sheet processes" (IPCC, 2021). Should these predictions be realised, Tuvalu's land will be entirely submerged by the ocean. Traditional island life would no longer be possible on the land. This is the duration this research takes to guess upon. It considers what it might be like for floating architecture to become the new ground for Tuvaluan life in the future. It imagines a future where culture and community persist even as the land goes under.

This research is designed within an Indigenous seven-generation temporality as articulated by Jones and Wildcat, who explain that "responsibility is extended through time into the distant future — seven generations" and that this "temporal orientation is grounded in Indigenous traditions and knowledge systems" (Jones & Wildcat, 2010). Design work is sited now in 2025. The final proposition is designed for 2200, when the floating architecture is all that stays and defines the extents of the former atoll. At the outermost prediction, Tuvalu's territorial boundaries will be lost beneath the sea. This would put Tuvaluan sovereignty and nationhood at existential risk.

This research explores radical resilience strategies for Tuvalu. The architectural proposition will enable a repurposed cultural identity that will both buoy and guard cultural heritage for generations to come. It draws on design-led inquiry as "a way of speculating and envisioning through the material, spatial and cultural possibilities of architecture" (Groat & Wang, 2013). The research project calls attention to the immediate threats of climate change. It also sets an example for other at-risk island nations around potential strategies for climate-resilient design.

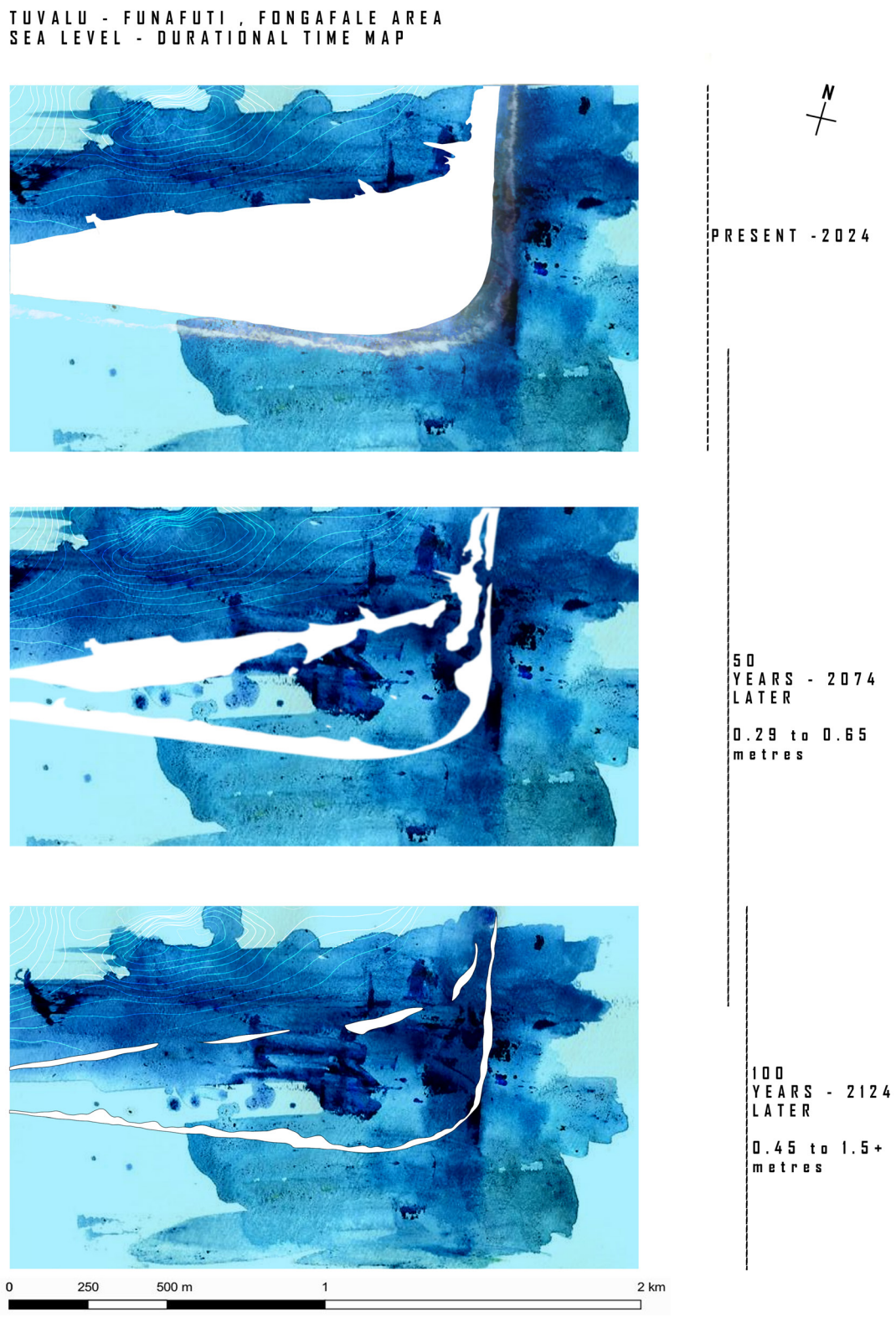

Figure 02
(Author, 2024) - Abstract perspective of Fongafale, showing the durational sea level rise in the home of the Tuvaluan capital of Funafuti.

EXEGESIS OUTLINE

Chapter One: Context collects the five major cornerstones of the project. Part One outlines the Funafuti Atoll Lagoon as both a fragile ecological site and the cultural heart of Tuvalu. It is positioned as the living ground for the proposed architectural response. Part two: The cultural and ecological connector, as the following chapters argue for an Oceanic subjectivity and the possibility of regionalism in the space of the sea, Hau'ofa's 'Our Sea of Islands' enables the sea to be positioned as a space of relation rather than of distance. The SeaCities framework (designed by Baumeister, Bertone, and Burton) is introduced in Part Three and includes a collection of urban tactics that respond to rising seas and guide strategies of flexible and resilient sea-level. Part Four turns to architectural case studies, including Oceanix City and the Maldives Floating City, to gather insights into modularity, cultural responsiveness, and waterborne living. Part Five presents the proposed design programme for Funafuti Lagoon, integrating regenerative co-housing and Marine Integrated Regenerative Systems (MIRS) as key strategies for sustaining both human and ecological communities.

Chapter Two: Methodology

The methodology of a project-led design engaging an Oceanic knowledge system and embodied research is described in this chapter. The methodology is situated within Pacific and ecological thought in Part One. It is also situated by mapping out strategies for responding to the passage of time, emphasising the tide and memory in Part Two. Diagramming and modelling are iterative testing and space refining methods explored in Part Three. These approaches coalesce to maintain balance between theory and practice. They place the research in context and culture, in Part Four.

Chapter Three: Design

The Design chapter takes us through a series of five design moments from the rise of the floating city. Part One: Early Physical Site Modelling for Scale and Lagoon Conditions. Part One begins to evaluate the water with two central designed forms: a fishing and community rig and a co-housing flotilla informed by vaka forms and Tuvaluan Christian-based architecture. Part Two presents the development of the two primary built forms: Lau Palu Moana, the floating fishing and community rig, and Vaka Lotu, the residential housing flotilla. Part Three addresses the HarvestPod, a modular energy/food/marine-repair platform, and presents regenerative systems. Following this, mooring systems are investigated. They explore how anchoring solutions can

better adjust to tidal and environmental changes in Part Four. The chapter ends by considering the representational language deployed to express the rhythm and the change of the city.

The research project's long-term vision grapples with the reality that the atoll will be entirely underwater within the next century. Instead of resorting to tall concrete and steel buildings, like many other island complexes, the flotilla residential modules are designed to keep the shape and lagoon silhouette of the island intact via floating structures. Beneath the city, solar systems and Marine Integrated Regenerative Systems (MIRS), which include coral farms and seaweed cultivation zones, help preserve biodiversity and enhance water quality. The fishing rig is designed to sustain coral/reef farms, creating a symbiotic connection between the built and natural environment. This development over the decades is a vision of Tuvalu thriving in the face of environmental challenges but retaining its cultural harmony and linkages with the ocean in the future.

1

CHAPTER ONE

Context

CHAPTER ONE

Context

This research project investigates how cultural and ecological regeneration can respond to the imminent challenges of climate change. Using a Pacific-informed, environmentally grounded design approach, the research develops sustainable, future-ready solutions. Rooted in Tuvaluan heritage and Pacific knowledge systems, this design responds to the threats of climate change whilst cherishing and honouring the core values of Tuvaluan life. The aim is to build an architecture that lives and is the foundation for Tuvalu's future.

This chapter, Contexts, unpacks five foundational areas essential to developing the research and design process.

Part One – In 'The Lagoon,' I seek to define Tuvalu's Funafuti Atoll Lagoon as the urgent driving force for survival and terrain of its culture. The lagoon is not just a rich ecological feature but also an important cultural site. This context provides the basis for the project's proposed architectural intervention to renew and pay tribute to these fragile marine environments.

Part Two – 'The Ocean' section of this chapter addresses the ocean as a cultural and ecological connector and as a potential methodological foundation. Drawing inspiration from Epeli Hau'ofa's seminal text, 'Our Sea of Islands,' this section honours how island communities are joined by the Pacific Ocean, which serves as a source of identity and resilience. The ocean now becomes the medium for imagining interconnected, floating futures.

Part Three – I explore SeaCities, Urban Tactics in the Face of Sea-Level Rise by Baumeister, Bertone, and Burton. I review innovative urban strategies that switch back at the rising sea, offering vital insights for designing adaptive, waterborne environments.

Part Four – Architectural Case Studies explains five important examples of floating and marine-based architecture. Case studies such as Oceanix City and the Maldives Floating City offer key insights about modularity, resilience, and cultural responsiveness.

Part Five – Floating City Programme with Regenerative Co-Housing discusses the project's architectural offer for Funafuti Lagoon, deploying Marine Integrated Regenerative Systems (MIRS) with culturally attuned regenerative co-housing typologies. Here, I explain how these systems are working to create self-contained worlds that prioritise not only ecosystem health but also human community.

Finally, through these five contexts, this chapter lays out a framework for understanding design as a place of regeneration: re-siting Tuvalu culture while confronting this eco-crisis.

Figure 03
(Jong & Gallagher, 2019) - An aerial view of Fongafale island, the home to the Tuvaluan capital of Funafuti.

PART ONE

The Lagoon

The Tuvalu Funafuti Atoll Lagoon is the biggest atoll and the capital of this Polynesian state in Oceania. It is at the heart of Tuvaluan people's lives and identities. Its waters and islands have offered generations food, shelter, and a profound sense of belonging. "The lagoon is central to the Tuvaluan sense of place and continuity" (Connell, 2009; Tekinene & Crocombe, 1990). This centrality is not only physical but also deeply cultural, shaping daily rhythms and grounding intergenerational knowledge. The lagoon provides a backdrop for daily life, underlies Indigenous knowledge systems, and sustains cultural traditions. "Indigenous knowledge is embedded in lived environments" (Hauʻofa, 1993; Smith, 1999). In this sense, the lagoon is not separate from the people but interwoven with their understanding of land, sea, and survival, an archive of stories, skills, and way of seeing.

But this previously stable environment is now on the verge of crisis. Rising sea levels threaten Funafuti so dramatically that the community is being forced to adapt and rethink how to live alongside their environment. "Sea-level rise poses existential threats to low-lying atolls" (McIver et al., 2015; Nurse et al., 2014). This is not a distant threat but an immediate, lived condition reshaping coastlines, food systems, and futures. Once viewed as a source of life, the lagoon has become a delicate frontline in the fight against climate change. This difference of resilience and vulnerability reflects the realities of many Pacific Island nations. "Pacific peoples are simultaneously resilient and vulnerable" (Kelman & West, 2009; SPC, 2021). Their strength lies not in the absence of hardship but in their enduring capacity to respond, reorganise, and carry forward cultural lifeways despite immense environmental pressures.

The lagoon is a place of adaptation, strength, and optimism through all these threats. It is changing tides and ancient coral support representing the hope of resilience even in periods of uncertainty. "Islanders do not passively await disaster; they adapt with creativity and hope" (Chand et al., 2022). This spirit of creative adaptation offers a vital lesson for architecture, one that embraces transformation rather than resisting change. Design inquiry is the intersection of fragility and transformation, where places hold the potential to become something else. The lagoon provides the cue for a regenerative architecture that looks ahead. "Design for sea-level rise must be more than protection — it should enable regeneration" (Baumeister et al., 2023). This moves beyond defensive measures,

urging design to become a participatory act of ecological and cultural renewal.

Based on this knowledge, the project looks to describe from an all-rounded view of the lagoon, not merely a place of intervention, but another source of lessons learned for resilient design. Through this, there is recognition of a future relationship between architecture and nature as opposed to current efforts against nature. "Architecture must shift from dominating nature to co-evolving with it" (Rawes, 2013). This shift acknowledges the agency of natural systems, proposing built environments that move in rhythm with oceanic and climatic patterns rather than looking to override them. The research looks to serve the island of Funafuti, not just as an asset to preserve, but in acknowledgement and celebration of the cultural and ecological importance. "The future of Pacific islands must honour both cultural continuity and ecological regeneration" (Tawake et al., 2020). In this framing, architectural design becomes an act of reciprocity, learning from place, giving back, and sustaining life for generations to come.

The Funafuti Lagoon, locally referred to as Te Namo, is both the centre of Tuvalu's geography as well as its cultural and natural identity. About 24 km wide and 18 km long, it is one of the largest natural lagoons in the Pacific and contains a large body of water covering more than 275 square kilometres (Connell, 2003). There is a narrow opening to the sea on the northwestern side of the lagoon called Te Ava Tepuka. The lagoon connects to the open ocean through several narrow channels, helping tidal exchange and access for small vessels (Damlamian, 2008). These links are vital for the lagoon's ecological health and help species move along with the water.

But even Te Namo is now under siege. Its waters are described as having a rich diversity of marine fauna, including economically important species, such as parrotfish, grouper, and surgeonfish. Seabirds, such as the black noddy (Anous minutus) and the white tern (Gygis alba), depend on the reef and islets for nesting and feeding (Gillett, 2016). However, urban concentration on Fongafale islet over the years has led to degradation. A hydrodynamic study saw that tidal flows are strongest through Te Ava Tepuka and Te Ava Pua Pua. This suggests these passages are critical to water renewal within the lagoon (Damlamian, 2008). A 2010 ecological survey reported that "in the lagoon adjacent to Fongafale, 96% of the area has less than 1% live coral cover," revealing extensive coral mortality linked to land-based pollution and sedimentation (Job & Ceccarelli, 2010). A study saw that "water quality tests also showed nutrient levels almost twice as high in front of populated areas than in unpopulated areas of the island." This correlates higher nutrient levels with areas of dense human settlement (N'Yeurt & Iese, 2015).v

Figure 04
(Author, 2024) - Tuvalu Species

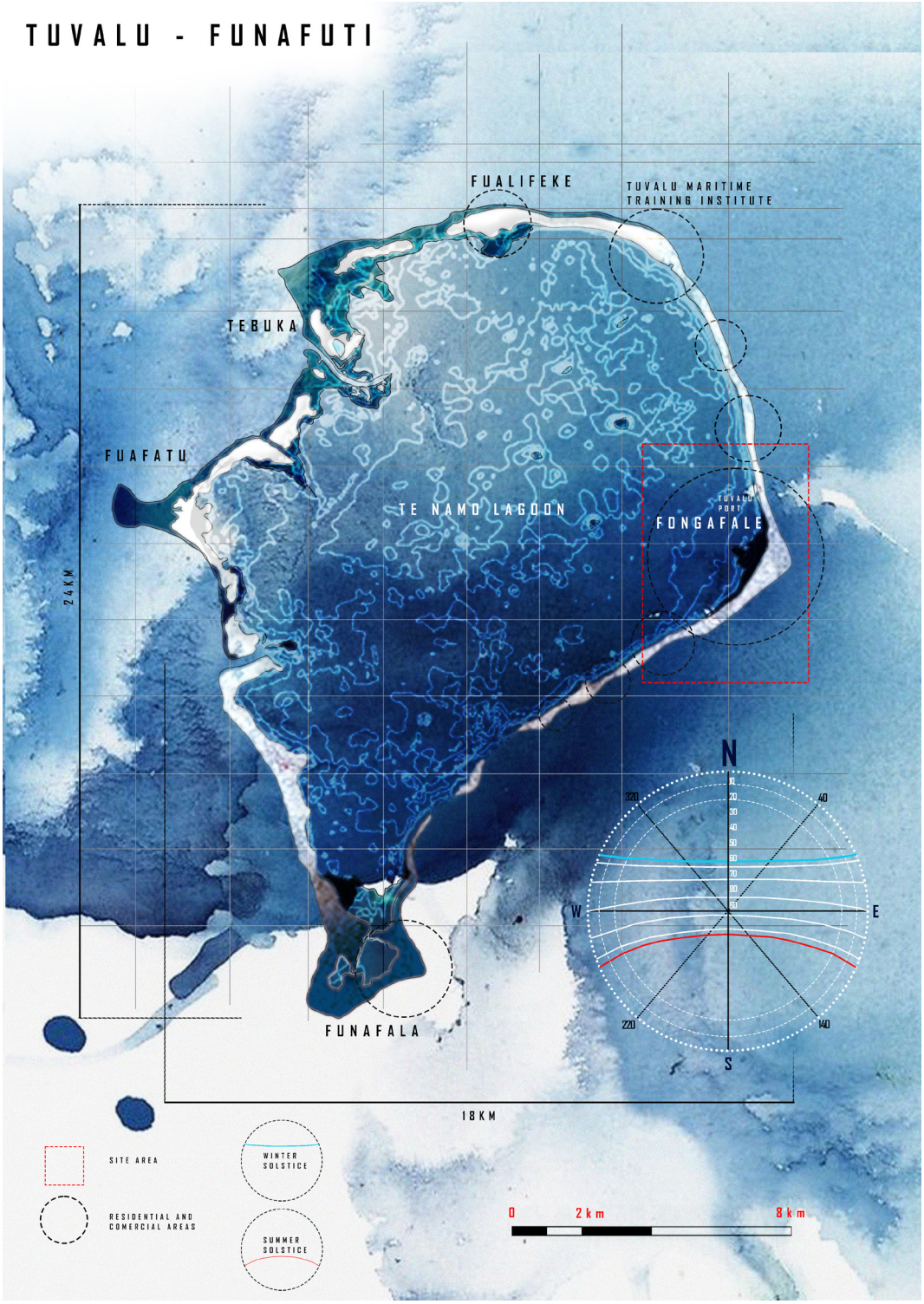

Figure 05
(Author, 2024) - Funafuti Site map
Site dimensions, Winter & Summer Solstice, Signifcant Areas & Topography.

PART TWO

The Ocean

In the second part, The Ocean defines what the term Oceania means. It constitutes the largest single body of water in the world. According to NOAA: "Covering more than 30 percent of the Earth's surface, the Pacific Ocean is the largest water mass on the planet. With a surface area of more than 155 million square kilometres (60 million square miles), this ocean basin is larger than the landmass of all the continents combined." (National Oceanic and Atmospheric Administration [NOAA]). It is not a backdrop to life in the Pacific but a pulsating and palpable presence. Where continents are visualised as solid and stagnant, the ocean is fluid and malleable, eternally churning. Pacific peoples have always understood the ocean to be a space of movement and connection. It offers sustenance, outlet, refuge, and purpose. It was already part of the way in which Pacific communities navigate, inhabit, and relate to each other. As Epeli Hau'ofa articulates, "Oceania is vast, Oceania is expanding. Oceania is hospitable and generous, Oceania is humanity rising from the depths of brine and regions of fire deeper still, Oceania is us." (Hau'ofa, 1994)

Epeli Hau'ofa's famed essay, Our Sea of Islands, calls for a re-imagining of the Pacific. He writes, "There is a gulf of difference between viewing the Pacific as 'islands in a far sea' and as 'a sea of islands.' The first emphasises dry surfaces in a vast ocean far from the centres of power." ... "The second is a portrayal of a people building and living in oceanic realities" (Hau'ofa, 2008). Oceania is a vast network of peoples and places, Hau'ofa argues, not a disjointed assemblage of small islands scattered across an ocean. The sea is not what separates the islands but what connects them. He writes, "The world of our ancestors was a large sea full of places to explore, to make their homes in, to breed generations of seafarers" (Hau'ofa, 2008). It eases cultural exchange, migration, storytelling and trade. Hau'ofa refutes colonial perspectives that depicted the Pacific as distant or marginal. He reminds us, "Theirs was a large world in which peoples and cultures moved and mingled, unhindered by boundaries of the kind erected much later by imperial powers" (Hau'ofa, 2008). He reminds us that the sea is a lived space, filled with histories and futures. From this perspective, the Pacific is not made of one great ocean with a lot of little islands. He says, "Oceania is us. We are the sea, we are the ocean" (Hau'ofa, 2008). It is an archipelago of islands that creates a region of cultural and ecological wholeness (Hau'ofa, 2008).

This understanding continues to shape how design and environmental thinking are approached by Indigenous researchers and designers. Tuputau Lelaulu's doctoral work, Maumoana, builds on Hau'ofa's vision by seeing the ocean as a living system with its own ecological logic (Lelaulu, 2021). His regenerative design framework introduces ideas like Vā Moana, Mauri Moana, and Mana Moana, which describe the deep relationships between people, place, and the sea. These ideas recognise the ocean as a source of life, identity, and knowledge. Instead of viewing water as empty space or a barrier, Maumoana sees the ocean as the starting point for strong and resilient design. It reminds us that regeneration is not just about fixing nature. It is also about repairing our relationships with place, with the ocean, and with each other.

Hana Salome Tuisano's doctoral research, Māopoopo, also explores these types of relationships by focusing on Tokelauan ideas of wellbeing (Tuisano, 2021). As someone with Tokelauan heritage, her work feels especially meaningful. It shows how well-being is shaped by our culture, environment, and the way we care for our communities. Her research connects Indigenous knowledge with public health and community needs in Aotearoa. It shows how cultural values can guide positive change. This kind of thinking is important in this research project too, which aims to design with the same care for people, place, and the ocean.

The Funafuti Lagoon is not a problem to be solved but an entity to live with it. It is a protected space sculpted by tides, coral, and cultural memory. The floating city proposed for Funafuti Lagoon within this research embodies this thinking. It does not overlay a grid or a land-based pattern. Instead, it envisions a dispersed flotilla of architectural vessels that shift, breathe, and change with the water. These are not defensive buildings, these are responsive buildings. They drift, tilt, and crack open to the wind. They take the logic of Tuvaluan village life into new forms. A sea of structures that are culturally rooted and environmentally coordinated.

Because of this ocean-led approach, the architecture is flexible, linked, interactive, not fixed. Like vaka moving across the horizon, the design is clustered together. Co-housing platforms are clustered around shared spaces that reflect the approach of fale gatherings, which is why these spaces are not completely enclosed.

PART THREE

Literature and Architectural Case Studies

SeaCities: Urban Tactics for Sea-Level Rise makes a prompt and valuable addition to the emerging branch of architectural thought that both reacts to climate change and works at the scale of cities. The authors frame sea-level rise not only as an environmental threat but as "an opportunity to explore potential SLR adaptation methods for each of these urban elements" (Baumeister et al., 2021). Rather than proposing large-scale engineering projects or simply retreating from the shore, SeaCities proposes a design-based approach that moves from "risk management to the creation of urban opportunities" (Baumeister et al., 2021).

The book remakes the relationship between cities and the sea. It encourages hybrid and nature-based solutions. "To achieve a far-reaching change from 'defeat the water' to 'living with the water,' the complete urban system must be considered" (Baumeister et al., 2021). This supports the idea that urban areas should work with water rather than against it. The authors highlight how historical societies like the Dutch approached flooding, as "The city is designed to live with the water rather than against it, adapting to rising sea levels and changing climate." (Bjarke Ingels Group (BIG), 2019).

The book is framed around a series of architectural case studies, design concepts and forward-looking strategies. Four major approaches proposed include "floating settlements, flexible shorelines, buoyant infrastructures, and tidal wetlands" (Baumeister et al., 2021). These are not one-size-fits-all but are adaptive to different urban systems. Instead of fixed solutions, SeaCities encourages "incremental development, localised responses, and systems thinking" through what it calls "system thinking and integrated approaches" (Bertone & Sahin, 2021).

The architectural design for the floating city in Funafuti Lagoon must respond to tides, seasonality, and shifting land/sea edges over time. This reflects one of the book's core principles: "Flooding... can stimulate the reorganisation and regeneration of states and their economic resources" (Baumeister et al., 2021).

The strategies proposed in SeaCities relate closely to the aims of this research. Particularly its emphasis on floating architecture, modular growth, and multiscale resilience. One chapter proposes the idea of urban adaptation through a "temporal correlation of design, monitoring and re-design

cycles" based on seasonal variation, to improve the resilience and effectiveness of urban systems (Giurgiu, 2021). This aligns with ideas explored in co-housing cluster design and Marine Integrated Regenerative Systems (MIRS).

Moreover, the book explores planning tools and governance models that support community-led and long-term adaptive processes. As it states: "The Dutch society had to be always open to new technologies for water management... their joint development and financing models were the reasons for Holland's rise to become a world power" (Baumeister et al., 2021). These ideas link well with Tuvaluan traditions of communal ownership and resilience.

Crucially, the strength of SeaCities lies not just in its technical insights but in its attitude toward designing "with uncertainty, care, and long-term thinking" (Baumeister et al., 2021). The SeaCities initiative is described as a platform for "urban experiments designed in response to the challenges associated with sea-level rise" (Baumeister et al., 2021). This resonates with the Tuvaluan vision for a floating city that centres culture, environmental restoration, and self-determination.

Even where technologies from SeaCities are not directly applied, the research benefits from its conceptual frameworks. These support further development and critical inquiry into future stages of design. It provides an adaptable and regionally grounded foundation for architectural thinking in the context of climate disruption.

This research offers a contextual analysis for global conversations on water-sensitive design and climate futures through the lens of SeaCities that remain firmly rooted in the Pacific. This allows the research to function on two registers: one shaped by Tuvaluan lived experience and cultural knowledge, and another embedded in global architectural discourse on climate resilience. Together, they illuminate not only the challenge of sea-level rise but the opportunity to plan for futures that are adaptive, just, and grounded in place.

PART FOUR

Architectural Exemplars

Oceanix City

A trend of floating and marine-based architecture projects is underway, offering innovative solutions to climate change and rising sea levels worldwide (Baumeister et al., 2021). This research targets key exemplars to serve as role models for the composition and use of floating cities. These models were selected for their relevance to Funafuti Lagoon and Tuvalu's vision of integrating local culture, ecological sustainability, and technological innovation. (Lelaulu, 2021; Chand, Warrick, & Lee, 2022)

The first is Oceanix City, an offshore community off Busan, South Korea, designed by the renowned firm Bjarke Ingels Group (BIG, Oceanix. 2019). The second is Maldives Floating City, by Waterstudio (Maldives Floating City, 2023), located in the lagoon near Malé, the capital of the Republic of Maldives. Both projects highlight progressive approaches to building buoyant cities that respond to sea-level rise while supporting the needs of wildlife and human health.

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Figure 06
(Oceanix - Gibson , 2019)

Designed by the Bjarke Ingels Group (BIG), Oceanix Busan is a monumental project aiming to create the first sustainable floating city in existence (Bjarke Ingels Group (BIG), 2019). The result is a master plan that exemplifies how waterfront cities might adapt as sea levels rise worldwide (UN-Habitat, 2021). It is found off the coast of Busan, South Korea. Oceanix City is a human-centred, resilient, and sustainable floating city featuring renewable energy production and sustainable water resource management. It benefits up to 12,000 residents across six hectares. The lesson learned from this project about adaptability and sustainability reflects how Tuvalu would envision their floating city in Funafuti Lagoon. It is designed to be resilient to weather changes while meeting the needs of locals without excessive borrowing. Oceanix Busan will be the world's first high-tech floating city. It is situated just off South Korea's Busan. Developed in partnership with the United Nations, the city of Busan, and the technology company Oceanix, it aims to be a prototype for "the world's first sustainable floating city." (UN-Habitat, 2021)

The framework for the city's development adheres to new urban planning strategies that are sustainable. Architectural design is in the capable hands of BIG – Bjarke Ingels Group, renowned for its innovative and sustainable urban strategies. (Bjarke Ingels Group (BIG), 2019)

Oceanix Busan, a floating community designed for resilience, will accommodate up to 12,000 residents across six hectares. It will include renewable energy systems, sustainable food production, and closed-loop waste management. The city is also developing structures designed to withstand catastrophic weather events and the challenges of rising sea levels. It aims to create a sustainable habitat for many years. (Bjarke Ingels Group (BIG), 2019)

Oceanix Busan presents an innovative approach to the unique challenges posed by climate change in urban settings. It shows the evolution of sustainable city design and planning in response to increasing sea levels. This initiative employs innovative technologies and adopts modular, scalable, and recyclable urban structures. These installations serve as a foundational model for future climate-resilient cities. Therefore, I believe this city contributes significantly to considerations of urban resilience, modularity, and scalability in floating city designs. This is especially relevant for Pacific Island nations like Tuvalu, which must effectively adapt to rising sea levels and other environmental challenges. (Chand, Warrick, & Lee, 2022)

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In the context of the proposed floating city in Funafuti Lagoon, Oceanix Busan effectively illustrates a path to navigate the integration of regenerative technologies and resilience design principles. To use floating cities in combating the pressing threat of climate change in Tuvalu, it is crucial to examine how this innovative architectural concept can merge culturally relevant development, environmentally sustainable practices, and innovative technologies. Its emphasis on renewable energy, sustainable living, and modular construction aligns perfectly with the vision for a floating city in Funafuti. This vision is one that adapts to its changing environment while supporting Tuvalu's cultural and ecological heritage.

A lesson from such a progressive model could further ensure that Tuvalu's floating city embraces these principles. This will help it stay resilient while integrating local traditions and sustainable construction techniques. (Chand, Warrick, & Lee, 2022)

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Figure 07
(Oceanix - Gibson , 2019) - Floating City Perspective

Figure 08
(Oceanix - Gibson , 2019) - Perspectives & Programmes

Maldives Floating City

Maldives Floating City (MFC), designed by Waterstudio (Maldives Floating City, 2023), the MFC illustrates an ambitious concept for climate-resilient land use planning. Situated on a lagoon near Malé, the capital of the Republic of Maldives, an island nation in South Asia. Its design consists of Maldivian design with modern sustainable features such as solar rooftops, green parks, and coral gardens. This feature of Maldives Floating City, which is based on sensitivity to culture and ecological balance, is a useful example for Tuvalu; through such inspiration, traditional yet innovative solutions can be developed (Lelaulu, 2021; Chand, Warrick, & Lee, 2022), complementing each other and leading the way in addressing sea level rise while preserving what makes them unique culturally. The Maldives Floating City (MFC) is a progressive would-be

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***Figure** 09*
Maldives Floating City, 2023) - Modular Plan View

urban development aimed at tackling the challenges of rising seas in the Maldives. Designed in collaboration with the Maldivian government and the Dutch practice Waterstudio, the development is intended to ease sustainable, climate-adapted housing in a country in which more than 80% of the land is lower than one metre above sea level. Unlike temporary or luxury developments, MFC is conceived as a permanent and operational urban solution that provides a long-term response to urban adaptation to climate change. (Baumeister et al., 2021; UN-Habitat, 2021)

Set in a lagoon approximately 10 minutes from Malé, the capital of the Maldives, the city would consist of interlinked hexagonal floating platforms that form a self-sustaining ecosystem. Those platforms will be home to homes, shops, schools, and other amenities, housing upwards of 20,000 residents while staying tethered to the main island. The design language thrives off traditional Maldivian culture, combining cultural identity with advanced technology in a climate-responsive way. (Lelaulu, 2021)

A key feature of the MFC is its eco-friendly element. The entire city is designed to minimise its environmental impact, with renewable energy-generating solar panels, green spaces to encourage biodiversity, and coral gardens situated below the platforms to help marine regeneration (Duarte et al., 2017; Kellogg et al., 2013). Systems for waste management and local food production are also integrated to limit external resources and promote self-sufficiency. (Todd & Todd, 1993; Smith et al., 2019)

For Tuvalu's floating city proposition in Funafuti Lagoon, the Maldives Floating City is a vital case study, as both countries are equally vulnerable to climate change and rising tides. In doing so, the modular, floating platform system upon which the MFC is built provides an important reference point for Tuvalu, allowing for an adaptable, flexible urban environment that can grow or be altered to suit changing environmental and population needs. Tuvalu would benefit from this initiative, which would enable the gradual development of a floating city that can adapt to rising sea levels, the needs of the community, and technological advancements while ensuring a strong structural design.

Figure 10
(Maldives Floating City, 2023) - Coral Design Biomimicry.

The incorporation of traditional Maldivian architecture in the MFC is another critical lesson learned for Tuvalu. By mixing local building traditions with new floating technologies, the design keeps it culturally real for the city rather than being an applied foreign solution. This principle is especially important for Tuvalu. It may not be sufficient to build just a floating city in Funafuti Lagoon, one that will somehow "house" a population of Tuvaluans who will inhabit a floating cityscape built of generic, externally imposed floating infrastructure; the built environment must incorporate Tuvaluan building techniques and space planning. (Chand, Warrick, & Lee, 2022)

It also illustrates how floating structures can help restore marine ecosystems, not just mitigate the impacts of the climate crisis. The addition of coral gardens and marine-integrated regenerative systems emphasises the need to balance urban development with the sea. As it pertains to the context of Tuvalu, this could take the form of MIRS (Marine Integrated Regenerative System), an element of my research that integrates and supports marine biodiversity in floating structures. Tuvalu's floating city could reinforce ecological resilience via the installation of floating platforms that promote marine life and support biodiversity, in addition to providing sustainable urban housing. (Chapman & Underwood, 2011; Duarte et al., 2017)

An emergent property of the MFC is its emphasis on self-sufficiency. By using solar power, designing decentralised water systems, and encouraging local food production, the city is promoting its independence from external sources of supply and building its resilience. This is especially important for Tuvalu, whose heavy dependency on imported food and fossil fuels makes it economically and environmentally vulnerable. (Chand, Warrick, & Lee, 2022) Through continued development of renewable energy, aquaponics, and decentralised waste management on a sustainable, low-impact floating city in Funafuti Lagoon.

Although the Maldives Floating City is an attractive precedent, there remains the need to design Tuvalu's floating city uniquely for its own environmental, cultural, and economic situation (Lelaulu, 2021; Pollock, 1992). While the Tuvaluan society is organised as a communal, extended family to many people, floating neighbourhoods need to be arranged in such a way that they do not lose focus on shared spaces and co-housing diversity. Material choices should also consider local availability, as importing massive quantities of building materials may be impractical. (McHarg, 1969)

Figure 11
(Maldives Floating City, 2023) - Perspective Site massing

In addition, the hydrodynamic conditions of Funafuti Lagoon are substantial and are dissimilar to those of the Maldives; thus, site-specific engineering solutions must be addressed to ensure floating platforms remain stable in the lagoon. (Barros et al., 2021; Marine Flex, 2017)

Based on these distinctions, the Maldives Floating City can exemplify a floating metropolis that goes beyond mere survival. It can become a lively, culturally vibrant community that is sustainable and effectively addresses the challenges of rising sea levels (Baumeister et al., 2021; Lelaulu, 2021), all while enhancing the quality of life for its residents. In Tuvalu's case, the aim is not just to create a floating city but to build a model for regenerative urbanism that enhances ecological systems, fosters a resilient society, and preserves Tuvaluan culture. The Maldives Floating City is a useful reference point for how they can all be stitched together effectively. (Waterstudio, 2020; Baumeister et al., 2021)

Leveraging the lessons learned from the Maldives Initiative will also help Tuvalu create a context-appropriate floating city in the Funafuti Lagoon that is not just a replica of its Maldivian counterpart, but a truly innovative model for sustainable, culturally anchored climate adaptation that is fit for a changing world. This would not only give Tuvalu a practical solution to mass climate displacement, but it would also place Tuvalu at the forefront of innovative, ocean-based urbanism.

(UN-Habitat, 2021)

PART FIVE

Floating Technologies

This research explores floating systems grounded in Tuvaluan cultural values and regenerative design (Mang & Reed, 2012; Lelaulu, 2021). This section explores systems which can support architectural or urban floating environments. Marine Integrated Regenerative Technologies (MIRS) are supplementary floating systems which can support biodiversity, improve water quality, and stabilise adjacent marine ecosystems (Chapman & Underwood, 2011; Kellogg et al., 2013; Duarte et al., 2017). These systems are the foundations of a new kind of urban resilience, one that responds to the climate crisis now unfurling with more than mere survival, but with locally rooted innovation. At the heart of that vision are floating technologies capable of changing with the rising seas and enabling regenerative, communal, ecologically attuned modes of life.(Smith et al., 2019)

The goal is to leverage a new kind of urban resilience that answers the unfolding climate crisis with survival and locally rooted innovation. Central to this vision is a set of floating technologies that can accommodate rising seas and other environmental swings, while providing a way of living that is regenerative, communal, and attuned to marine ecologies.(Todd & Todd, 1993; Jones & Wildcat, 2010)

This is where regenerative co-housing is crucial to the design. The design favours shared infrastructure, water systems, and social space over individual homes or units, and clustered housing arrangements instead. These clusters nurture resilience at ecological as well as social levels. Environmentally, they are low-impact, flexible, low-embodied energy structures, made from locally sourced materials and passive design principles right for the lagoon climate. Socially, they build the ability of community members to support one another through shared kitchens, gardens, and communal gathering spaces. During disruptions, environmental or economic, these networks offer stability and care. (Chand, Warrick, & Lee, 2022)

Floating cities have been proposed worldwide as a solution to the problem of rising sea levels, though very few projects have considered local culture or context. Other projects, like Oceanix City and the Maldives Floating City, have modular, high-tech visions for living on water (Baumeister et al., 2021; Waterstudio, 2020). They are certainly the right scope and complexity, with the scale of infrastructure and environmental systems well suited to the lessons these projects hold, but the projects often

risk neglecting the cultural dimensions of mining living with the ocean. The Funafuti proposal pushes back against this impulse. Rather, it refigures floating urbanism through a South Pacific lens; one that puts community, tradition and the responsiveness to the rhythms of the sea at its centre (Chand, Warrick, & Lee, 2022; Lelaulu, 2021). In these waters, floating is no longer a futuristic novelty but a continuation of ancestral knowledge, where navigation, adaptability and communal resilience are already hardwired into Tuvaluan life.

The city of floating 'Flotilla' platforms of varied sizes that can move, merge or grow over time. Each platform functions as a mini-island, which adds to the city's body. Co-housing platforms are arranged to allow passageways, visual connection to the water and joint access to gardens, kitchens or fishing space. MIRS structures provide habitat for fish, shellfish, and algae underneath these. These systems do more than regenerate the ecosystem below, though; they create opportunities for food production and environmental education. (Smith et al., 2019)

Important design strategies comprise floating foundations that follow the flow of the tides, modular structures that enable phasing of growth, greywater and composting loops for sustainable waste disposal, and integrated seaweed or oyster farming systems. These concepts were inspired by SeaCities: Urban Tactics for Sea-Level Rise (Baumeister et al., 2021), which provides practical models for adaptable coastal infrastructure. Even if not all strategies may be a part of the final design, their inclusion in the research reflects familiarity with contemporary solutions and contributes to the long-term viability of the project. Even if you never built them, they function as a conceptual toolkit that might inform future iterations, tweaks, or scaling attempts.

This approach shows various disciplines: architectural design, marine science, cultural knowledge, and local resource planning. The proposal is not about a floating city, though. It is creating systems of life that regenerate, sustain, and adapt. The lagoon is an ally, rather than an adversary. Infrastructure becomes community. Water is what becomes the connective tissue. The floating city becomes a continuation of the Tuvaluan identity despite change. (Lelaulu, 2021; Pollock, 1992)

Marine Integrated Regenerative Systems (MIRS) for the proposed Funafuti Floating City

Introduction

Tuvalu's future is threatened by rising sea levels and climate change, so life on the Funafuti Atoll requires innovative and regenerative solutions to survive. Floating cities are one potential answer, but their potential will not be realised unless they couple ecological systems and socio-technical systems for marine well-being and livelihoods. Marine Integrated Regenerative Systems (MIRS) provide a means of achieving that balance. These systems combine urban development with marine conservation, converting

structures adrift into engaging players for ecological restoration. This protected space, which can also include on- or offshore aspects, can integrate seaweed cultivation, coral reef restoration, and shellfish farming under floating platforms to improve water quality and strengthen local food security and new economic opportunities. It references global precedents around floating cities, futuristic in their physical planning yet rooted in traditional Tuvaluan knowledge that is potentially applied at this place.

MIRS in the context of Funafuti

This section presents the main regenerative marine systems that contribute to the survival of the floating city proposed here. They include cultivation of seaweed for water purification, carbon sequestration, and marine habitat; restoration of coral reefs using cultured corals and transplantation of them; and sustainable aquaculture that relieves pressure from wild fish stocks. Mariculture is envisioned through salt-resistant crops such as taro and coconuts, utilising 'harvest pods' structured in Chapter 3, Part 3. Together, these Marine Integrated Regenerative Systems (MIRS) offer ecological services and support a resilient and self-reliant population in Funafuti.

Seaweed Cultivation

Seaweed, especially kelp, is essential for carbon sequestration and marine ecosystem health. Introducing nutrient-absorbing seaweed farms in sustainable floating systems in Funafuti could improve water quality and help local fisheries. Moreover, harvested seaweed could be converted into food, biofuels, and exportable products, which can help the community's economic development (Duarte et al., 2017).

With little land, marine-based agriculture works within not just environmental but also economic sustainability for Tuvalu.

Figure 12
(Gibson, 2019) - Oceanix Floating City
Underwater showing regenerative technologies

Coral Reef Restoration & Fishing

Coral reefs are essential for marine life and the safeguarding of islands like Tuvalu. They offer a home, food, and a place to breed for many, many types of critters. Reefs also diminish the energy of waves, helping protect the coast from erosion, flooding, and storms. The coral atolls of Funafuti are affected by higher sea temperatures, ocean acidification, overfishing, and pollution. Marine creatures can be penalised when the seawall is penetrated.

Floating platforms could help restore these reefs. They may encompass coral nurseries, where robust, heat-tolerant species of coral are raised in a safe harbour. The corals can subsequently be replanted in damaged reef sites to aid in recovery. This can enhance the fish and marine organisms' population, helping restore ecosystem balance. Coral reef restoration also helps mitigate wave energy and curb coastal erosion. Reef-like structures generate ecological as well as socio-economic advantages to Tuvalu by creating a system that protects and regenerates (Rinkevich, 2015).

Artificial Reefs

Artificial reefs can be interspersed with timber or other floating structures to increase marine habitats while strengthening the island to reduce storm surges (UN-Habitat, 2019). Oceanix City illustrates that modular platforms that use porous concrete can aid marine biodiversity. Artificial reefs built with bio-concrete can allow coral to stake a safe and stable base while also working as a basis for floating cities. Biotechnology companies developing eco-blocks to stimulate natural coral colonisation have applied this (Goreau & Hilbertz, 2005). In Funafuti, these structures can help marine resilience while securing the floating city's structural stability.

While MIRS offers many benefits, careful ecological management is necessary. Floating structures may introduce invasive species, while excessive shading could change photosynthetic organisms like seagrasses and corals. Continuous ecological monitoring and adaptive management are crucial for reducing these risks (Chapman & Underwood, 2011).

Aquaculture (Mussel and Oyster Farming)

Mussel and oyster farms under floating cities filter pollutants from the water while producing a sustainable protein source. These shellfish enhance water quality by filtering out excess nitrogen and other nutrients and contaminants while sustaining local fisheries and aquaculture-based livelihoods (Kellogg et al., 2013). With Funafuti's lagoon suffering from pollution and runoff, such systems might help to restore its ecological equilibrium.

Figure 13
(Kuwait dive team, 2025) - Artificial Reef interaction with Kuwait dive team.

MIRS Scalability and Economic Feasibility

MIRS must be expanded to effectively manage a complete floating city, which will be costly. While promising, on-the-ground implementation efforts in Tuvalu will require international finance and technical partnerships. However, MIRS could contribute to Tuvalu's blue economy with sustainable aquaculture and eco-tourism, resulting in long-term economic benefits (Smith et al., 2019).

A close relationship with the ocean has long defined Tuvaluan culture. MIRS adheres to traditional ecological knowledge, promoting an attitude of harmony with the sea. Interweaving regenerative systems with local practices, the floating city augments Tuvalu's heritage while enabling its cultural resilience to continue for generations to come.

Until then, marine science, material engineering, and urban planning must advance MIRS into the future of Funafuti. Whether it is bio-concrete that fosters marine life or genetically resilient corals, innovations like these could enhance the chances of MIRS success. The trick is for these technologies to be used in partnership with locals to ensure sustainable and culturally relevant development.

Floating cities in Funafuti must have a degree of adaptability incorporated into the design to have flexibility when responding to the impacts of climate change (Walker & Salt, 2006). The city can regenerate and stay resilient by embedding MIRS in the design. Cultivating an intertidal ecosystem can turn floating cities into productive and sustainable systems for both economic and environmental gain through joint ventures, which MIRS aims to pursue seaweed cultivation, coral restoration, and shellfish farming. But in the end, this requires some strategic nature management, financing and a bit of Tuvaluan site-specific knowledge. Facing a grief- and loss-filled future in Tuvalu, beset by climate grief and loss, MIRS is a proactive and regenerative solution, always working to protect life on the atoll.

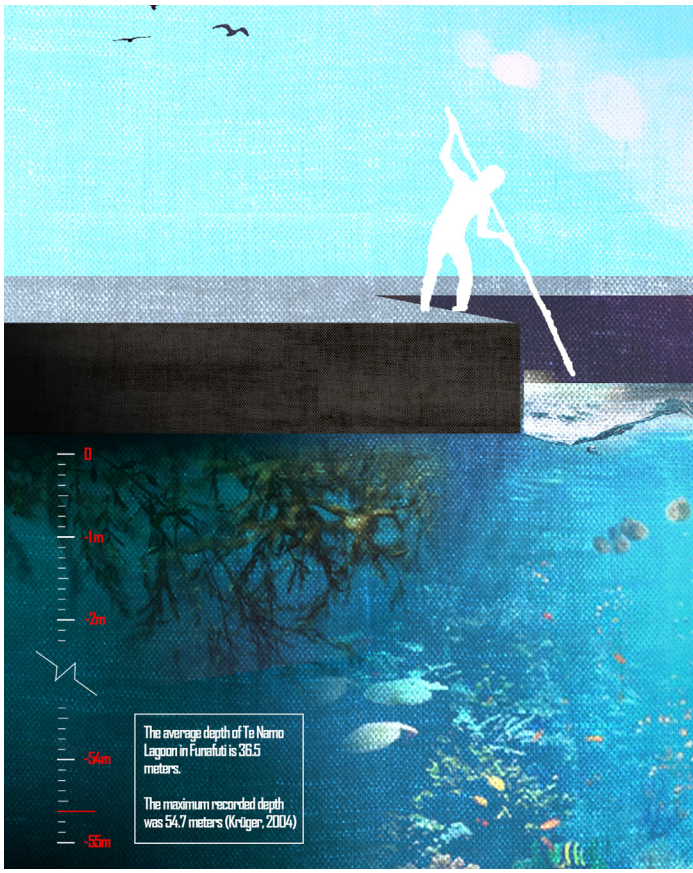


Figure 14
(Author, 2024) - Lagoon Depth

Conclusion

This chapter has discussed key contexts for this design research, outlining how the cultural and ecological significances of Funafuti Lagoon, the interconnectivity of Pacific Island communities, and innovative urban strategies inform the floating city design. Architectural case studies and regenerative co-housing models inform necessary guidelines for flexible, sustainable solutions.

The chapter that follows, Methodology, explores the research methods that informed this design process, such as mapping, model-making, and diagramming techniques used to connect theoretical insights with real-world design outputs based on the unique environment of Funafuti Lagoon.

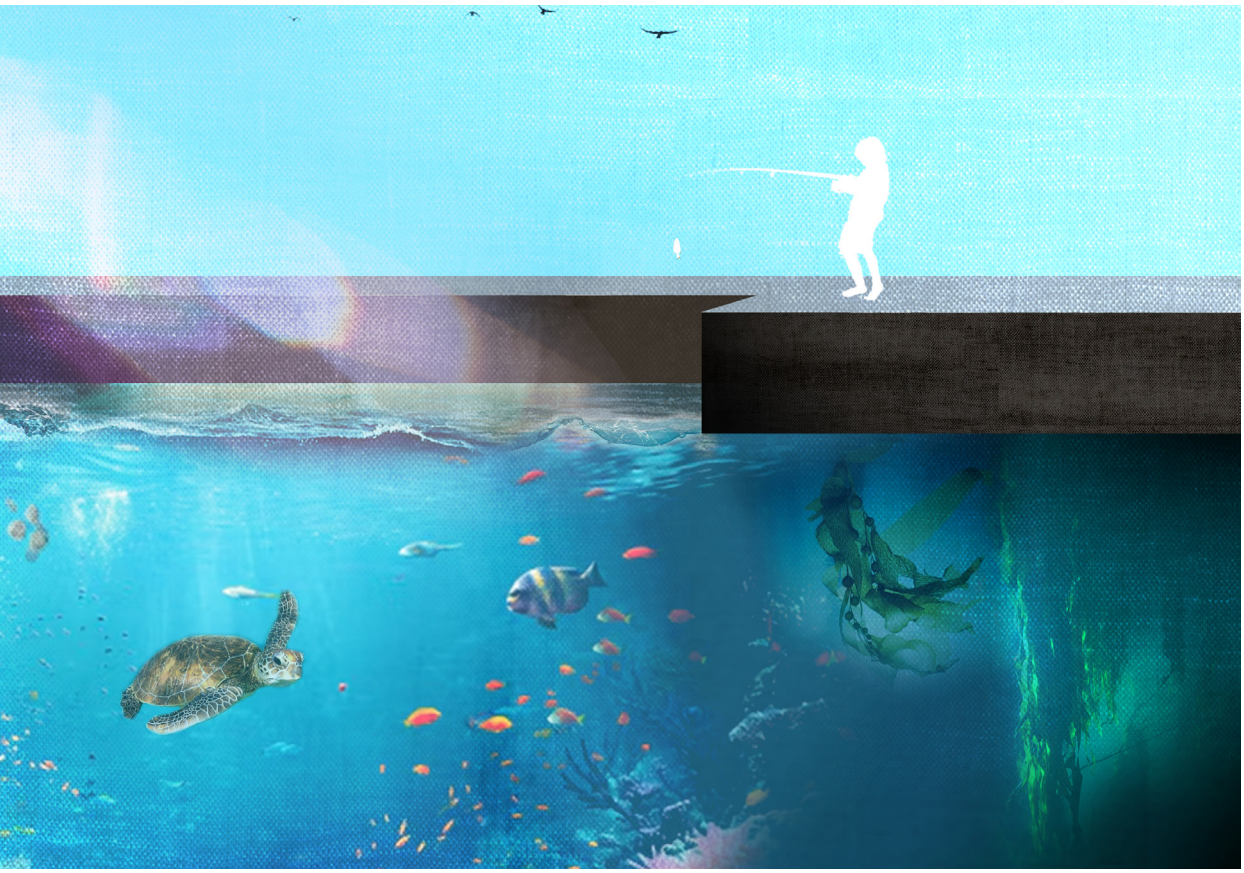


Figure 14
(Author, 2024) - Shows MIRS Species, Seaweed, & Coral.

2

CHAPTER TWO

Methodology

CHAPTER TWO

Methodology

This chapter describes the design-led research methodology that underpinned the design of a floating city for the Tuvalu Funafuti Lagoon. The methodology details how this research began to unpack the intersections of place, culture, and design through embodied, situated, and culturally sensitive practices. It also addresses some of the limitations of the research, including working from a distance from the site and working with sparse data. It was done through creative and respectful forms of inquiry, addressing these challenges. This research was not only concerned with the outcome or the final design. They were also about learning, listening, and imagining what Tuvalu's futures might be in a time of climate change.

PART ONE

Oceanic Methodology

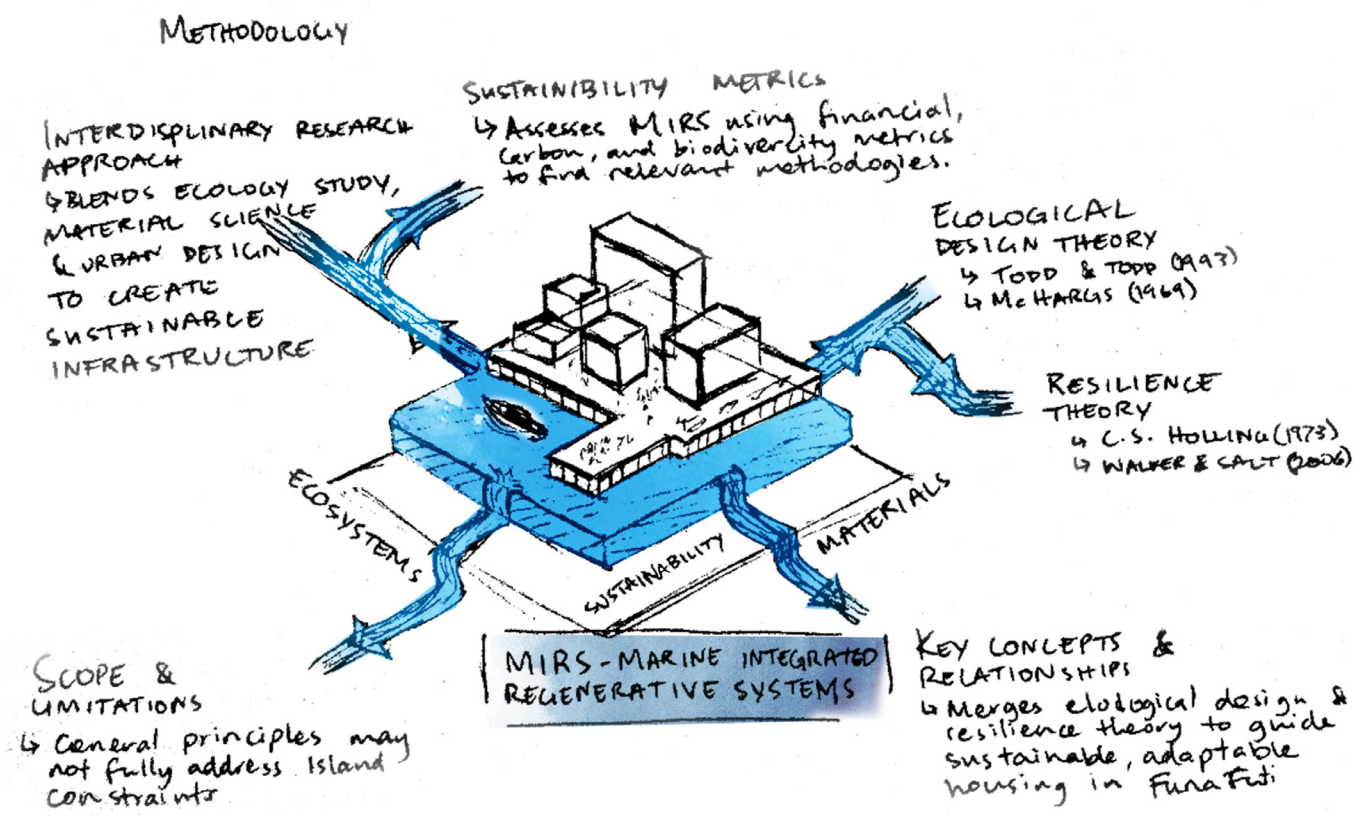
This research responds to Oceanic, ecological, and resilience thinking, using a design-led approach. A methodology is the strategy employed to direct the research; it determines how information is collected, evaluated, and analysed (Groat & Wang, 2013). In architecture, this comprises working in both creative and analytical modes.

Design-thinking approach in this study takes design as a manner of thinking and exploring, not only as a product. It is about drawing, model making, mapping, and testing out ideas through both physical and digital means. This enables the design to react to place, context, and culture as an evolving strategy.

Ecological thinking in this research refers to understanding the built environment as part of larger living systems, where materials, energy, and people are all connected. It considers how design can work with natural processes rather than against them (Mang & Reed, 2012). Resilience thinking focuses on how communities can adapt to environmental stress, like climate change and sea-level rise, by building systems that are flexible, connected, and able to recover from disruption (Walker & Salt, 2006). These ideas help shape a design response that supports both the environment and the people of Tuvalu.

Ecological Design Theory is to design with nature, not against it. The innovative approach suggested by scholars such as John Todd and Ian McHarg is to design cities to be part of a larger ecosystem, to do no harm and to heal the environment. This rule applies to Funafuti; floating cities not only need to reduce environmental damage but also need to increase marine ecosystems (Todd & Todd, 1993; McHarg, 1969).

Design-led research methodology is well suited to this project because it allows for flexible and sensitive ways of collaborating with Tuvaluan knowledge and values in a context of design explorations. Rather than applying a fixed or generalised model, the approach is shaped by the specific relationships people have with land and sea in Funafuti. These relationships are often passed on through stories, shared activities, and everyday experiences, rather than through written documents.



Mapping, modelling, and drawing were used not only as design tools. They were also respectful ways of engaging with the lagoon and Tuvaluan ways of living. These methods helped to reflect the lived experience of place. Even when direct access was not possible. Through these methods, the research tried to stay grounded in Tuvaluan knowledge systems. And cultural rhythms.

The idea of situated knowledge, from the Pacific, played a key role in shaping this process. This meant recognising that all knowledge is shaped by the position of the person creating it. Rather than pretending to be neutral or complete. The design approach remained open to the researcher's own limitations. And the importance of Tuvaluan genealogies, values, and ethics.

Figure 15
(Author, 2024) - MIRS Methodology Theories Diagram

For example, the significance of intergenerational learning was such that it influenced my decision to use family memory and oral history as key knowledge sources. Family stories handed down from generation to generation provided information about constructing airier, raised houses with thatched roofs. These could endure seasonal flooding and fierce winds. Stories also brought the traditional fishing methods to life. With families working together using vaka (canoes) and hand lines. Furthermore, understanding how to navigate the lagoon, climb coconut trees, and cope with the tough, hot weather and cyclones was also transmitted through experience.

As I could not be physically present in Tuvalu during the project, indirect but meaningful sources of knowledge provided valuable cultural insights. They helped shape my design approach. By grounding it in the realities of Tuvaluan life. Prioritising lightweight, flexible structures. And creating a close relationship between built forms and the environment. These oral histories became a vital part of my methodology. Ensuring that my design honoured Tuvaluan ways of knowing.

Design work was not created in isolation from culture but developed through a careful relationship with traditional ways of living and building. The way that the design was imagined was guided by ideas from family and community. Pacific writers such as Teresia Teaiwa and Albert Wendt were influential. Teaiwa's writings on Pacific embodiment, notably her bearing witness that "we sweat and cry salt water," reframed the ocean less as a literal space than as an emotional and spiritual one (Teaiwa, 2017). The ocean felt like something powerful and sacred. Intimately tied to identity, history, and kinship.

The concept of vā, understood as the relational space between people and things and developed by New Zealand Samoan writer Albert Wendt, also informed the city's design approach

within the context of Tuvalu space is not understood as empty but as animated by relationships. In Wendt's words, vā is "the space between, the betweenness, not 'empty' space, not space that separates but space that relates, that holds separate entities and things together in the Unity-that-is-All" (Wendt,1996). The plan of the floating city addressed this. By ordering modules in a manner that honoured connections between families. Between land and sea. And between past and future.

Figure 16
(Pedro, Tuvalu | SPC Coastal Fisheries and Aquaculture - CBFM, 2022) - Tuvaluan on his Vaka

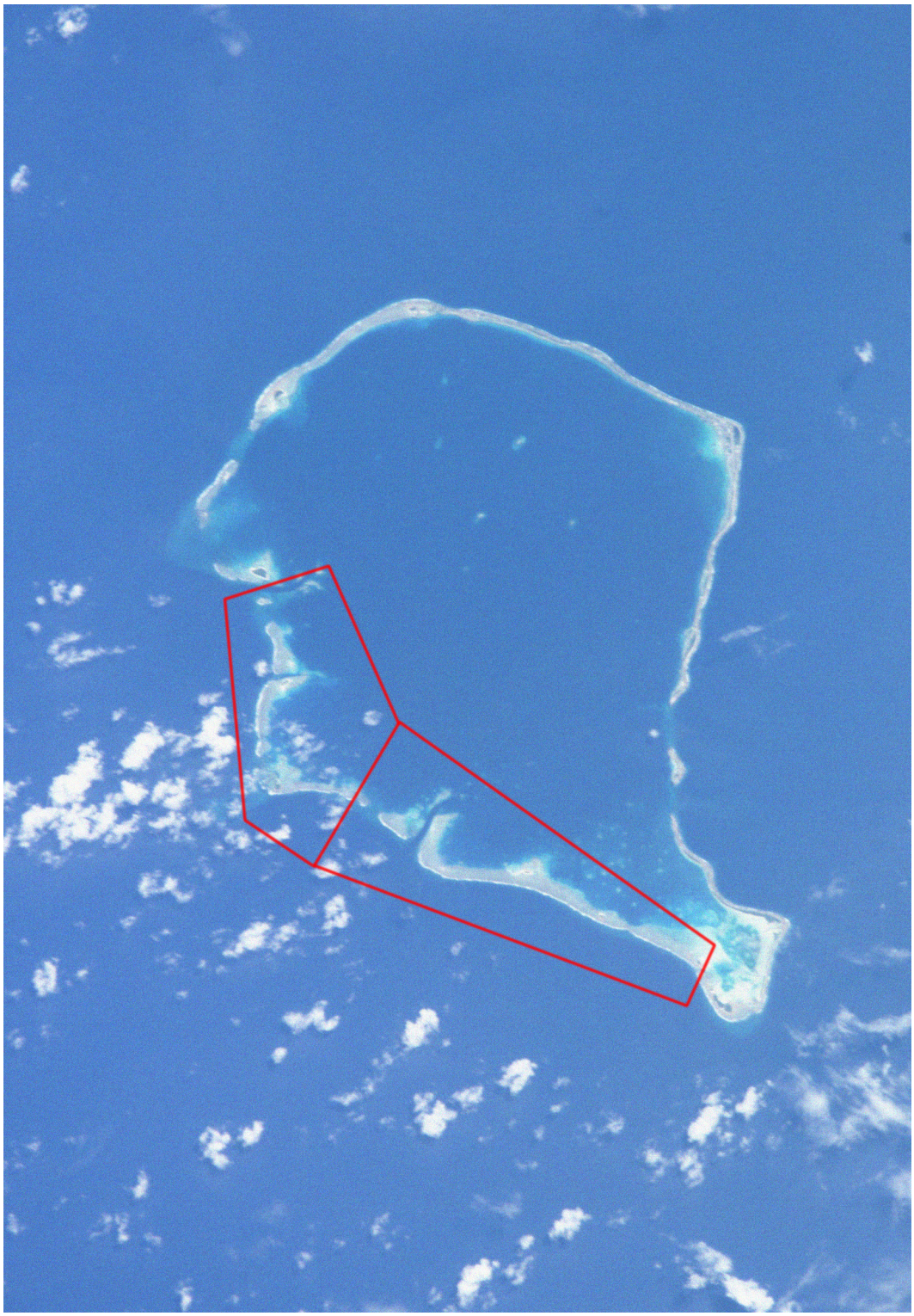


Figure 17
(NASA, Author, 2002) – Aerial photograph of the Funafuti Conservation Area, where the ocean is protected as part of community and ancestral life.

PART TWO

Mapping Method

Mapping was a key part of the research. It was used not only to show physical data. But to explore time, memory, and cultural meaning. Maps were created that layered scientific information, such as sea-level rise projections, with Tuvaluan knowledge. Including family histories, places of gathering, and traditional routes across the lagoon.

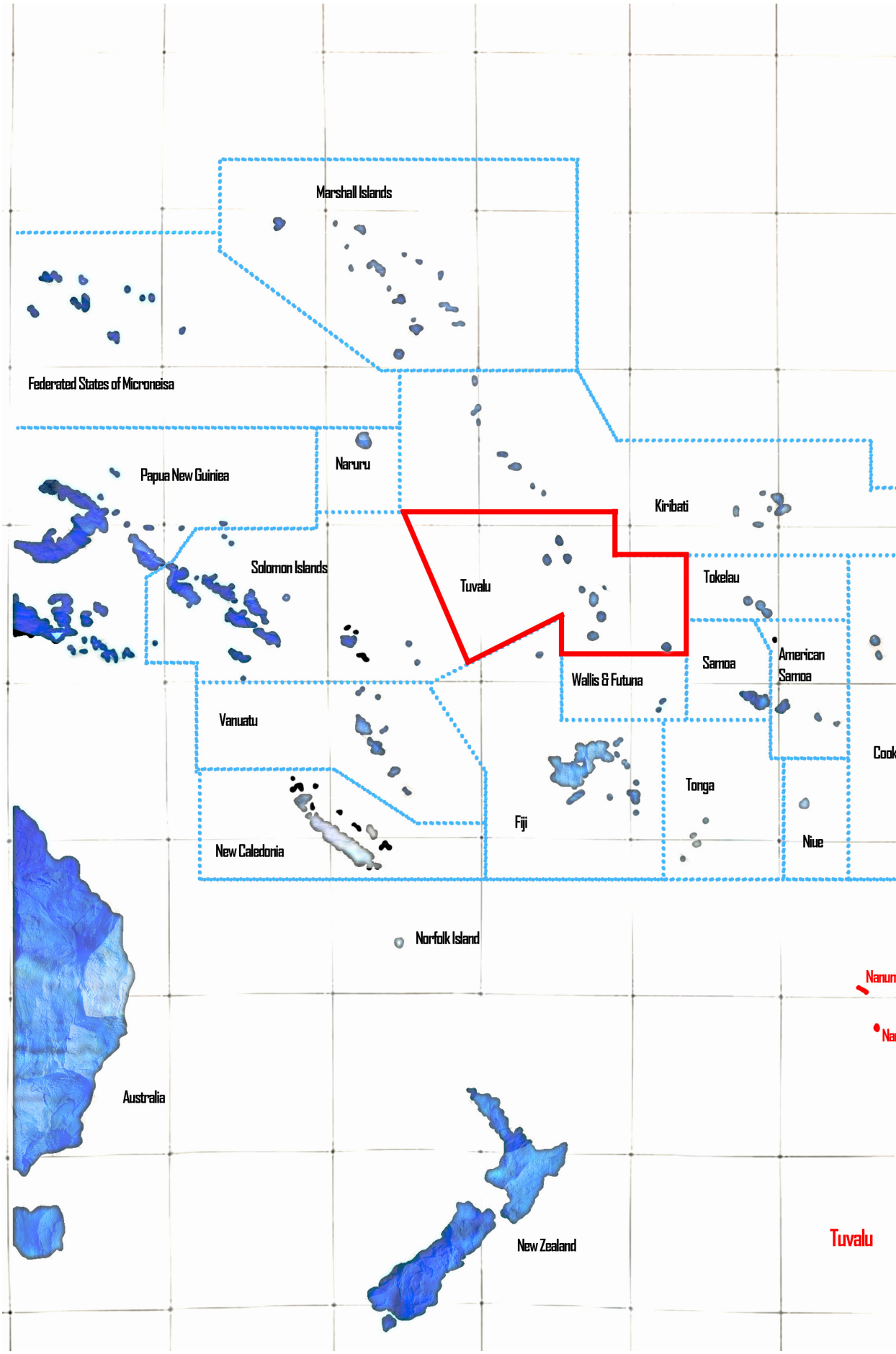
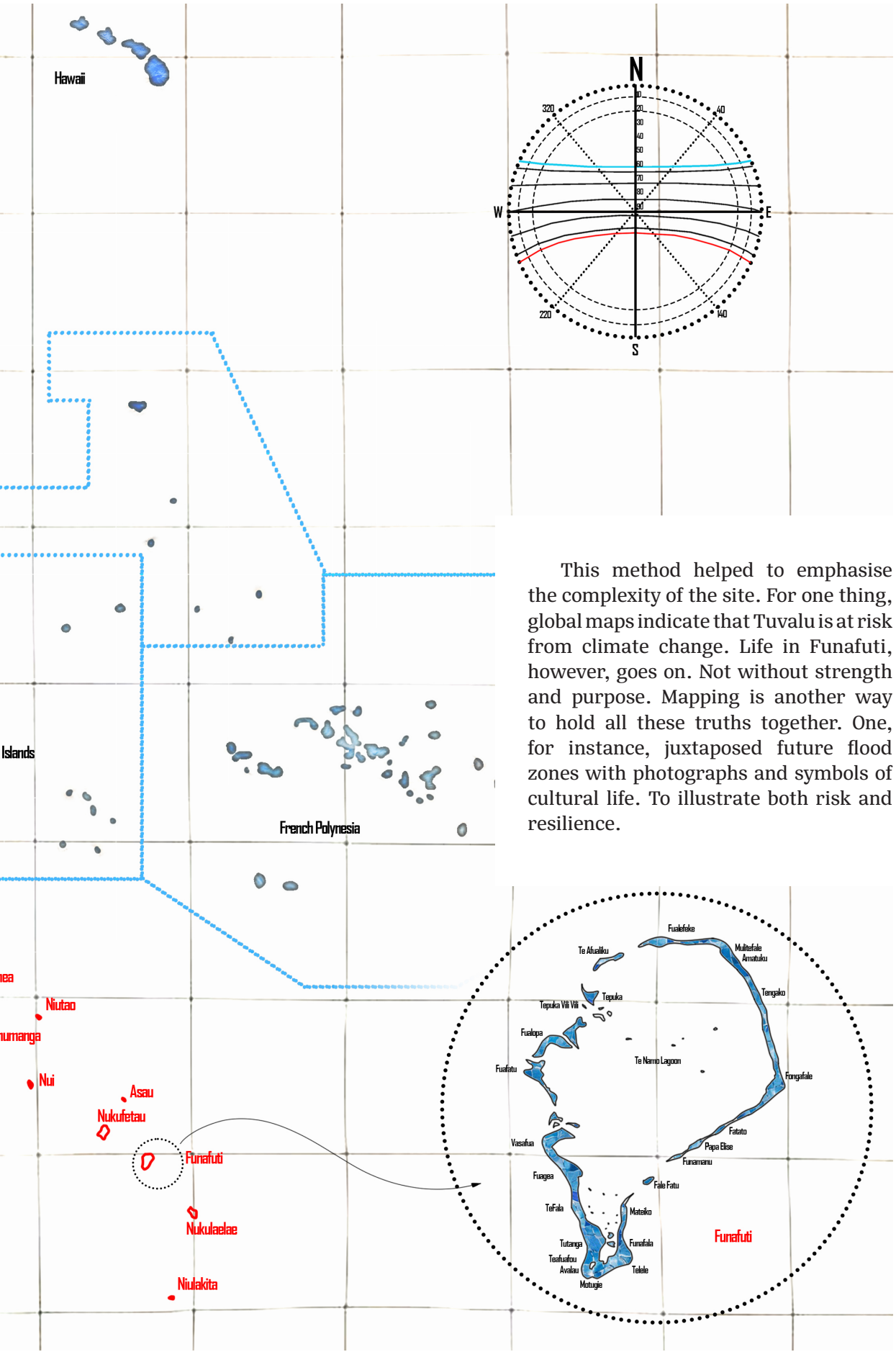


Figure 18
(Author, 2024) – Pacific Map



This method helped to emphasise the complexity of the site. For one thing, global maps indicate that Tuvalu is at risk from climate change. Life in Funafuti, however, goes on. Not without strength and purpose. Mapping is another way to hold all these truths together. One, for instance, juxtaposed future flood zones with photographs and symbols of cultural life. To illustrate both risk and resilience.

Figure 18
(Author, 2024) – Pacific Map Shows all Nine Islands of Tuvalu.

Funanfuti - 2024

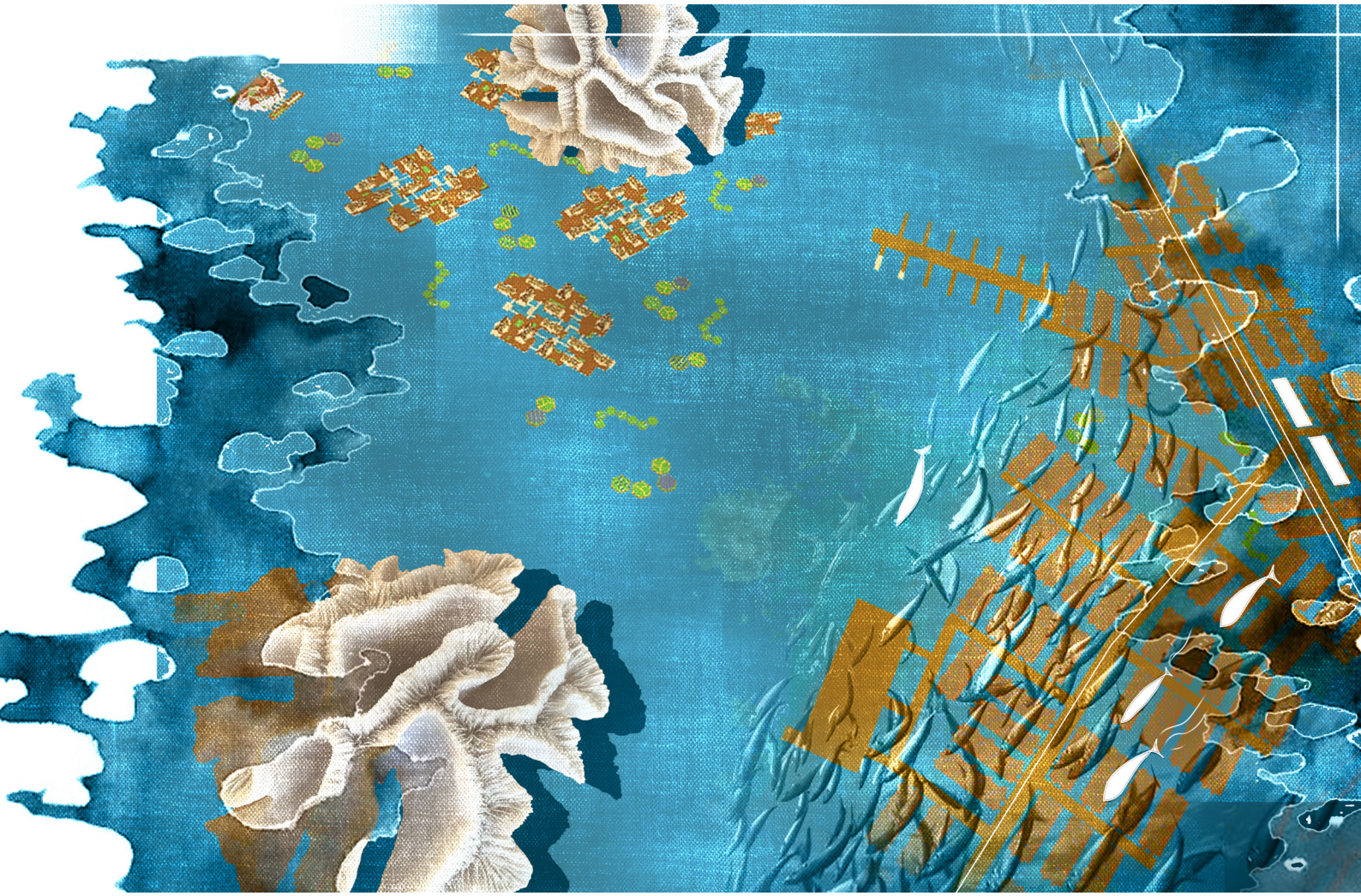
Layers of oral histories and community memory were combined with older maps, colonial-era nautical charts and recent satellite imagery. To create a fuller picture of the Funafuti Lagoon. Such sources provided not only raw spatial information but they also revealed the lived contours of the site, traditional canoe routes over the reef and specific places where family and community activities like fishing or congregation would take place. In some places, where no formal data existed, the research reached out into creative speculation. Treating these gaps as opportunities, rather than constraints. These absences invited design thinking and storytelling. Giving room for reimagining lost or overlooked knowledge and reinforcing the notion that architecture can respond, not just to what is measurable but also, to what is remembered, felt or aspired to.

Figure 19
(Steve Menzies, 2024) - Contrast of present and 50 years later

Figure 20
(Steve Menzies, Author, 2024) - Contrast of present and 50 years later

Figure 21
(Unknown, Te Papa, circa 1920) – Map showing voyages of the Polynesian Navigators

Figure 22
(Unknown, Te Papa, circa 1920) – Map showing voyages of the Polynesian Navigators



The process of making maps became a generative tool in and of itself. As I started to draw the city modules, the composition began to resemble schools of fish or formations of vaka (canoes) grouped together. Additionally, the modules clustered together to resemble corals. This visual link made me think that the city might mimic the life patterns in the lagoon itself.

Figure 23
(Author, 2025) - Floating modules echoing fish schools, corals, and vaka lines.

PART THREE

Model Method

Physical and digital models were both used in the design process. To explore materials, forms, and how the floating city might respond to changing conditions. Cardboard, plywood, and resin were chosen for their accessibility and ease of manipulation.

Echoing the resourceful and adaptive nature of building in Tuvalu. The process of model-making was intentionally slow. Shaped by the careful sculpting of clay and the need to consider each element thoughtfully. This pace created space for reflection on the city's potential behaviour in its environment. For instance, how it might shift with the tide, withstand storms, or provide shelter in a dynamic seascape.

Figure 24
(Author, 2025v) - Physical model ideation
Exploring forms of the Vaka & Sail.

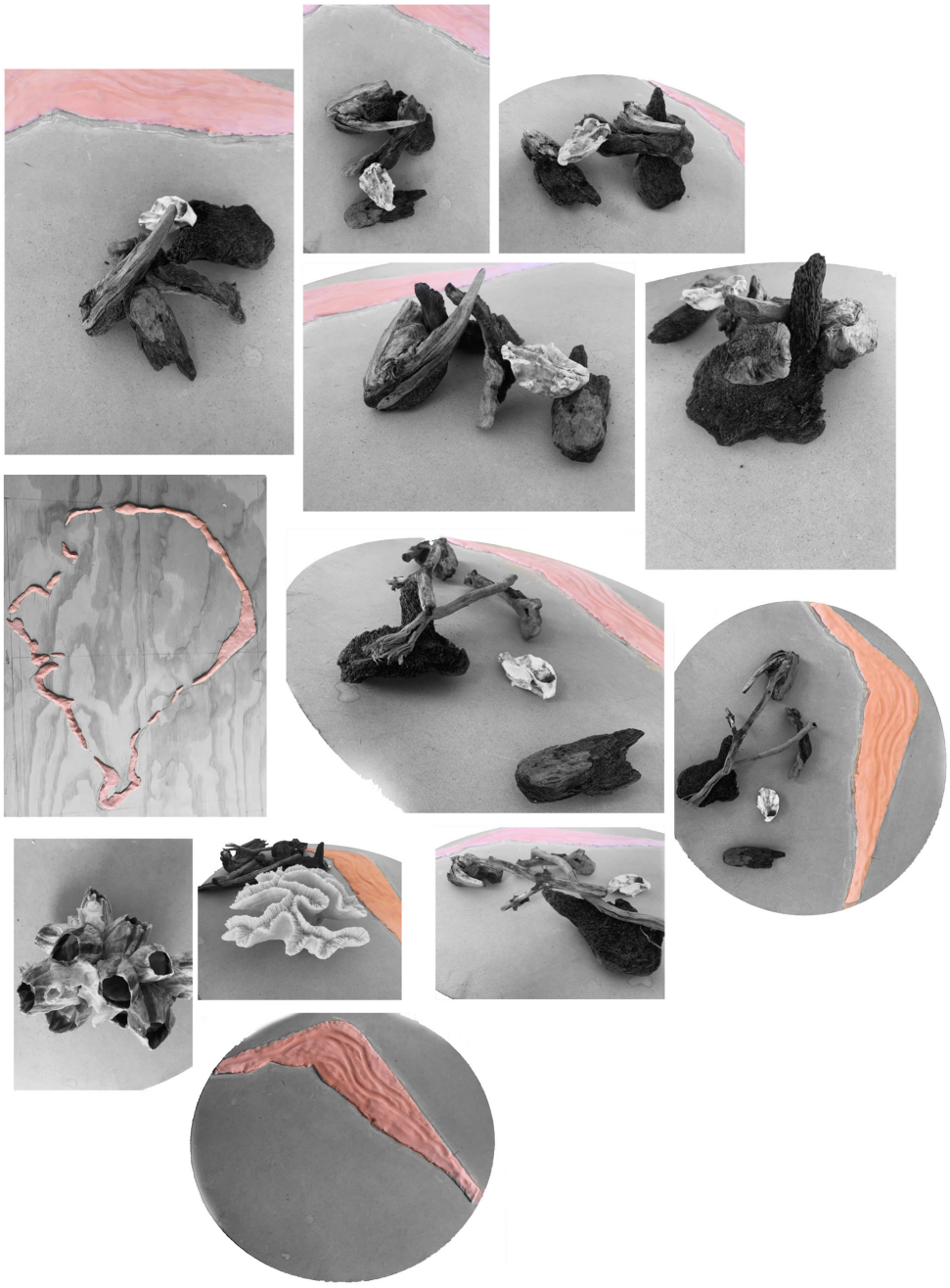
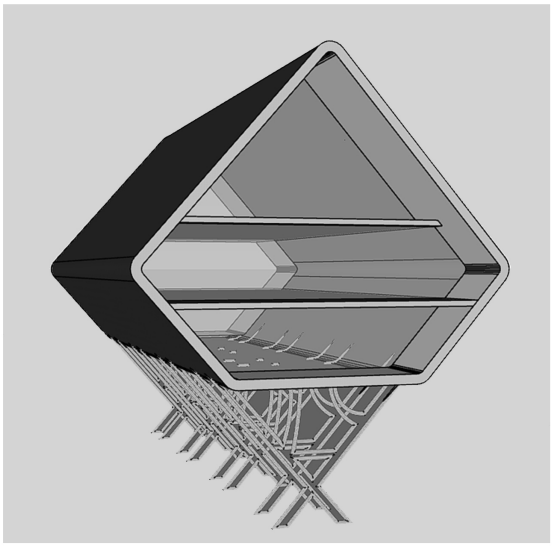
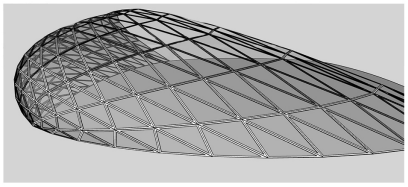
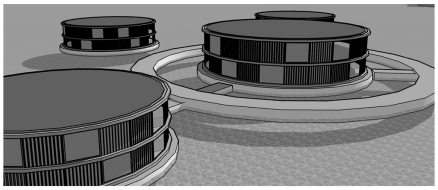
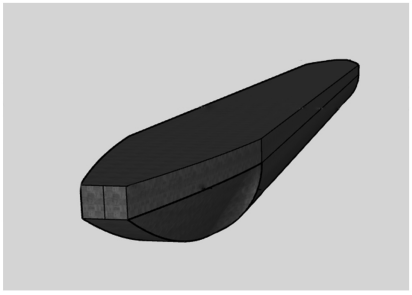


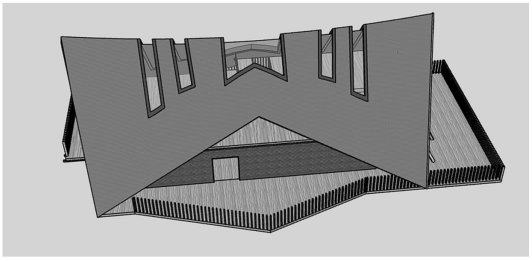
Figure 25
(Author, 2024) - Site Modeling
Clay, drift wood & coral to explore site massing composition.

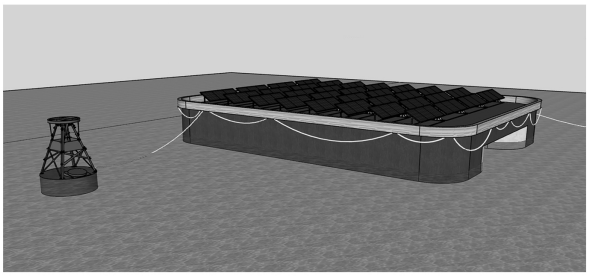


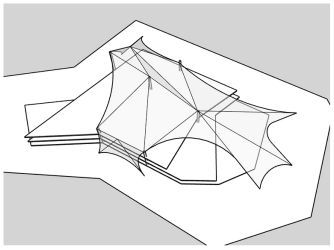


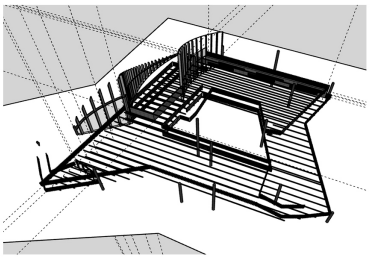












Digital modelling was also used to evaluate how the city might grow or change over time. Many of the models started as hand sketches and were later built into digital layers. These simulations tested the structural spans of the modules, the spacing between platforms, and how the design might support shared community life.

Figure 26
(Author, 2024) = Digital modeling ideation stage
Exploring different forms.

PART FOUR

Drawing Method

Drawing was another important part of the research. It was used not just to show what the city might look like, but to imagine how life might be lived on water. Plans, sections, and elevations were created that took inspiration from traditional fale, meeting houses, and the communal layout of villages.

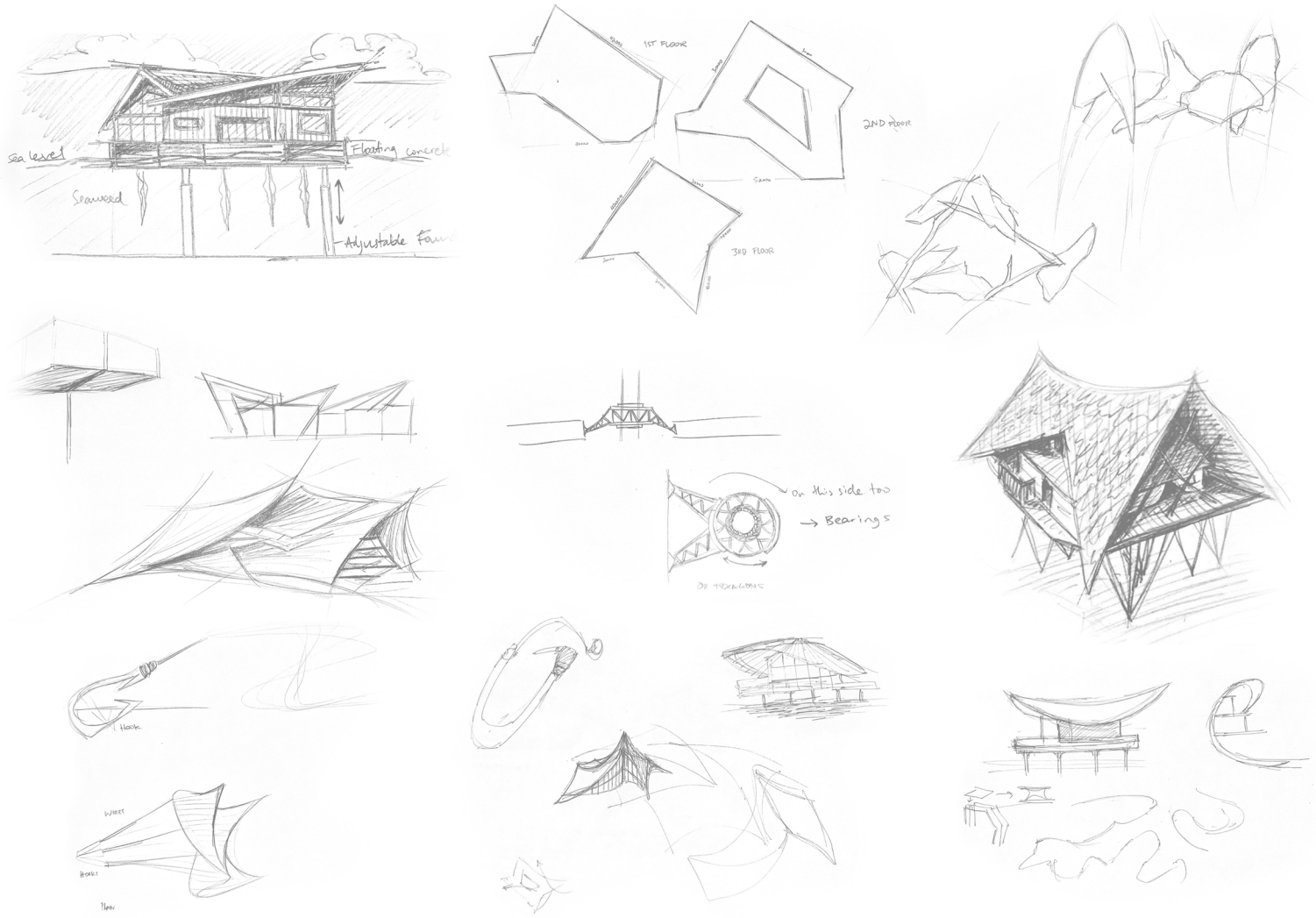


Figure 27
(Author, 2025) - Ideation drawing process.

The drawings also explored feeling and movement. Colour, texture, and line were used to represent the sound of rain, the texture of coral, the sway of palms, and the shape of vaka. These elements helped connect the drawings to the sensory experience of life in Tuvalu.

Drawing was an ongoing process. It was used to evaluate ideas, not just to present results. One image shows several versions of the same drawing. Layered and adjusted over time, as the design evolved.

Figure 28
(Author, 2025) - Showing existing Funafuti Church a century in the future.

PART FIVE

Time-based Drawing Method

Durational change over time is central to this research. Drawings began in 2035 and extended over generations to 2200. Over this time, the outline of the island changed dramatically. With land gradually being overtaken until the final image shows only sea. The design proposal becomes the way by which the former extents of the island are traced. Now an island of floating elements, defined in red below, outlines Tuvalu.

Two maps were created to show how the floating city could change over time. These maps showed projections for 2070, and 2200. Each map explored various stages in the life of the city, such as expanding, retreating, or reconnecting.

Figure 29
(Author, 2025) - Durational Module Composition
Showing the year 2070 Module Site Massing

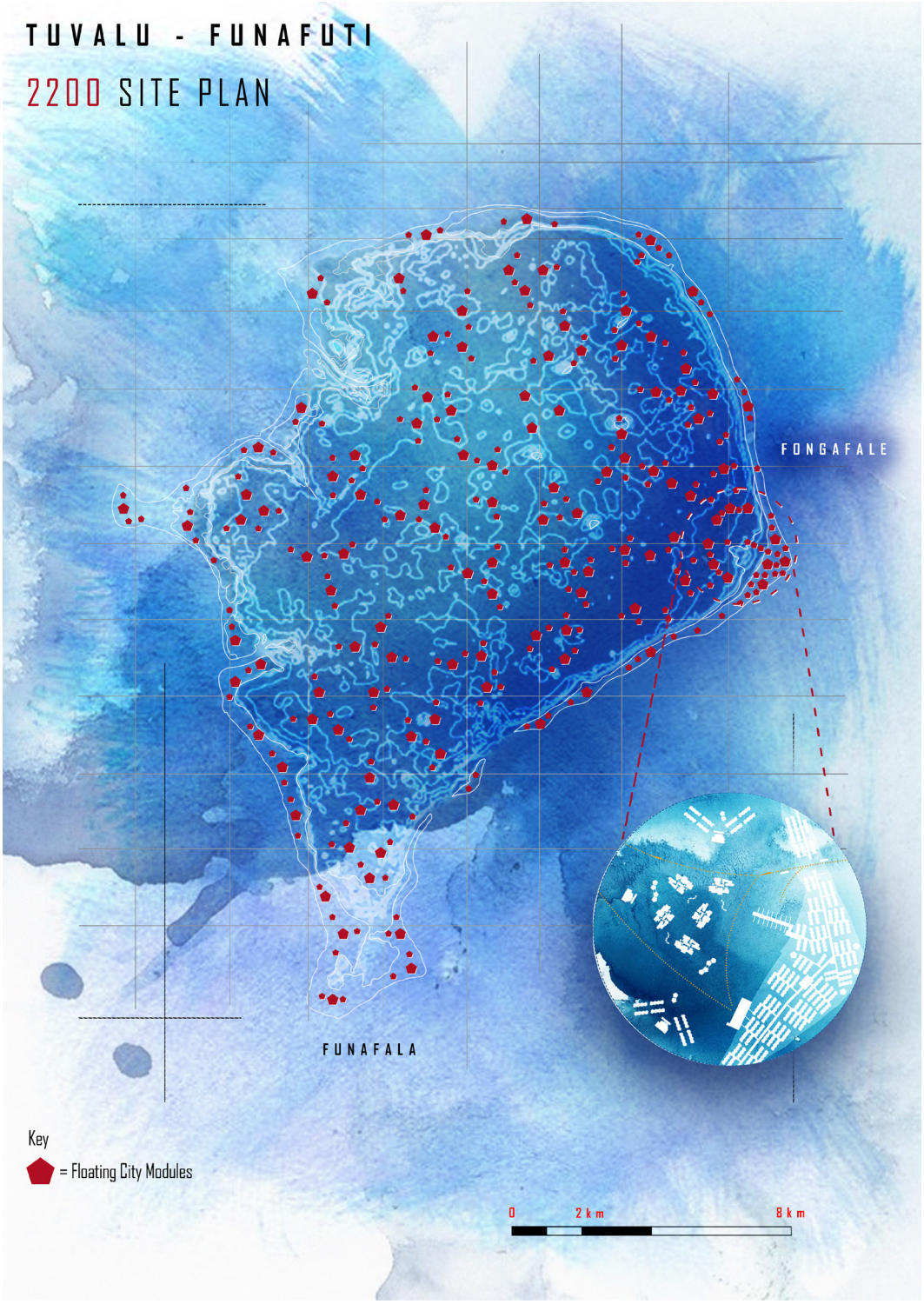
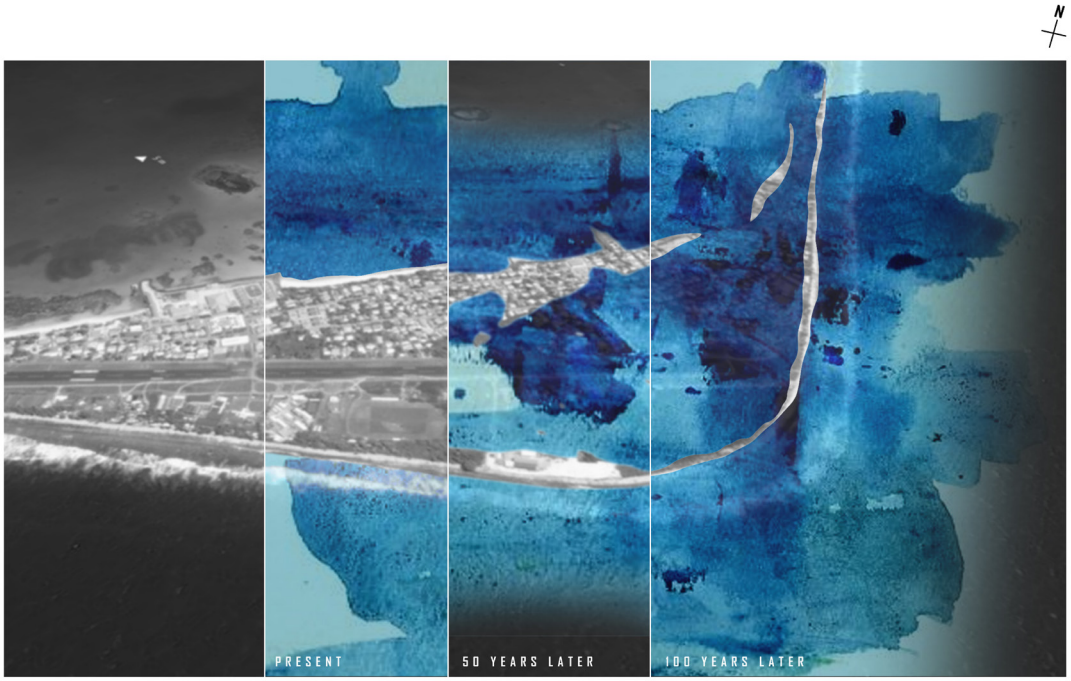


Figure 30
(Author, 2025) - 2200 Map of Funafuti underwater but covered in modules maintaining Tuvalu's sovereignty.



These changes followed Indigenous periods. For example, fale are often rebuilt every few decades. And major events like funerals and church gatherings follow seasonal or generational rhythms. The city design reflected this idea by allowing the modules to shift, break apart, or be reassembled. As noted by Herbig, Zohrer, and Samoliy (2009), "the construction of a fale, especially the large and important fale tele, often involves the whole extended family and help from their village community."

One drawing imagined the city in the year 2150. When the sea level may have risen by at least four metres. It showed how some parts of the city would have moved inland. While others remained tied to cultural landmarks such as churches or meeting spaces.

Figure 31
(Author, 2024) - Fogafale Durational Overlay shows the sea level rise over the years.

Figure 32
(Harry, 2024) - Original Image of the Funafuti Church in 2024

Figure 33
(Author, 2025) - Showing the remnants with the 4+ metre sea level increase. It shows the Church preserved on the floating platform 125 years later.

Conclusion

A design-led and culturally responsive methodology has been described in this chapter. This research engaged with Tuvaluan knowledge systems through mapping, modelling, and drawing as care and understanding tools. The Ongoing reflection and contextual analysis helped the research remain grounded in the day-to-day realities of climate change. While also envisioning hopeful futures.

Despite some limitations, such as distance from the site and the lack of complete data, these were transformed into opportunities for speculative imagination, reflection and adaptation. Working through the visuals became a process of thinking deeply and respectfully about Tuvalu's future.

Instead of designing for the lagoon, the project aimed to design with the lagoon. It is not a solution all wrapped up nicely. But a proposal that is grounded in Tuvaluan culture, which is forged in the crucible of the climate crisis, and which adapts as time goes on.

CHAPTER THREE

Design

CHAPTER THREE

Design

This chapter describes the progression of the design proposal for a regenerative floating city in the lagoon of Funafuti. It outlines the iterative and tiered design that formed three crucial architectural elements of the project: Lau Palu Moana (the floating fishing and community rig), Vaka Lotu (the housing flotilla) and the HarvestPod (a regenerative infrastructural unit). The elements were developed from a design-led methodology that was driven by site-responsive experimentation and cultural referencing. With a strong focus on Pacific material knowledge, Tuvaluan Christian values and lagoon ecology.

The design process was trial-and-error-based and experimental, both physically as well as digitally. A flotilla system built not to catch fish but to carry cultural, ecological, and infrastructural weight. The latter comprises five components in this chapter. Part One chronicles the original physical modelling that was used to gauge the scale and composition of the lagoon. Part Two focuses on the fishing rig and housing flotilla architectural prototype. In Part Three, I move on to Regenerative System Strategies. Part Four discusses the design and environmental considerations for the mooring systems. In Part Five, I reflect on our representational approaches to communicating the project.

PART ONE

Site Modelling and Early Compositional Studies

As a first grounding of the project within the geography of Funafuti, a physical model was constructed at a scale of 1:50,000. I selected this scale to also illustrate the full extent of the atoll. Where massing interventions are sited in the Fongafale area, reflecting a vision of development in 2035. The model was built using plywood, clay, and string. Ply formed the base contour of the reef and land edge. Clay sculpted the land. And string traced the site of Fongafale of the atoll.

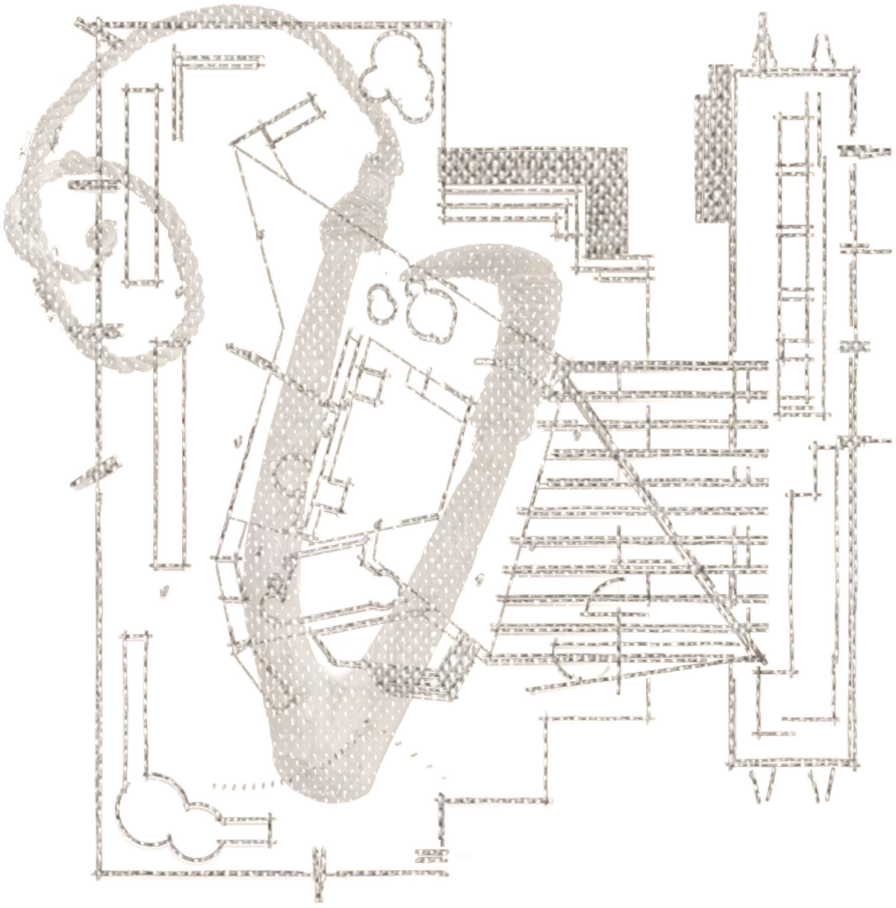
Figure 34
(Author, 2024) - Funafuti Laggon ClaySite Model Author used for site massing ideation.

Overall, this site model evolved into a primary design tool. Proportionate relationships around the lagoon allowed for testing of module layout. Influence with the wider ecology and visualising of key design relationships. This helped establish how flotilla clusters could interact with currents, the edge of the reef and prevailing winds. The process also clarified the area of the proposed site and suggested the final module composition. Physically working in this way made the daily and seasonal rhythms of the site clearer to read. And allowed for an embodied sense of how the lagoon functions as a living system.

PART TWO

Architectural Prototypes – Flotilla Forms and Community Spaces

This section presents the development of the two primary built forms: Lau Palu Moana, the floating fishing and community rig, and Vaka Lotu, the residential housing flotilla.



LAU PALU MOANA – DEEP-SEA HOOK OF THE OCEAN

Figure 35
(Author, 2025) - Lau Palu Moana "Deep Sea Hook of the Ocean"

The first of these architectural interventions designed was Lau Palu Moana. It was conceptually inspired by the ama of the vaka, the side extension that keeps a canoe balanced and stable. These cultural cues influenced the platform's extended horizontal gesture. At once stabilising and generous, it responds to the lagoon's open conditions while accommodating an extended communal surface.

Originally conceived as a site for fishing and gathering, the rig transformed into a full-fledged multipurpose setup. This encompasses shared fish table and preparation areas, open-air kitchenette spaces, and various informal zones for swimming, diving, playing, and gathering. The platform structure accommodates fish and cargo cranes to sustain subsistence and small-scale commercial activities.

The rig takes an organic form, influenced by the flow of swell in the ocean. Located up above a platform, a canopy references traditional vaka sails and wave forms, serving as both gesture and functional response. It provides shelter from the sun, blocks the wind, and helps give the platform a personality.

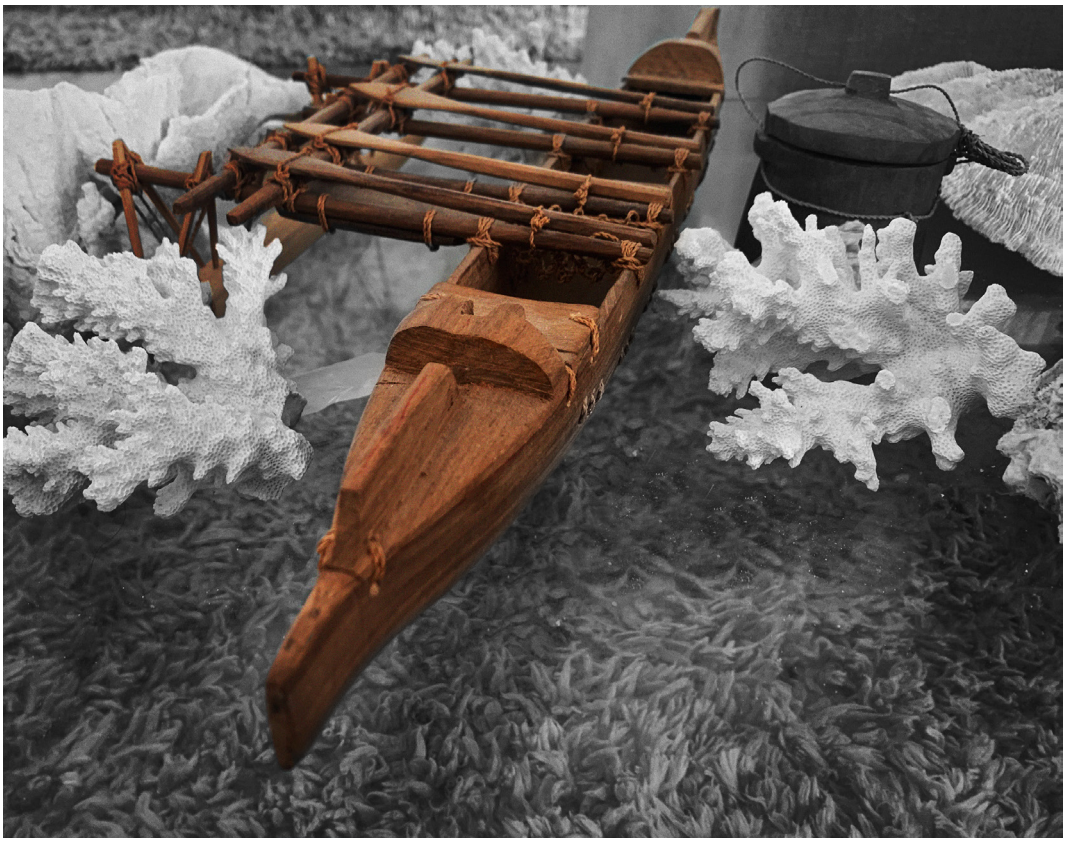


Figure 36
(Author, 2024) - Image of family Tokelauan Vaka. Shows the Ama that influenced the Lau Palu Moana design language.

The MIRS units are distributed around and underneath the rig, thus creating a hybridised ecological and social space. The surrounding water becomes a place for cultivation and recreation. Seasonally and culturally responsive, the platform invites daily life, informal trade, and ritual gatherings. Part Four discusses the importance of mooring systems to maintaining this stability.

Figure 37
(Author, 2025) - The design presentation includes an image that shows this canopy's sail-like shape and wave-based design.

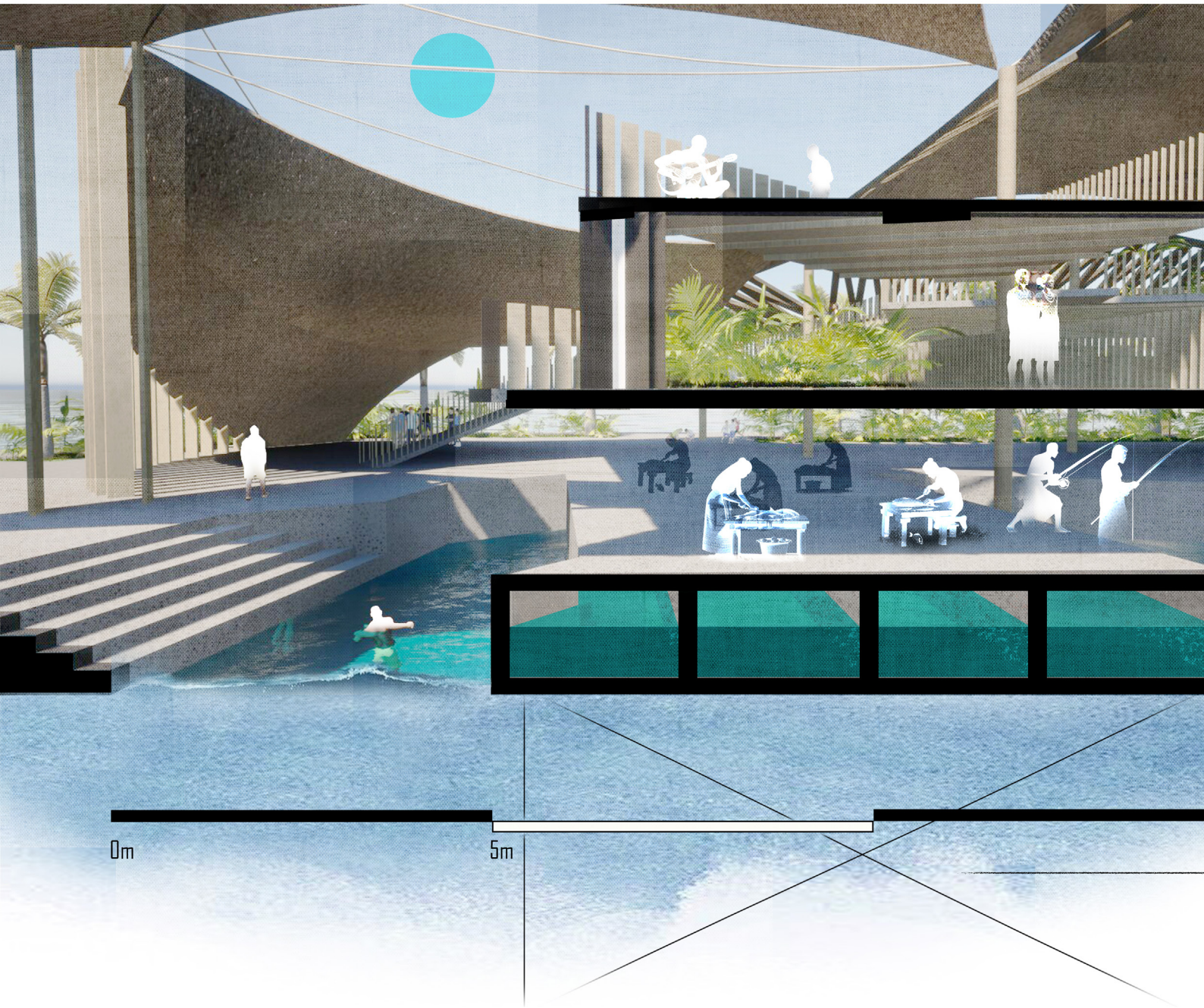


Figure 38
(Author, 2024) - Sectional Perspective AA.
Shows programmes, water systems & Perspective AA1 angle.

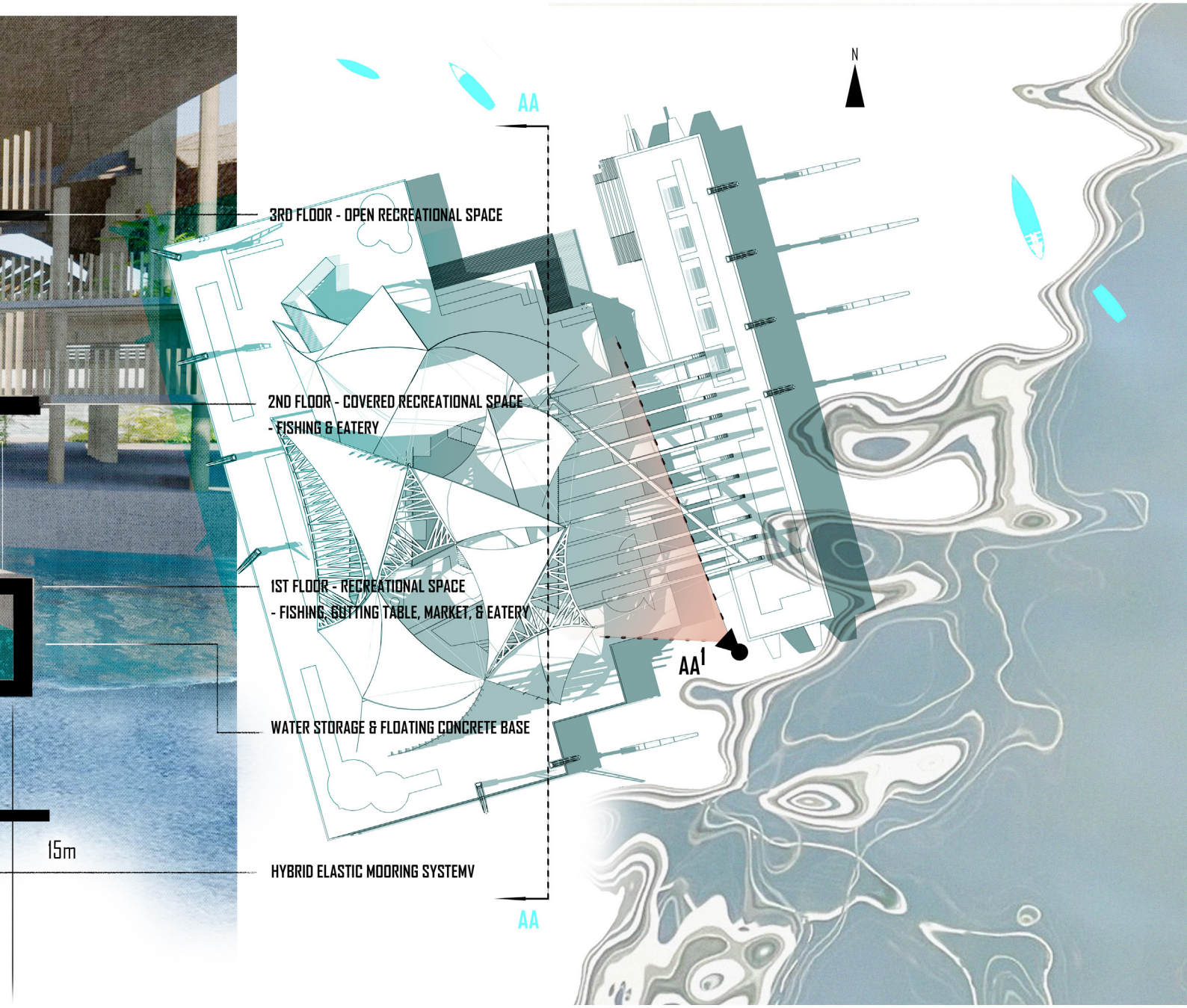

3RD FLOOR - OPEN RECREATIONAL SPACE
2ND FLOOR - COVERED RECREATIONAL SPACE
- FISHING & EATERY
1ST FLOOR - RECREATIONAL SPACE
- FISHING, GUTTING TABLE, MARKET, & EATERY
WATER STORAGE & FLOATING CONCRETE BASE
15m
HYBRID ELASTIC MOORING SYSTEMV
AA
AA
AA1
N

Figure 39
(Author, 2024) - Perspective AA1.
Shows programmes

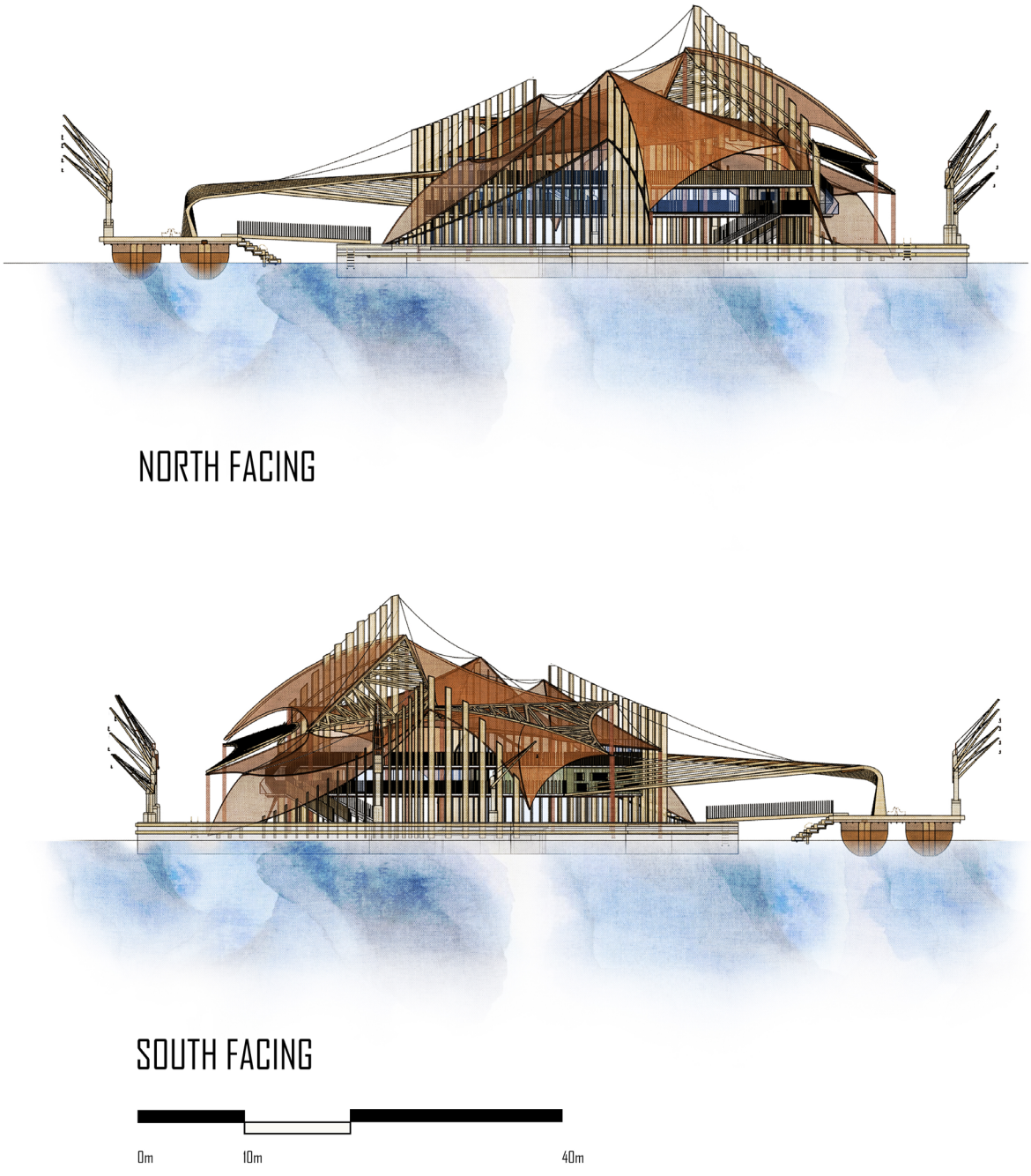
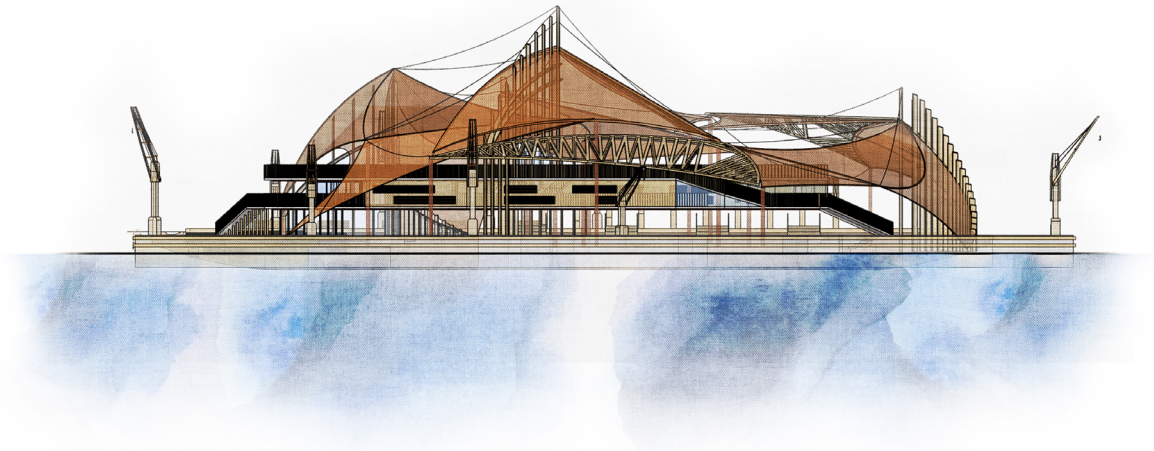
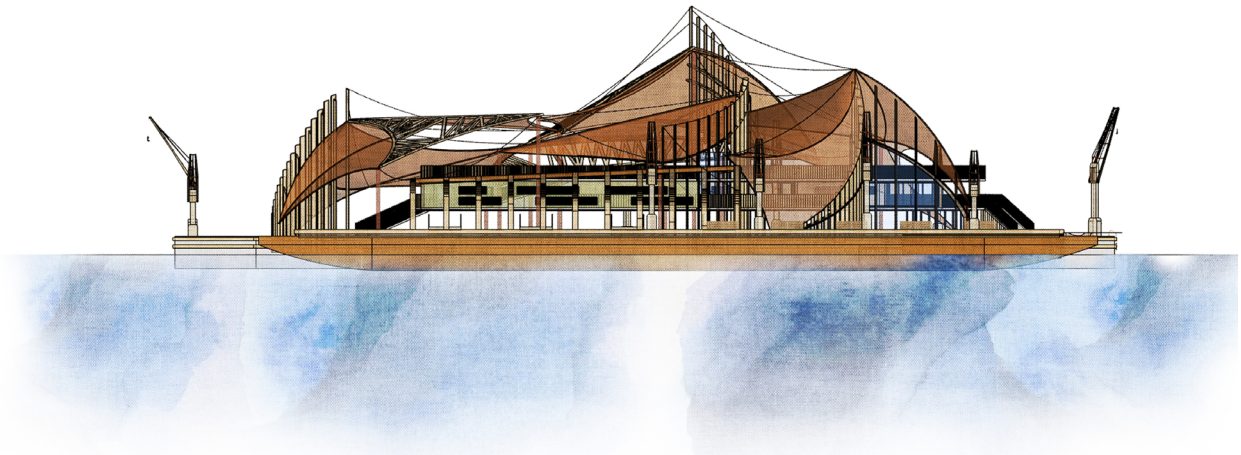


Figure 40
(Author, 2024) - Elevations
North & South Faces

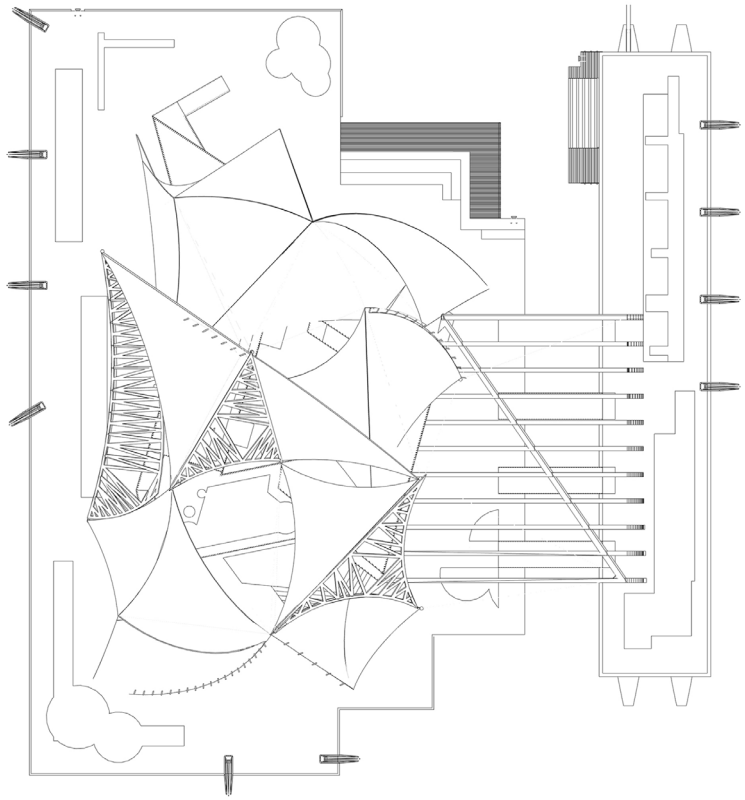


EAST FACING

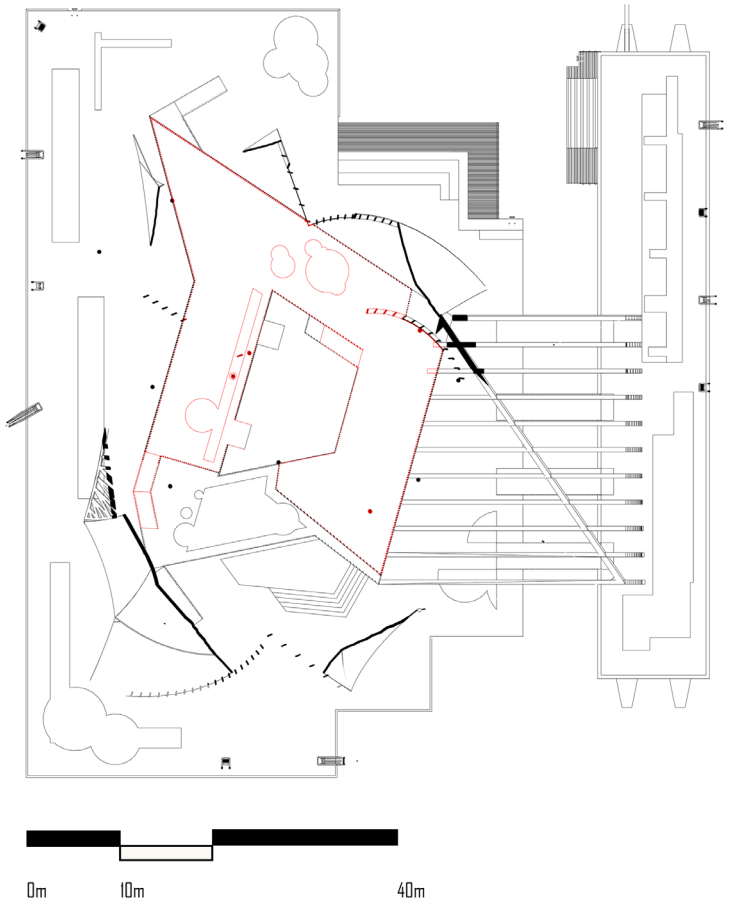


WEST FACING

Figure 41
(Author, 2024) - Elevations
East & West Faces



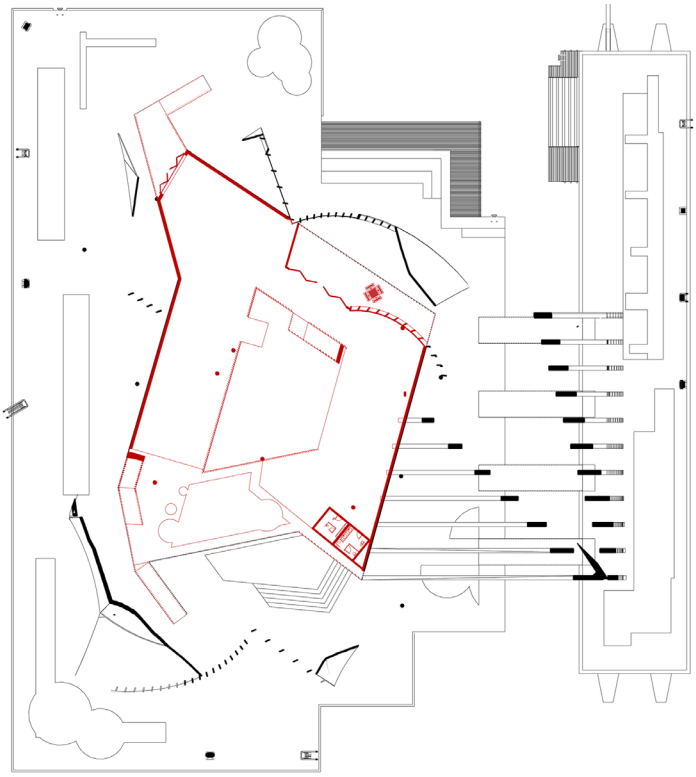
ROOF VIEW



3RD FLOOR

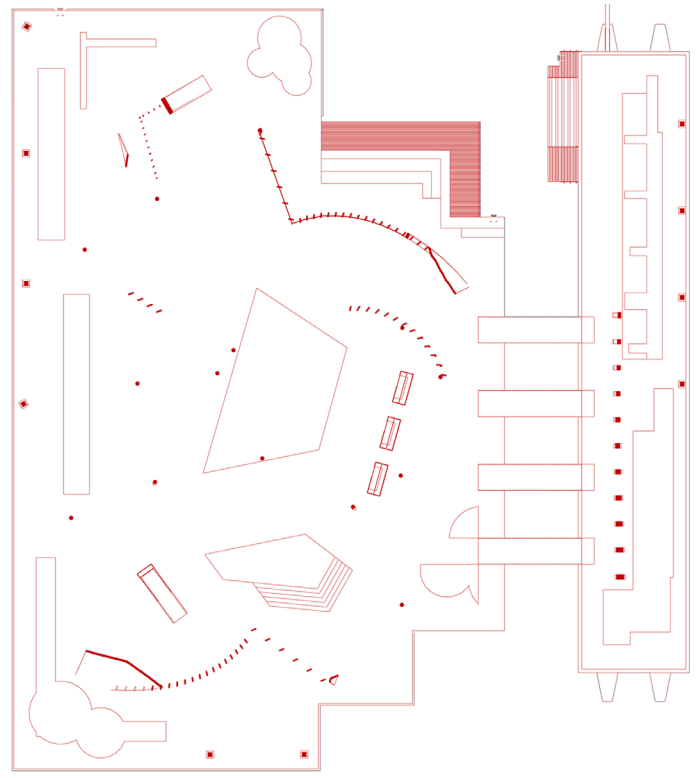
Recreational Area.
- Look out
- community gathering space

Figure 42
(Author, 2024) - Plan Views
3rd & Roof Floor



2ND FLOOR

Recreational Area
- Look out
- community gathering space
- 2nd Floor fishing spot.
- Restroom
- Dining area



1ST FLOOR

Recreational Area
- Fishing Zone
- Fish Market
- community gathering space
- Pool zone
- Ama Diving Board
- Restroom
- Butcher tables

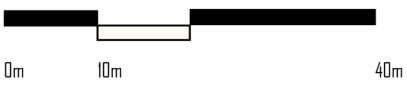


Figure 43
(Author, 2024) - Plan Views
1st & 2nd Floor

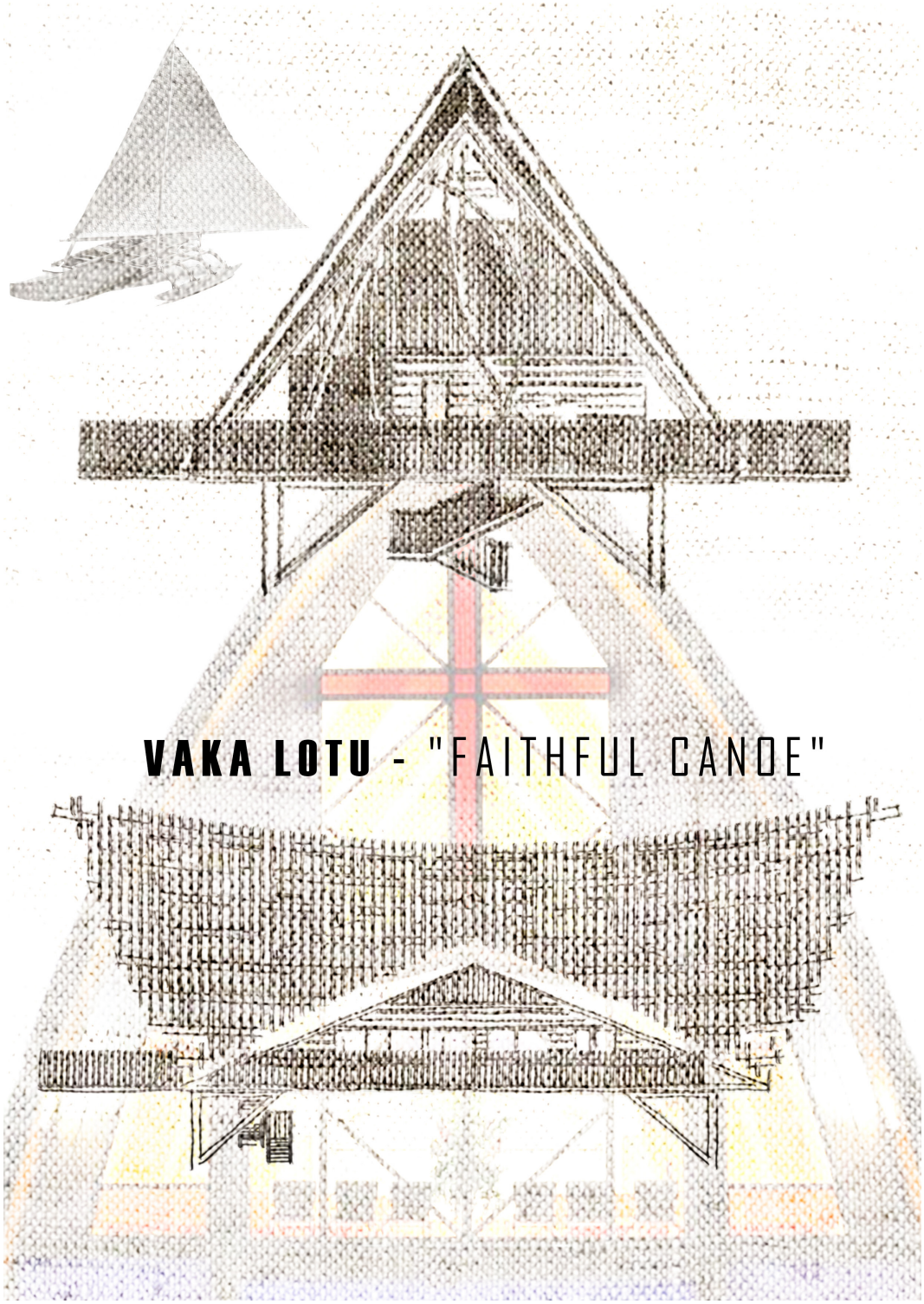


Figure 44
(Author, 2024) – Vaka Lotu – "Faithful Canoe"

Vaka Lotu, the central residential element, draws from two core influences: the vaka's form and language, extending the flotilla logic. This architectural language supports both cultural expression and environmental performance.

The structure includes a curved main form, tapering at the ends. The Vaka Lotu is the central habitation component of the design. It is based on two main influences. The first is the form and language of the vaka; the flotilla logic continues. The second is the Tuvalu West Auckland Christian Church, whose roofline inspired the curve of the building. It is the architecturally communicative vocabulary that serves both cultural expression and performance with the environment.

Figure 45
(Savings, 2025) - The Tuvalu Christian Church is a church of Tuvalu heritage in West Auckland

The design features a bowed primary shape with the ends of the structure tapering inward like a vaka hull, enhancing aerodynamics while encouraging the collection of rainwater. The outer structure wraps the underlying structure. This outer skin creates a climate buffer. It collects rainwater, provides shade, and protects against storms. Rainwater flows into storage tanks hidden underneath the platform. These tanks can also provide ballast, increasing buoyancy and stability.

Vaka Lotu diction is precise: both structural and spiritual. “Vaka” is the name for the canoe itself, the design language that keeps the platform above water. “Lotu” references faith and prayer. This connection to Tuvaluan Christianity offered a design ethic from which to draw, embedding the values of community, care, and protection into the form of housing itself.

Each unit is modular and meant to comfortably fit six people, or, in extended family situations, a maximum of twelve.

Figure 46
(Author, 2024) - Vaka Lotu in intense weather climate. Showing the tenasity of the modules and how it handles weather.

Its internal arrangement facilitates communal inhabitation and flexible privacy. Shaded verandas allow the air to flow and link the home to the sea.

The main material used for the structural frame and internal lining is timber. The focus is on durable species used traditionally in large vaka construction, such as ifilele or toa. These materials would, where possible, be taken from the Pacific. Fabrication would be conducted in regional maritime hubs or vaka-building yards. The finished modules would either be shipped or towed to Funafuti. This approach incorporates a modular and movement aspect, as it conveys a regional network of exchange occurring.

Housing flotilla is organised as a cluster, with shared decks, water access zones, and semi-communal gardens between modules. These clusters preserve family-level privacy yet facilitate relational proximity. The spatial logic draws on the Pacific concept of vā, which recognises that the space between people and things is not separating but relational. Part Four provides additional details on mooring coordination for these clusters.

The hull of a vaka improves aerodynamics and promotes rainwater collection. A secondary façade shell envelopes the inner structure. This outer skin acts as a climate buffer, collecting rainwater, providing shade, and offering protection from storms. Rainwater is directed into storage tanks housed beneath the platform. These tanks also provide ballast, enhancing buoyancy and stability.

The term Vaka Lotu reflects both structure and spirit. “Vaka” refers to the canoe, the design language that holds the platform above water. “Lotu” references faith and prayer. This connection to Tuvaluan Christianity provided a guiding

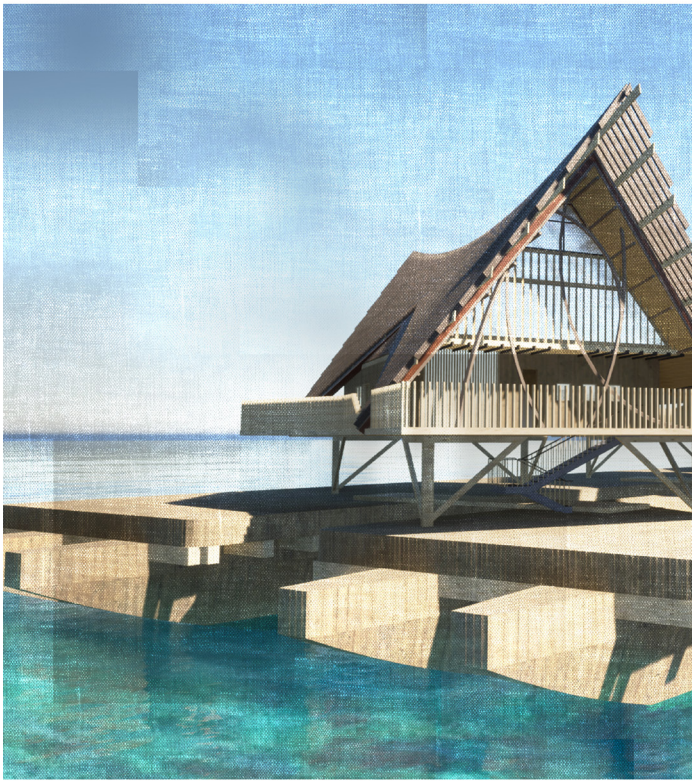
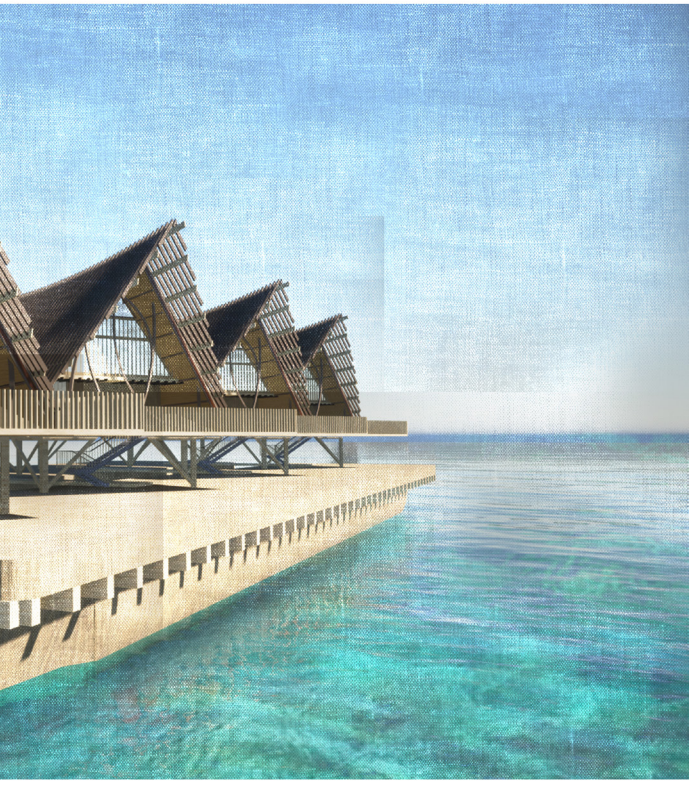


Figure 47
(Author, 2024) - Vaka Lotu perspective

design ethic. It embeds the values of community, care, and protection into the housing's form.

The internal layout supports communal living and adaptable privacy. Shaded verandas promote airflow and connect residents with the surrounding sea.



Timber is the primary material used for the structural frame and internal lining. Durable species traditionally used in large vaka construction are prioritised, such as ifilele or toa. These materials would be sourced from the Pacific, where possible. Fabrication is proposed to occur in regional maritime hubs or vaka-building yards. The completed modules would be shipped or towed to Funafuti. This construction method reflects traditional regional exchange networks, while allowing for modularity and movement across time.

Organisation of the housing flotilla follows a hexagonal clustering system, with shared decks, water access zones, and semi-communal gardens between modules. These clusters support relational proximity while preserving family-level privacy. The spatial logic draws from the Pacific notion of vā. It acknowledges the space between people and things as a place of relationship rather than separation. Mooring coordination for these clusters is covered in Part Four.

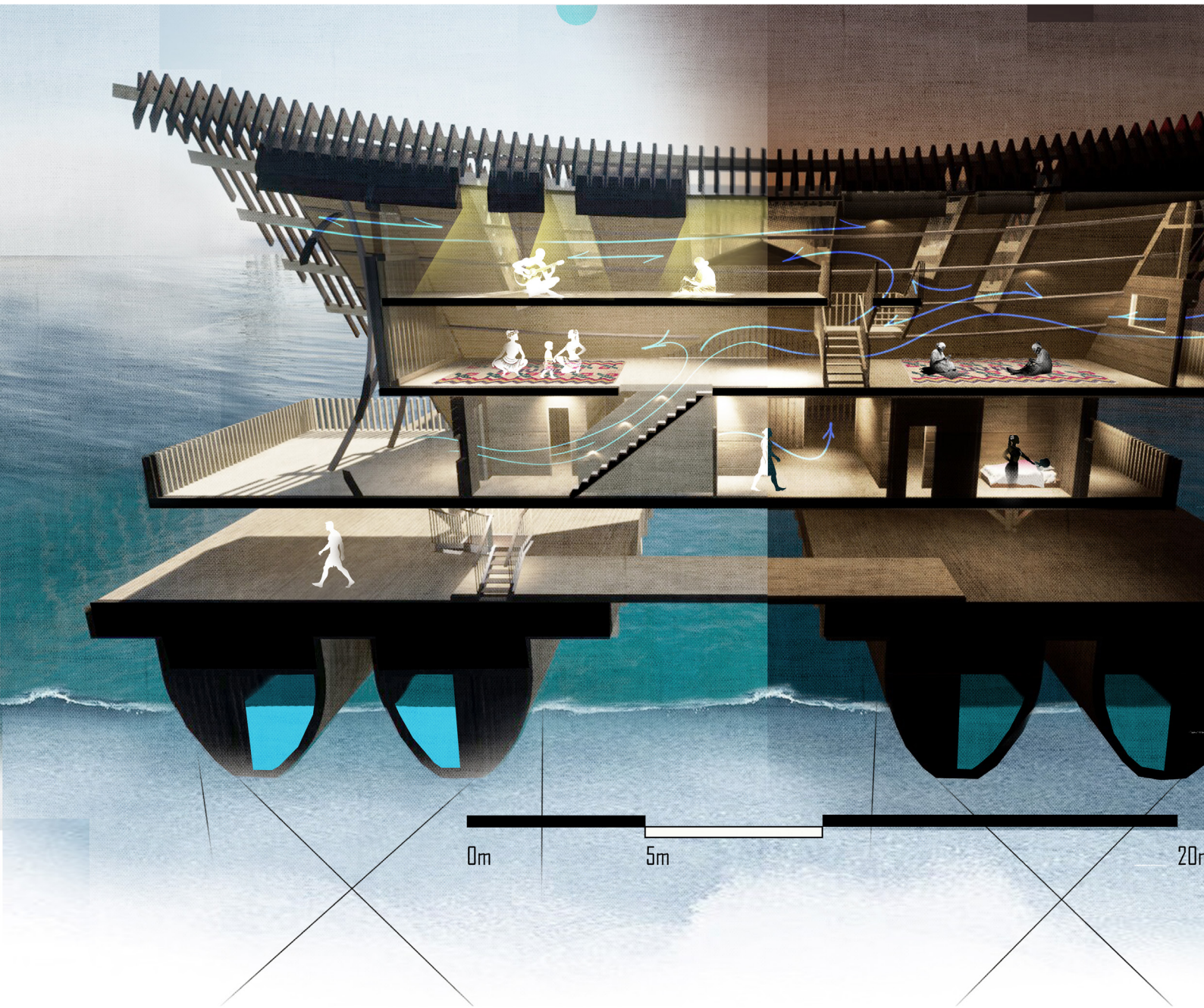
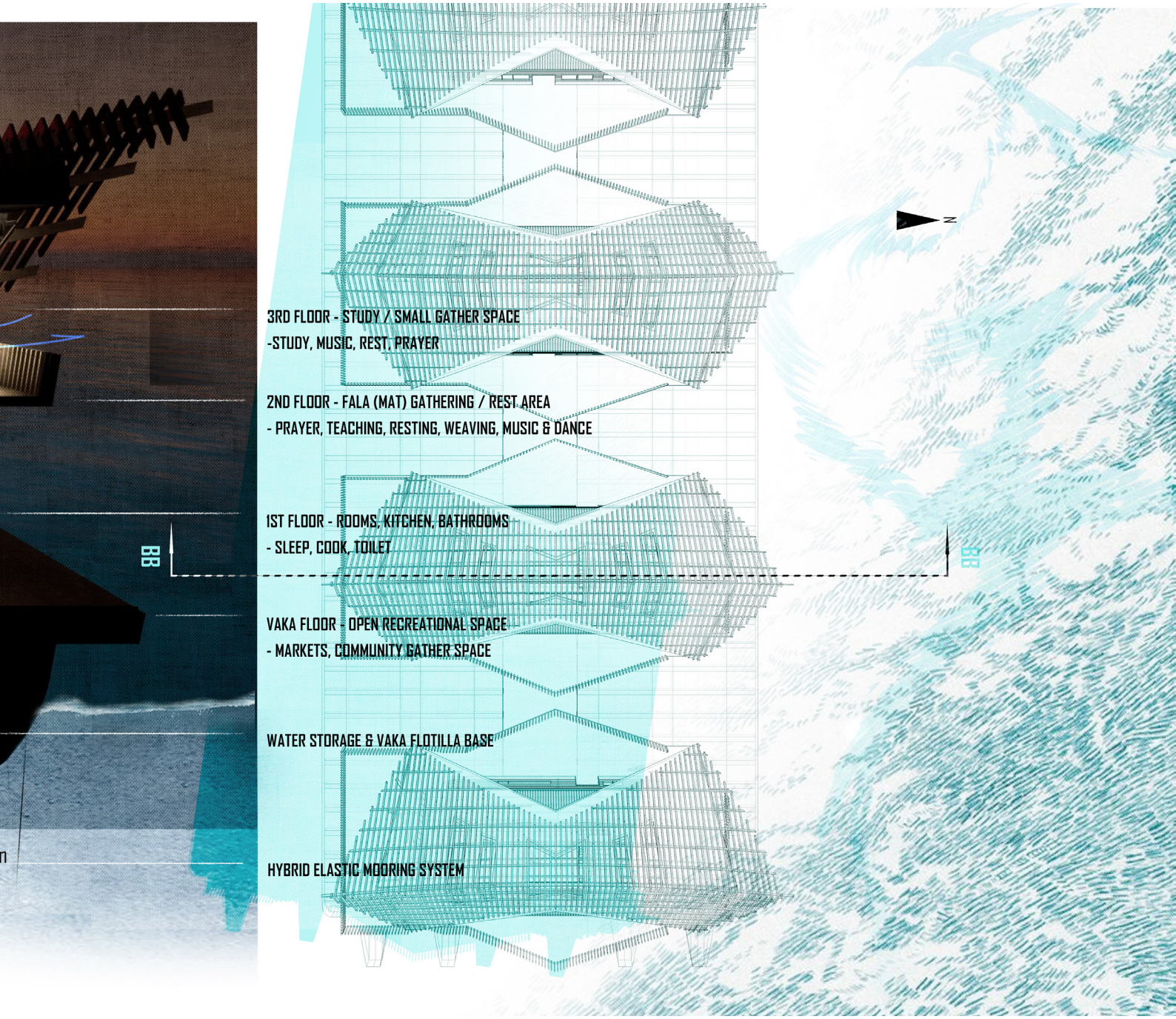
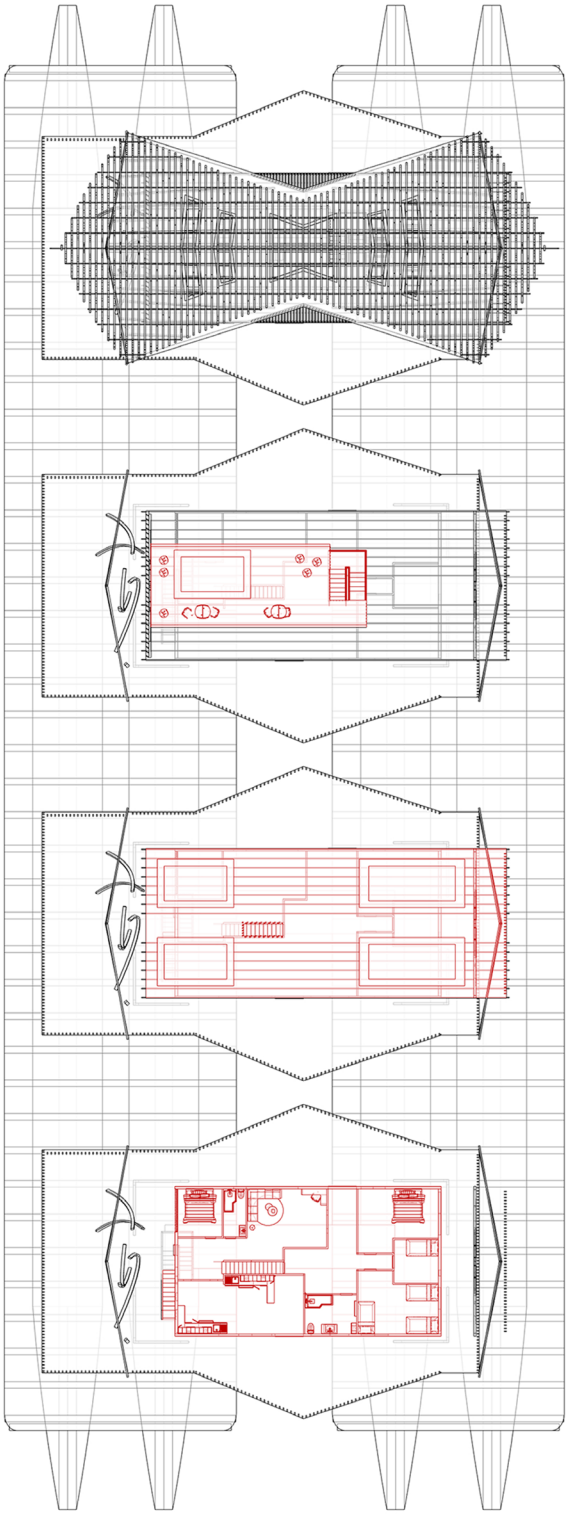


Figure 48
(Author, 2025) - Vaka Lotu Sectional Perspective BB Shows systems, programmes, Air circulation & Natural Sunlight


3RD FLOOR - STUDY / SMALL GATHER SPACE
-STUDY, MUSIC, REST, PRAYER
2ND FLOOR - FALA (MAT) GATHERING / REST AREA
- PRAYER, TEACHING, RESTING, WEAVING, MUSIC & DANCE
1ST FLOOR - ROOMS, KITCHEN, BATHROOMS
- SLEEP, COOK, TOILET
VAKA FLOOR - OPEN RECREATIONAL SPACE
- MARKETS, COMMUNITY GATHER SPACE
WATER STORAGE & VAKA FLOTILLA BASE
HYBRID ELASTIC MOORING SYSTEM
BB
BB
N



ROOF VIEW

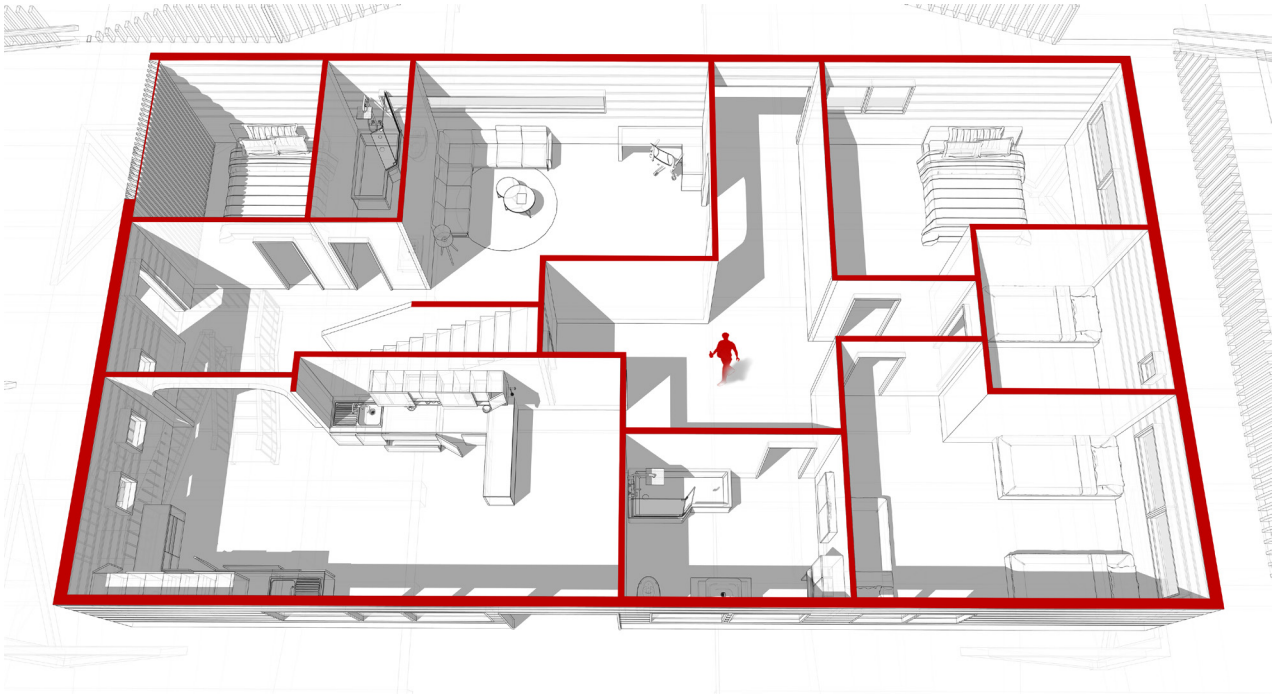
3RD FLOOR
Study / Gather Space
- Study
- Music
- Rest
- Prayer

2ND FLOOR
Fala (Mat) Gathering/ Rest area
- Prayer
- Teaching
- Resting
- Weaving
- Dance

1ST FLOOR
Living Area
- Bedrooms
- Kitchen
- Bathrooms
- Living room

0m 5m 20m

Figure 49
(Author, 2025) - Vaka Lotu Floor Plans



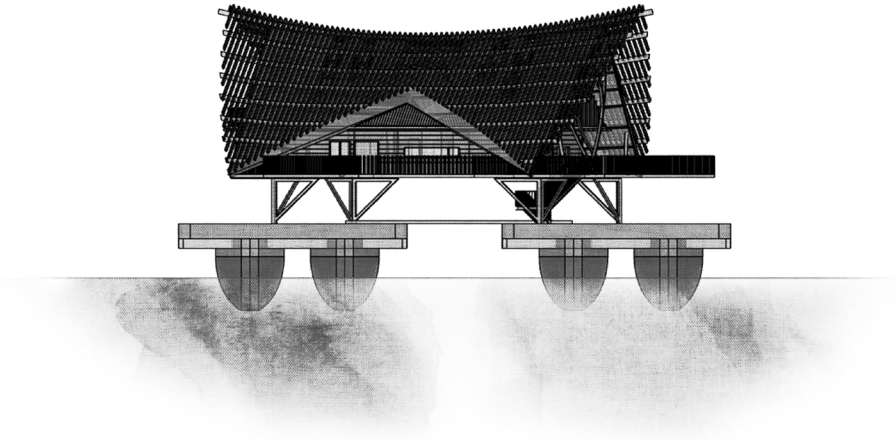


Figure 50
(Author, 2025) - Vaka Lotu 1st Floor Plan Perspective

Figure 51
(Author, 2024) - Vaka Lotu West Facing Elevation

PART THREE

Regenerative Infrastructure and Systems

The third key design component is the HarvestPod, a modular platform dedicated to resource generation and environmental repair. These units are distributed among and around the housing clusters, supporting closed-loop systems.

HarvestPods

The HarvestPod is hexagonally shaped, so it will fit into the flotilla's wider modular system. Two main types of pods have been developed:

1. Solar HarvestPods, their roof surfaces angled for optimum solar exposure. The microgrid is formed, and energy is collected and distributed by these modules to the surrounding clusters.

2. Food-based HarvestPods, designed with coconut and taro planting beds, offer both cultural relevance and functional agricultural support. beds. These were selected based on their cultural relevance and ability to grow in floating systems. Shallow planters and floating soil membranes let taro grow without permanent ground, while coconut trees provide shade, materials, and symbolic value.

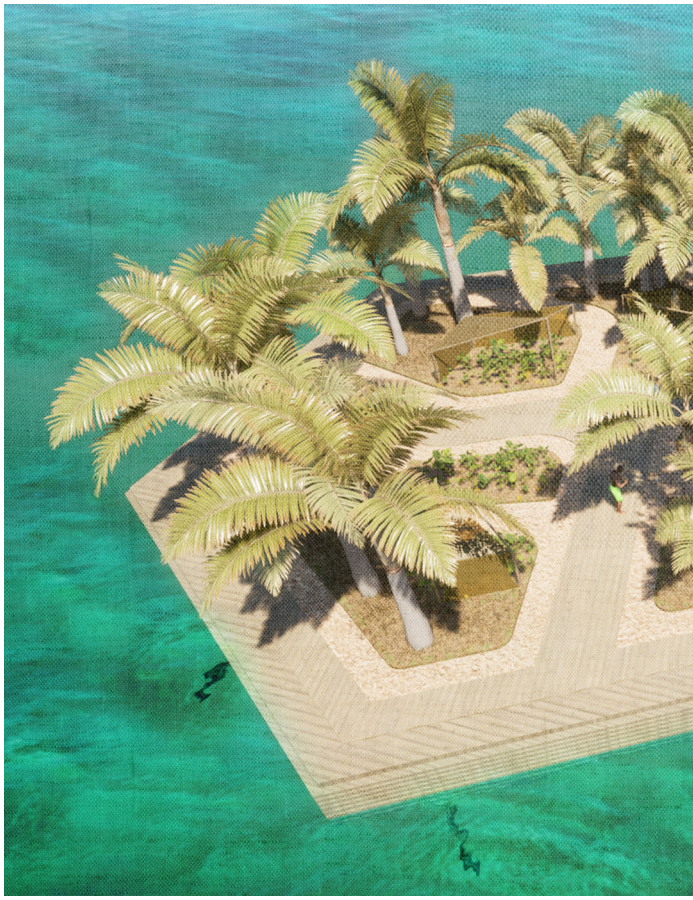


Figure 52
(Author, 2024) - Harvest Pod
Shows the two pods - Food & Energy systems

Underneath each pod is a MIRS platform that merges aquaculture, coral regeneration, and seaweed farming. These marine systems also provide biodiversity and food production, supporting regenerative aspects of the project.

Systems Integration

The floating city is embedded with multi-layered regenerative systems. These include:

- Water harvesting and recycling: Water is collected from the curved roof shells of each unit and stored under the floating platforms. Positioning between the vaka-inspired hulls balances them and protects the equipment from sun exposure. Water is filtered for household tasks or diverted to food pod irrigation.

- Electricity: Solar farms feed into a common energy grid shared by HarvestPods. Battery units are distributed across the flotilla, which reduces dependence on a single system. Energy consumption is tracked and allocated based on what is needed.

- Waste Systems: Depending on the type of pod, greywater is either treated through natural or mechanical filtering systems. Food and organic waste are composted within neighbourhoods or transported to specialised pods where it is turned into biogas.

- Further MIRS anchoring of each tank brings flotation stability, to be continued under Part Four.

Figure 53
(Author, 2024) - Harvest Pod
Coconut & Taro farm systems

Figure 54
(Author, 2024) - Harvest Pod
Coconut & Taro farm systems

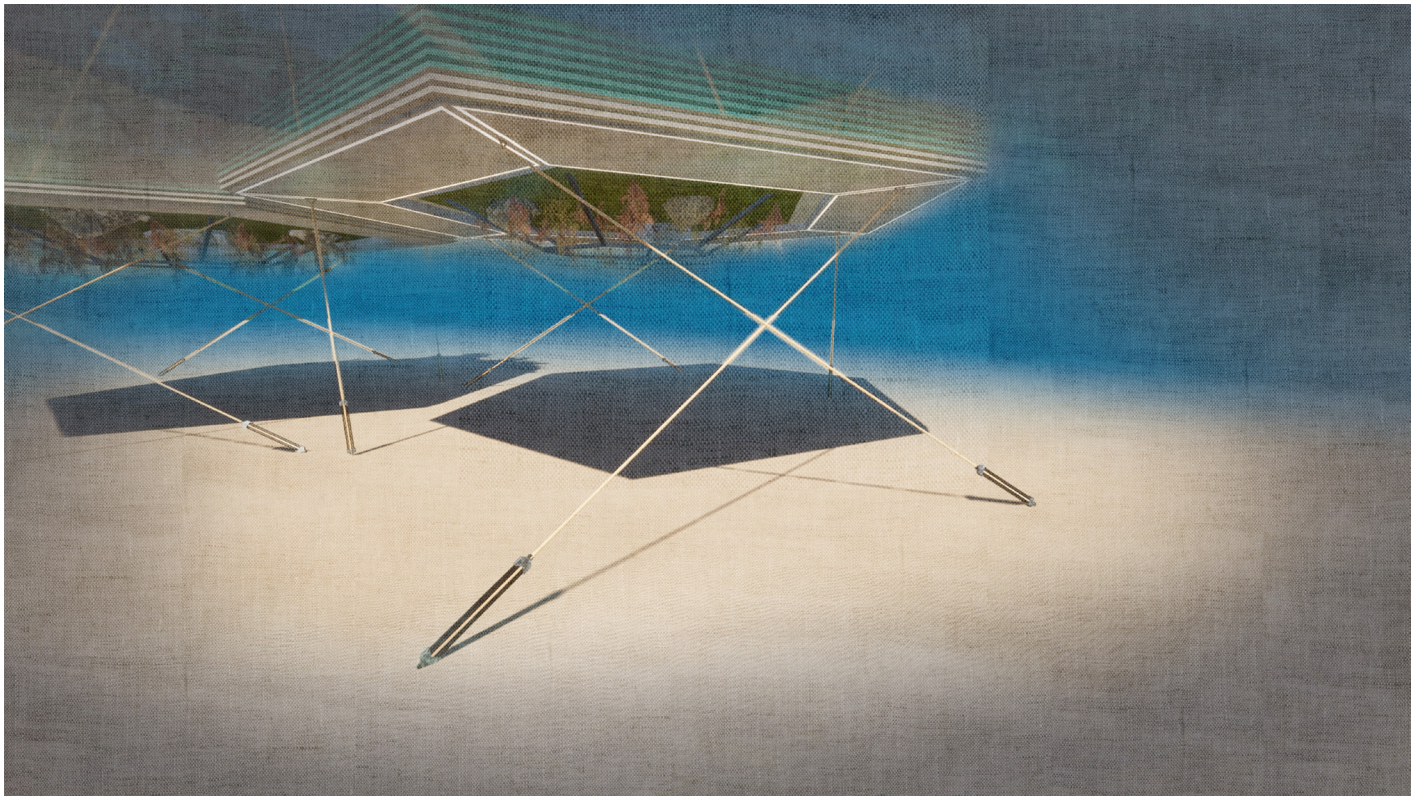


Figure 55
(Author, 2024) - Harvest Pod
MIRS & Mooring

PART FOUR

Mooring Strategies for the Floating City

Mooring the Floating City

Comprehending how the floating city stays anchored in place is key to its long service, security, and durability. Mooring is the process of anchoring a floating structure to the sea floor. For Tuvalu's floating city, a mooring system had to be selected that could meet not only environmental conditions but also cultural expectations. In this design, however, mooring is not just an acceptance of structural fact but a part of a new architectural language of living with water. It attunes itself to flows and swells of tides, winds, and seasons.

The following section elaborates on the anchoring techniques employed in the design. This mooring system then supplies the floating vessels discussed earlier in this chapter: Lau Palu Moana and Vaka Lotu. It is outlined in depth here and referenced in Part Five, which explains its interplay with regenerative systems.

Why Mooring?

A floating urban system, which contrasts with conventional coastal or pile construction, needs not only flotation but also a mooring system that will enable it to float freely without drifting and be structurally sound. In Funafuti Lagoon, this need becomes more specific. Design constraints arise from environmental sensitivity, the shallowness of the waters, and cultural values. The seabed is soft and ecologically sensitive, making invasive techniques less attractive. Rising seas also mean that the system cannot become obsolete. You must adapt it over time.

A large hunk of concrete dropped behind a vessel, or a drag anchor that is dragged into the seabed, will not work. This is first because of the shifting bottom of the lagoon underneath, and second because of the dangers these methods pose to an area rich in coral ecosystems. Thus, design development led to consideration of several types of mooring systems according to the conditions of Funafuti Lagoon. (Alpha Marine Installations (AMI), 2025)

Exploring Mooring Systems

Several mooring styles were conceived and explored conceptually through the design process, all with definite advantages and disadvantages. The test results indicated the two most viable systems were tension leg mooring (TLM) and elastic mooring with helical anchors. The final solution was a hybrid system consisting of characteristics from both. (Seaflex. n.d.)

Tension Leg Mooring (TLM)

TLM relies on vertical or angled cables maintained under constant tension. These are linked from the base of a floating platform to the anchoring points situated on the seabed. As the cables become taut, they stabilise the platform as well as prevent extensive vertical and horizontal movement. This mooring type is used in deep-sea floating structures such as offshore oil rigs, where it must resist both current and wave loads. (Barros et al., 2021)

Pros:

- Provides a high degree of structural stability.
- Reduces lateral and vertical movement
- Allows modular units to stay spatially organised.

Cons:

- More suited to deeper waters
- Requires significant tensioning infrastructure.
- Can be technically challenging in shallow atoll settings

In Funafuti, the main difficulty with TLM is the lagoon's shallow depth. There is not enough depth to install long vertical anchors that can create the downward tension needed for the system to work optimally. Modifications to the cable angles and anchoring points would be necessary for this system to work effectively in the site. (Barros et al., 2021)

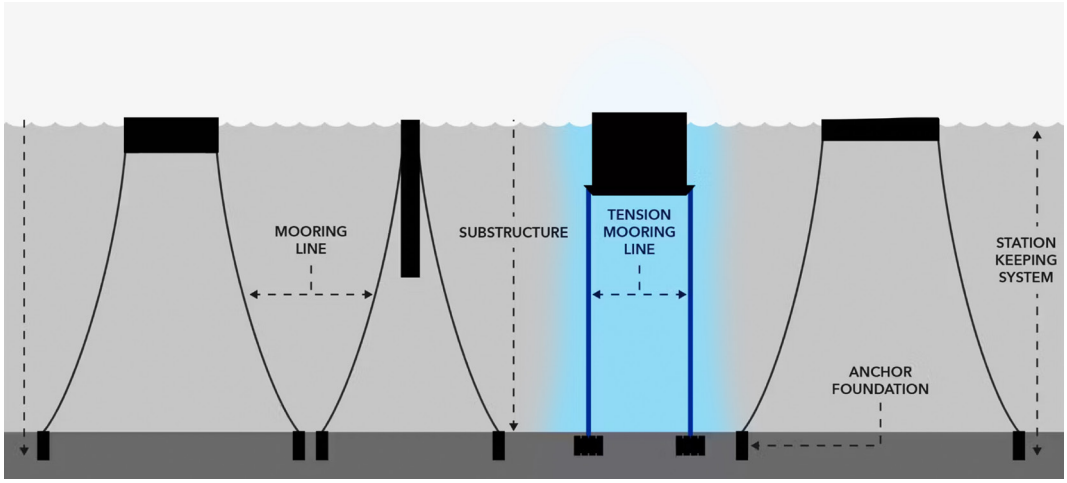


Figure 56
(Barros et al., 2021) - Tension Mooring
One of the four highlighted in blue shows the mooring system.

Elastic Mooring with Helical Anchors

Elastic mooring systems, such as MarineFlex, are more flexible. They use stretchy ropes or cables that can expand and contract in response to wave action, tides, or storms. These cables are secured to the seabed using helical anchors, which are like giant screws that twist into the seabed without requiring extensive excavation. (Alpha Marine Installations (AMI), 2025)

Pros:

- Allows the natural movement of floating platforms.
- Adapts to sea-level rise and seasonal changes.
- Less invasive to seabed environments
- Helical anchors are more environmentally friendly.

Cons:

- Offers less control over exact positioning
- Too much flexibility can disrupt spatial organisation
- It may not be suitable on its own for dense urban layouts.

Elastic mooring is appropriate in areas where more flexibility is needed, such as around the edges of platforms or between modules that are less spatially dependent. It also reduces the stress on the structure by absorbing wave energy, allowing the floating city to move with the water instead of resisting it. (Alpha Marine Installations (AMI), 2025)

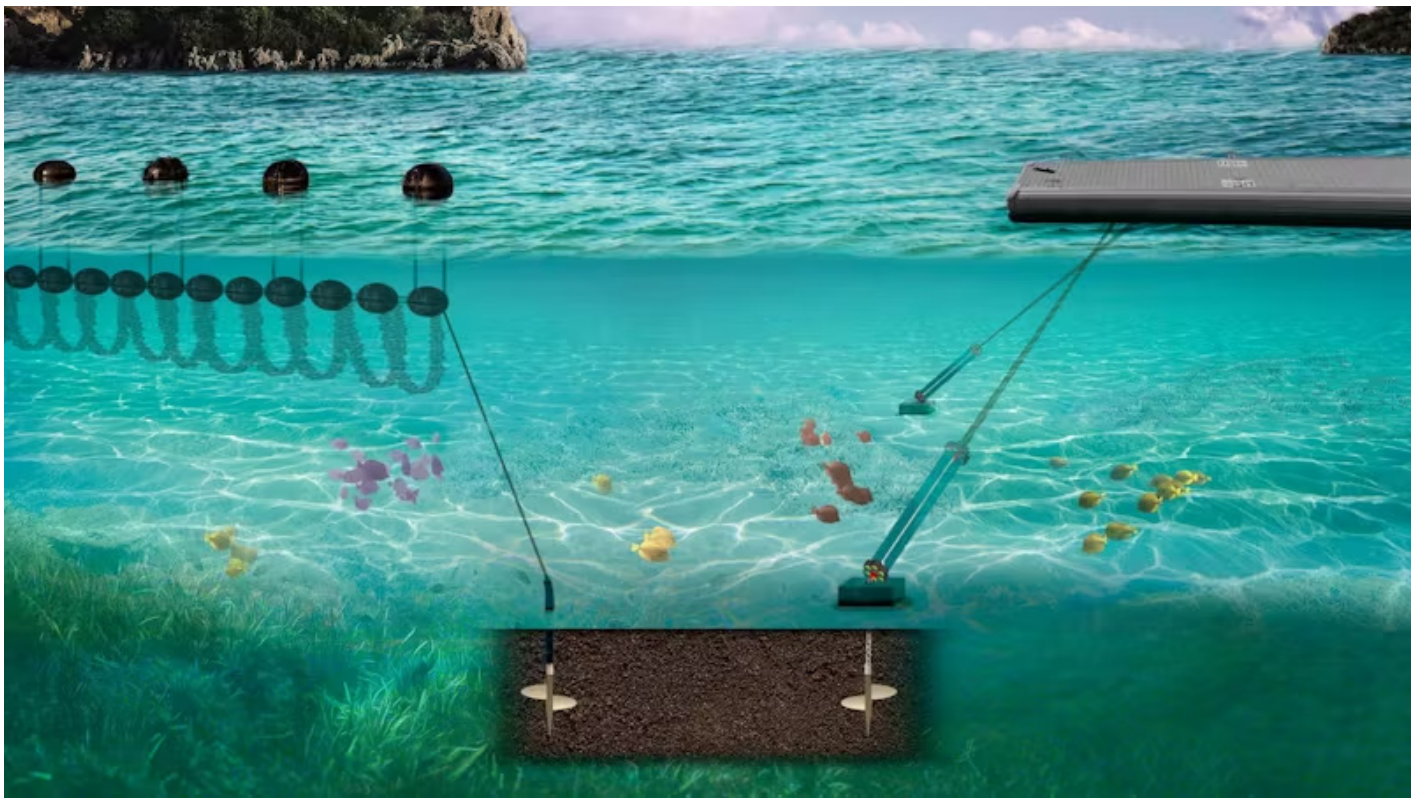


Figure 57
(MarineFlex, 2017) - Helical anchor installation: Example of elastic mooring with wave action and helical anchor.

Developing a Hybrid Mooring System

As a compromise between TLM and elastic mooring systems, the final proposed solution is a hybrid system, which employs both. For example, TLM can be deployed to keep the core or central platforms where they are. These could be important housing blocks, common facilities, and infrastructural services. Around these, elastic mooring is employed to tether platforms that can absorb a little movement, like fishing rigs, farms, and recreational spaces.

This shows that it enables a clear spatial hierarchy in the design of the floating city while also adapting to the varying lagoon conditions.

The hybrid system also supports the idea of a living city that is responsive to nature. Tensioned cables ensure organisation and reliability, while the elastic elements allow the modules to "breathe" and move in rhythm with the water.

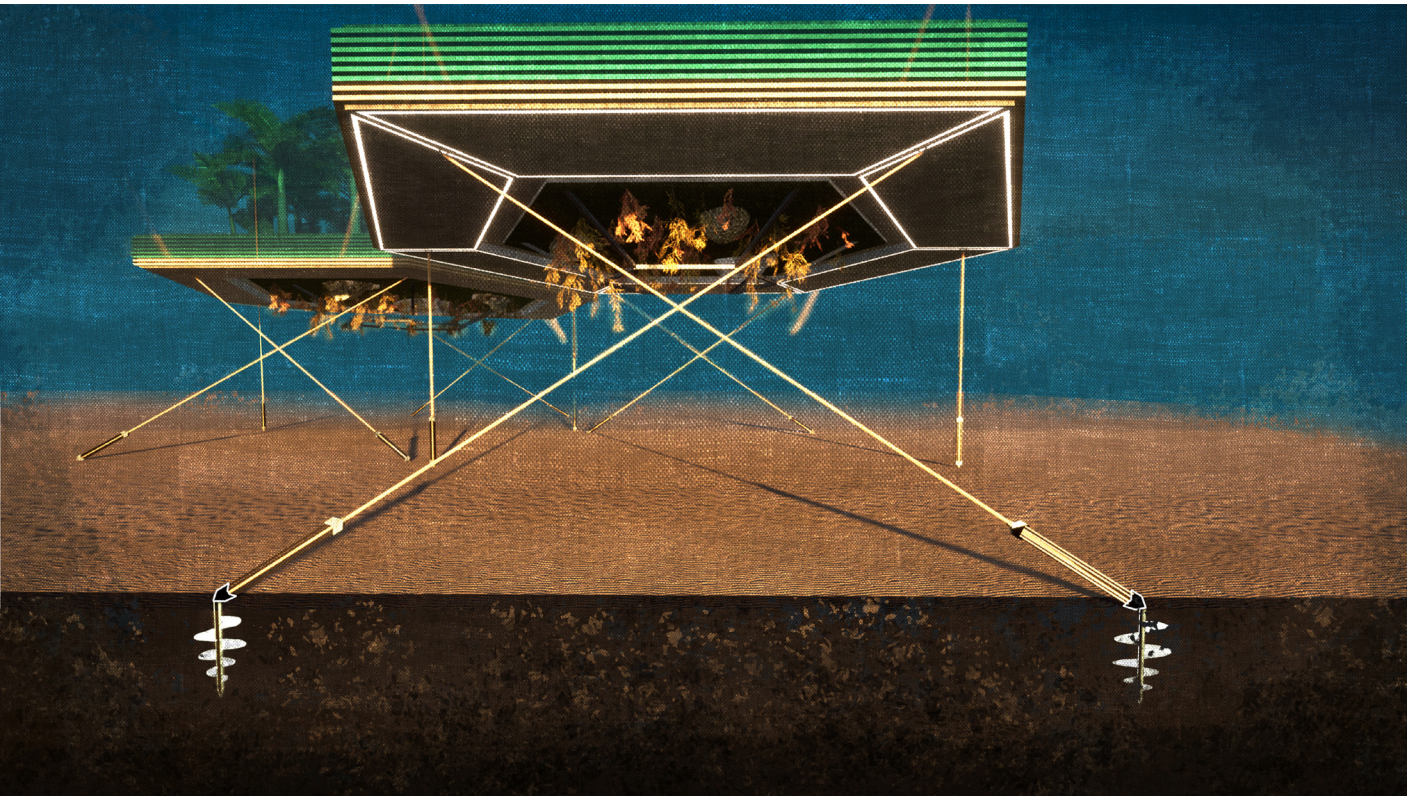


Figure 58
(Author, 2024) - Showing a diagram of a hybrid mooring system showing TLM in the core and elastic mooring on the perimeter.

Environmental and Cultural Considerations

Environmental impact was one of the main aspects for selecting this mooring scheme. Helical anchors are considered more sea-bed-friendly compared to conventional drag anchors or piles. They also fit with Tuvaluan values of safeguarding the lagoon and its ecosystems. The cultural context also promotes adaptation, respect for natural cycles and interdependence with the sea. The hybrid mooring system is like these concepts.

The strategy also considers sea-level rise. Elastic components ensure vertical movement as sea levels change over time. The core tensioned platforms keep the layout from changing. This pairing is important for long-term usability and planning.

Traditionally, anchoring systems were either hidden in the background or ignored as technical features. Here, they are viewed as an active component of the architecture. They are essential not just for maintaining the safety of structures, but for enabling the kind of flexible, modular way of living that the floating city embodies.

Summary

This design of mooring enables an adaptive but orderly style of urbanism in Funafuti Lagoon. It is based on a hybrid approach using TLM and elastic mooring with helical anchors. This system accepts displacement but guarantees spatial stability of the structure. It balances environmental protection with technical performance. It supports the wider regenerative design framework addressed throughout the research.

The anchoring strategy allows the floating city to function like a ship, pinned tightly but softly to the ocean environment. This is expanded upon in Part Five, where integration between regenerative systems such as MIRS and energy storage is introduced. The mooring system will be important in determining how the city operates, evolves, and thrives over time. Sea-level rise and a changing environment will dictate economic patterns and survival strategies.

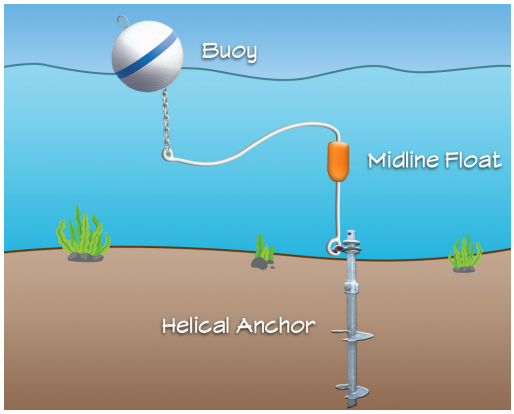


Figure 59
(Alpha Marine Installations (AMI), 2025) - Helical Anchor

PART FIVE

Representational Methods and Outputs

The floating city design process was developed through an anatomical and iterative process of hand-drawing, digital modelling, and physical prototyping. This hybrid approach facilitated an exploratory iterative methodology. It tested concepts both manually and digitally. Representational techniques became incredibly significant for the architectural language of the project. This was especially true where spatial, cultural, and environmental systems needed to collide meaningfully.

Design concepts started with hand sketches, cardboard, and wood models. They were used to examine scale relationships within Funafuti Lagoon. They also assessed the potential of various spatial configurations. These models aided in visualising how floating platforms might group, migrate, or moor in the face of the lagoon's currents and prevailing winds. This work premised design decisions on mapping the durational aspects of ocean life, tides, wind directions, and species migratory paths. They also form part of the very basis of the location of mooring systems described in Part Four.

As the project developed, digital tools were used to refine form, structure, and systems integration. The canopy of Lau Palu Moana was inspired by sail forms and waves. It was digitally modelled and evaluated using sketch overlays and 3D renders. Environmental strategies like rainwater collection and solar orientation were assessed and visualised through digital modelling and sketch overlays. This clarified their spatial and formal implications.

To explore the social and communal layout of Vaka Lotu, exploded diagrams were created. These helped understand how modular units could relate in shared co-housing clusters. The diagrams broke down each unit into components. They showed shared kitchens, gardens, and water storage between family clusters. This visualisation highlights the regenerative co-housing strategies central to the floating city's design. It supports the programme's emphasis on

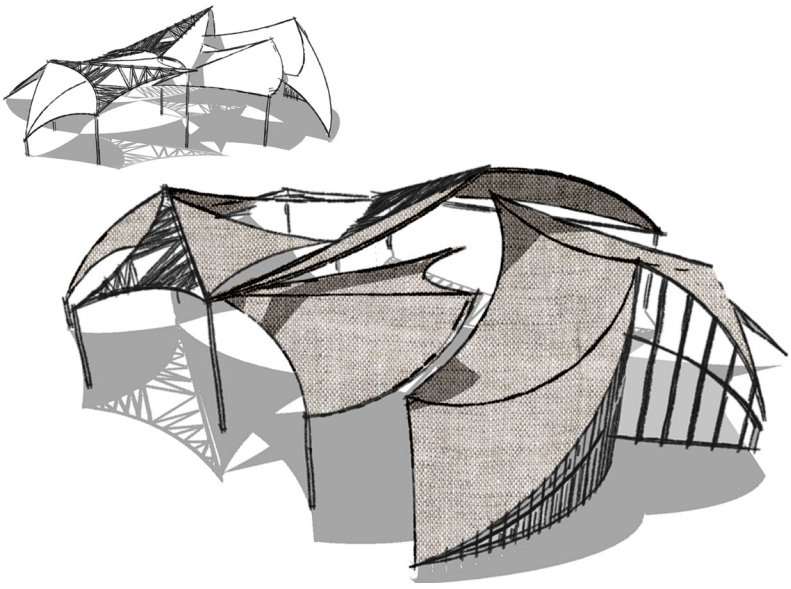


Figure 60
(Author, 2024) - The Lau Palu Moana canopy shows its structural ribs and shading.

shared living, resilience, and cultural continuity.

Technical aspects such as waste treatment, energy generation, and water collection were evaluated through system overlays. Sectional drawings and isometric overlays helped imagine the integration of Marine Integrated Regenerative Systems (MIRS) below the floating platforms. These systems are placed beneath the structures and partially integrated into the mooring lines. They generate zones for enhanced biodiversity and marine life support. This image of MIRS visually demonstrates the synergetic relationship between infrastructure, ecology, and architecture to rehabilitate the lagoon environment.

The hybrid mooring strategy developed in Part Four is embedded in the representational logic of the drawings. Tension leg mooring (TLM) anchors central platforms that require rigidity. Flexible MarineFlex lines and helical anchors support peripheral structures that move with the tide. These mooring systems are diagrammed in plan and section to show their relationship to structure and seabed ecology.

Figure 61
(Author, 2025) - Showing Harvest Pod platform with MIRS underneath and elastic mooring line connection.

Final Drawings

The last package of drawings consists of:

- Sectional perspectives of living clusters and communal spaces

- Plans showing the spatial arrangement of floating modules.

- Atmospheric renders of lived experience and materiality

The visual approaches were chosen to offer unique insight into different layers of the project. In sum, they build a vision of an urban system that is afloat, regenerative, and fundamentally Tuvaluan. Report outputs support the wider research. They visualise how architectural design connects structure, ecology, culture, and resilience.

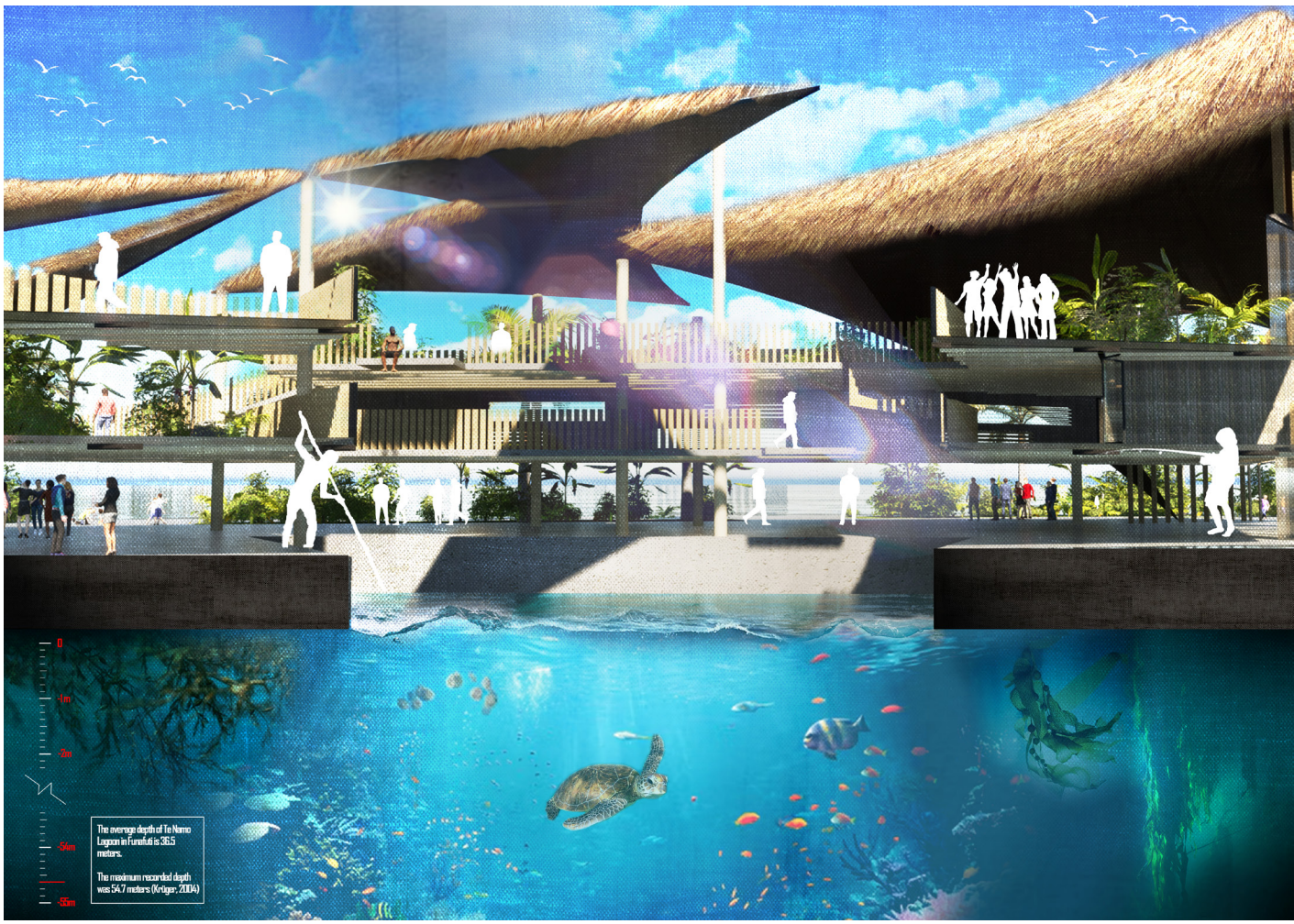


Figure 62
(Author, 2024) – Sectional Perspective showing MIRS underneath Lau Palu Moana & Programmes

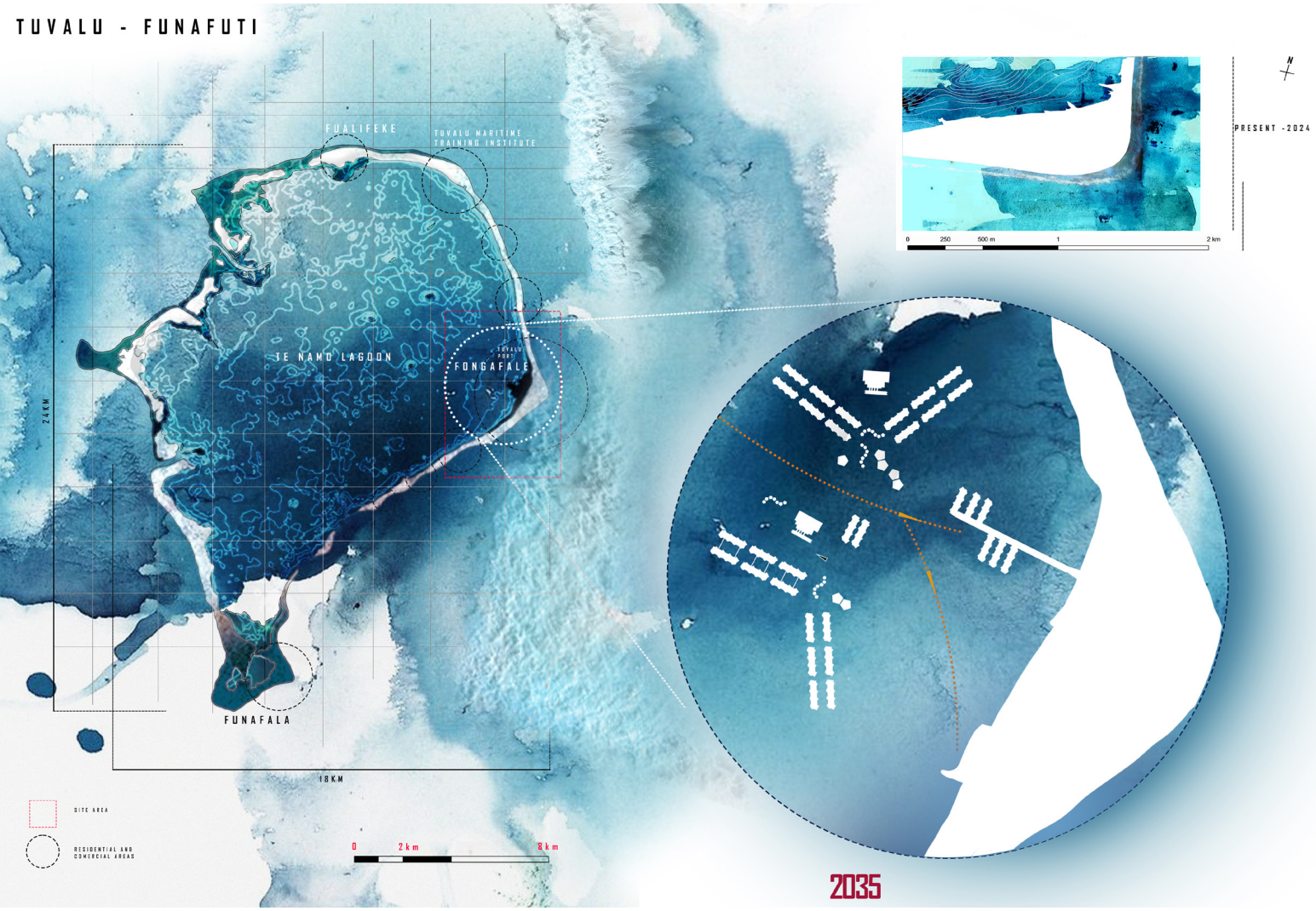
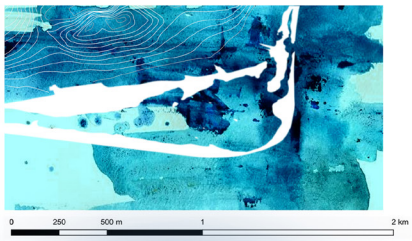
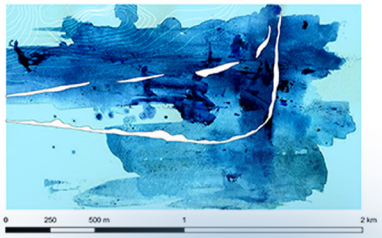


Figure 63
(Author, 2024) - Plans showing the spatial arrangement of floating modules over time.



50
YEARS - 2074
LATER



100
YEARS - 2124
LATER

2070

2200

Figure 64
(Author, 2024) - 2035 Perspective Render
Lagoon View

Figure 65
(Author, 2025) - 2200 Perspective BB1
Rendering all the modules exceeded the system's capabilities, so an alternative visual was selected.


BB1

Figure 66
(Author, 2024) - Lau Palu Moana Perspective showing programmes.

Figure 67
(Author, 2024) - Lau Palu Moana Perspective showing programmes.

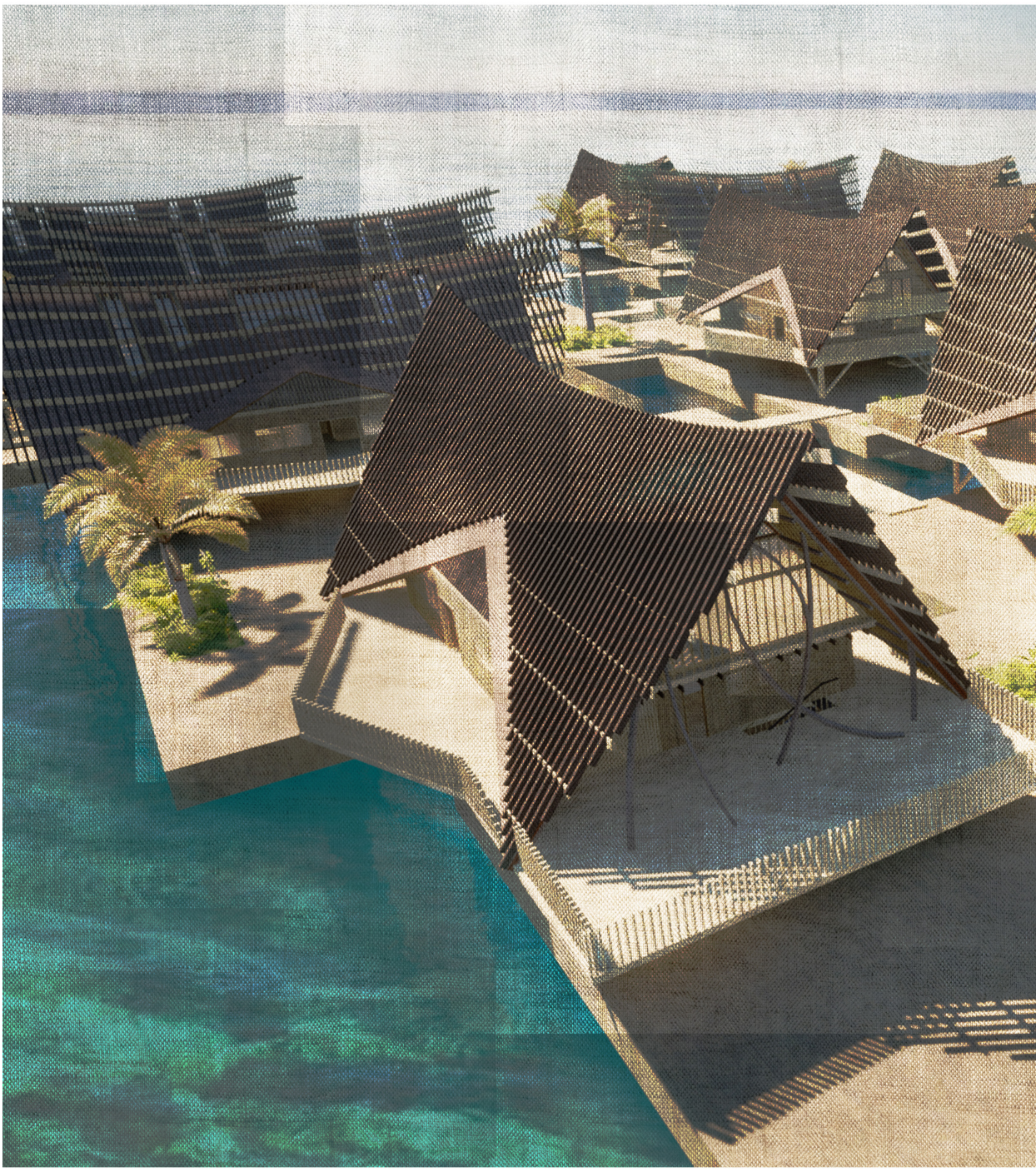


Figure 68
(Author, 2024) - Vaka Lotu Perspective of the connected modules in 2070

Figure 69
(Author, 2025) - The silhouette of Funafuti lives on through modules preserving its original form.

“Where land fades,
form remembers —
Tuvalu lives, sovereign
above the sea.”

– Alex Tepou-Dickson

CONCLUSION

The Future of Floating Cities in Tuvalu

This research has investigated whether a floating city in Funafuti Lagoon can be designed to adapt to climate change in a resilient, regenerative, and Tuvaluan culture manner. Chapter One sets the cultural, environmental, and spatial scene of the lagoon and the ocean. These are inspired respectively by Pacific thought and marine urbanism. In Chapter Two, the thesis discussed how embodied, design-led research tools, techniques, and practices, including mappings, modelling, and diagramming, were used to develop and validate claims. Chapter Three has developed a design proposal that combines regenerative co-housing and MIRS. This introduces a housing model that contributes to supporting the resilience of the community and the biodiversity of the lagoon.

This study demonstrates how place-based design informed by ecological systems and Indigenous knowledge can enable ecological and cultural resilience in the most challenging circumstances. Results suggest a built environment that does not divide the land from the sea or the people from the culture. In terms of future possibilities for this research, additional evaluation of the implementation of MIRS in shallow reef environments, for example, could be undertaken. An examination of policies required for co-housing in marine environments is another possibility. This work provides a promising beginning. It posits that the future of floating cities in Tuvalu might be shaped not just by survival, but also by care, connection, and cultural continuity.

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Figure 70
(Author, 2025) - Final Presentation

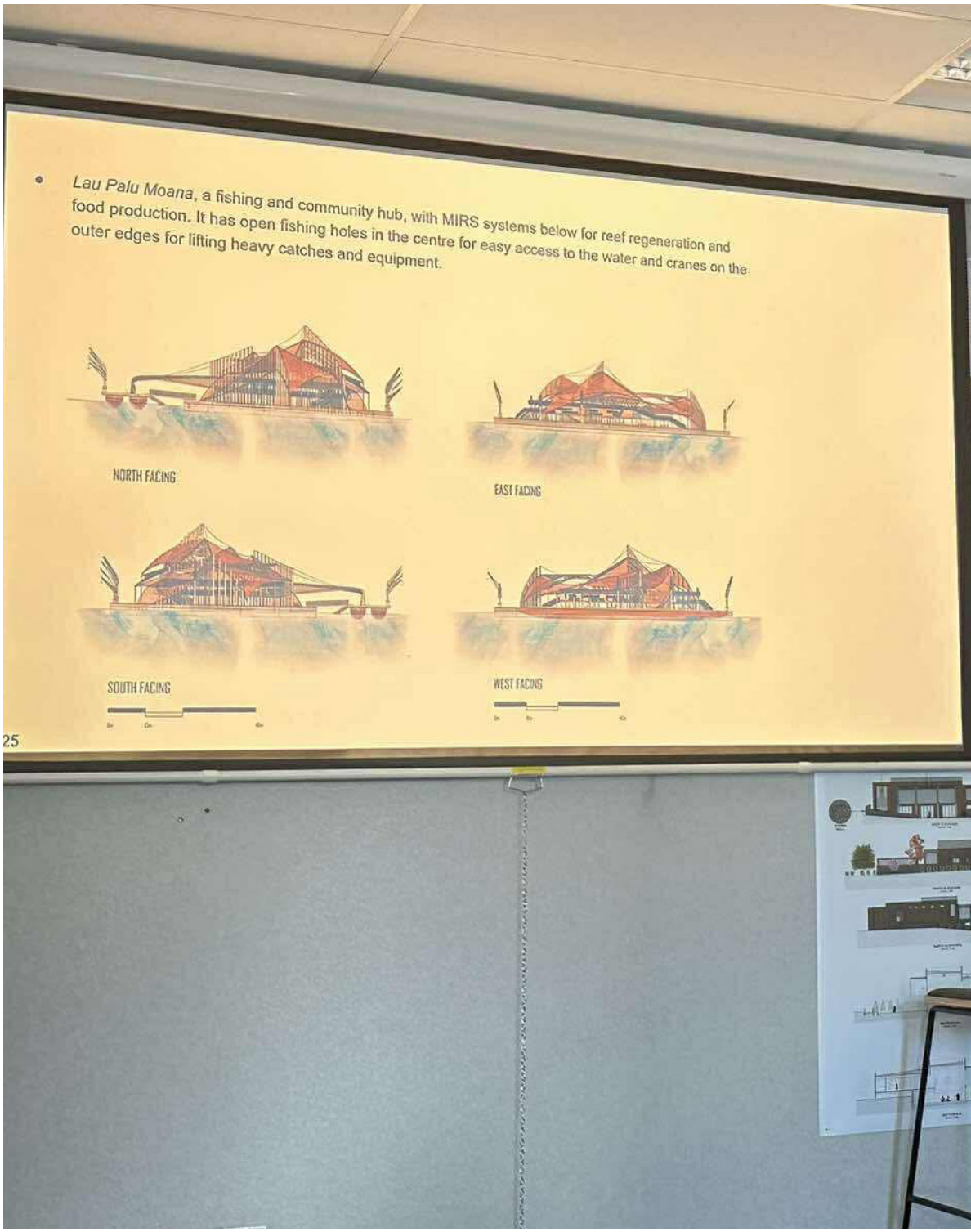


Figure 71
(Author, 2025) - Final Presentation Slideshow

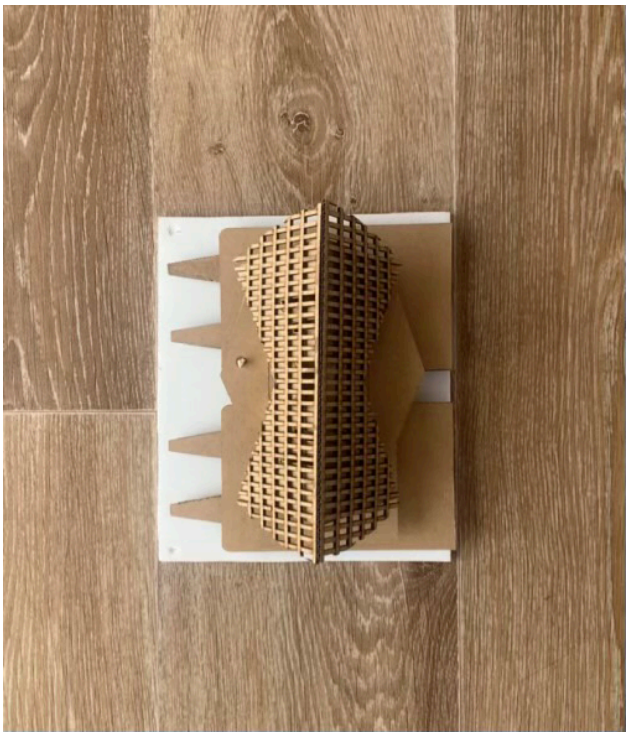
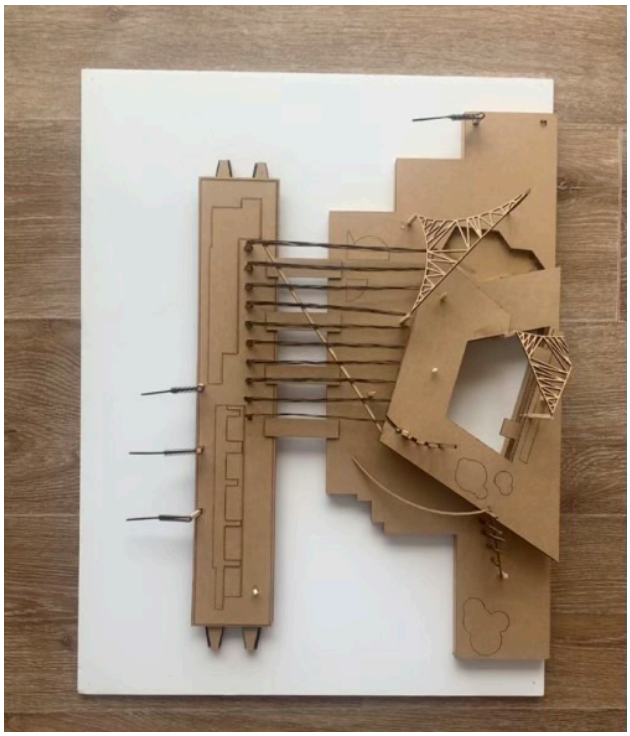


Figure 72
(Author, 2025) - Final Model (Vaka Lotu Module)



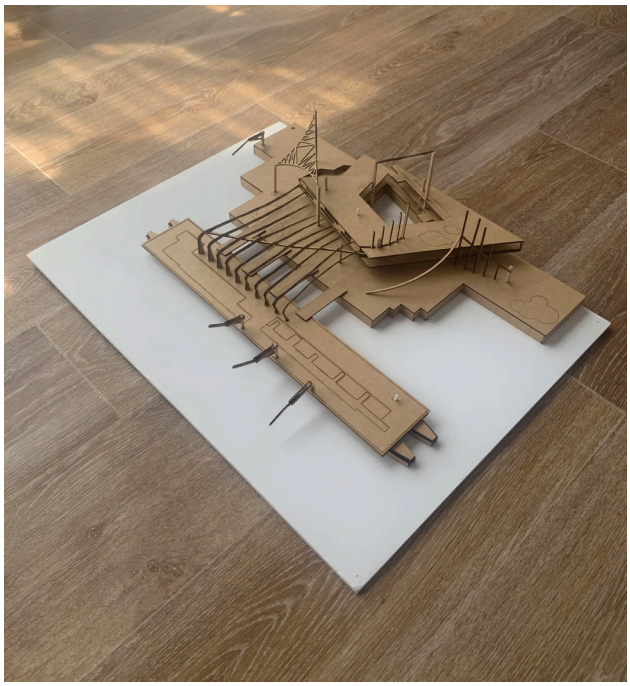


Figure 73
(Author, 2025) - Final Model (Lau Palu Moana)

Figure 74
(Author, 2025) - Final Model (2200 Site Massing Model)