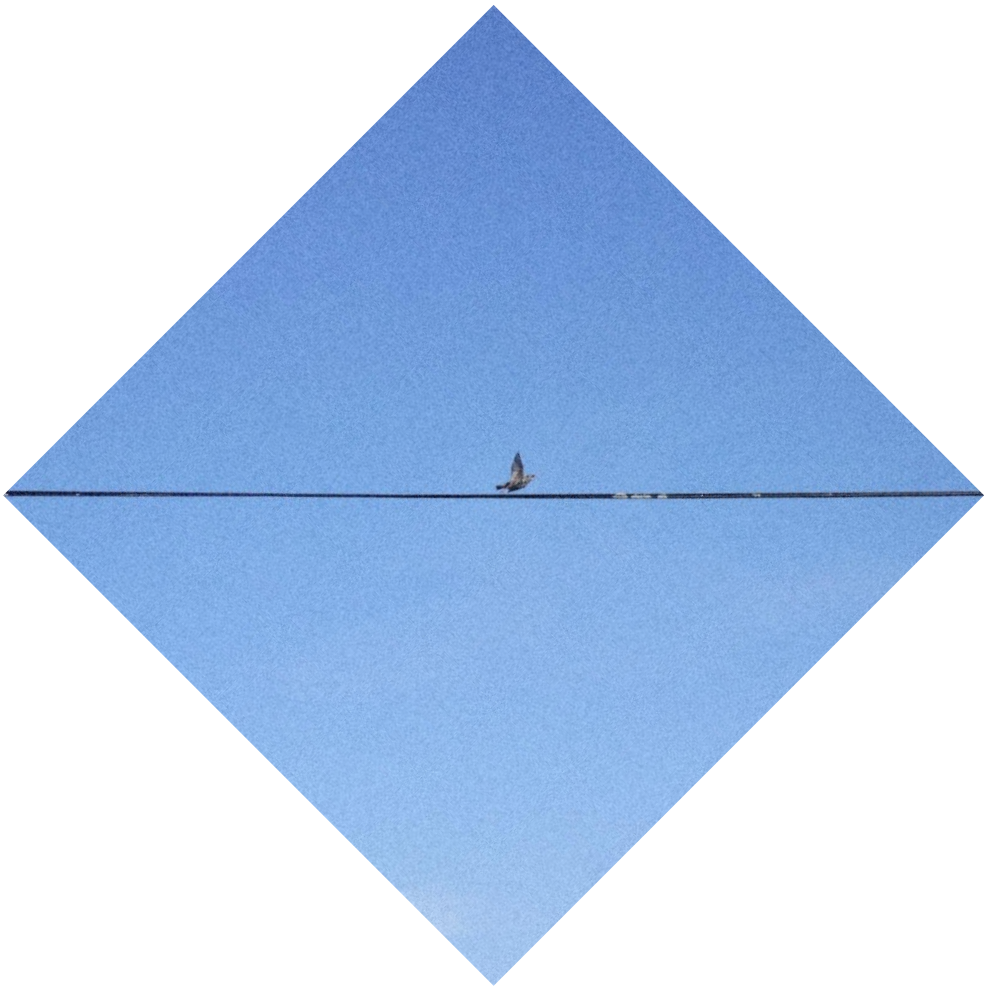
Mesh Architecture

A design strategy for regenerating relationships to more-than-human entities



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Abstract

This architectural design thesis discusses the themes of indigenous culture and relational ecology within architectural design, ecological site mappings, and the development of an architectural design strategy termed Mesh Architecture. The aim of this thesis is to ask the question, how can Mesh Architecture improve the wellbeing of more-than-human entities in Aotearoa (New Zealand)?

This thesis discusses the relationships between indigenous people groups, European colonial empire expansion, anthropogenically caused global climate change, and architecture. Examining the ways in which indigenous cultures interact with their natural environments through cultural practices, an argument for relational ecological worldviews is given. Based on writings from both authors of indigenous heritage and writers of European origin, Mesh Architecture is offered as an alternative design practice incorporating these two worldviews. This practice is then tested through a theoretical architectural design in Rotorua. A research process of mapping, including informational spatial mappings, diagrammatic mesh maps, and hikoi (walking) maps are employed to evaluate a site of architectural development. This site is critically explored to discover existing ecological relationships which inform the conceptual design programme. Mesh Architecture is then tested through the design of a community centre located on the boundary between suburban township and natural landscape, and through the design of an awa (river) pathway spanning the Waingaehe awa.

Employing Mesh Architecture in Architectural practice has demonstrated that by using this design strategy, architecture is encouraged to be ecologically regenerative, the needs of more-than-human entities are incorporated into urban spaces, and relationships between humans and more-than-humans are strengthened. This results in architecture which begins to decolonise urban spaces, encouraging traditional indigenous cultures to have more agency within the deeply ingrained colonial culture of Aotearoa.

Keywords: architecture, Anthropocene, colonisation, relational ecology, mapping, mesh

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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), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Todd Samuel Collis 21/10/2021

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Within the mapping research component of this thesis, elements of work have been collaboratively produced with other students at AUT. This work is in Chapter 3 Methods (p.30). These collaborators are Matangireia Yates-Francis, Yennegh Badimayalew, and Madeline Dumagan. The informational spatial mapping exercise was undertaken collectively, each student developed separate maps which were shared to create a large breadth of knowledge, while the mesh mapping exercise was a collaboration between all four students to create one document. Within the mesh map collaboration, each student provided the information to populate the section for their own work. I, Todd Collis, then collated this information and created the diagram from this group work. For each figure included which shows work created through collaboration, a note is given stating who contributed to the individual piece.

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Preface

Tēnā koutou katoa

Greetings

Nō Ingarangi aku tīpuna.

He tangata tiriti mātou ko taku whānau.

My ancestors come from England

My family are people of the treaty

Ko Maungakiekie te maunga.

Ko Manukau te moana.

Maungakiekie (One Tree Hill) is the mountain

Manukau is the ocean

I tipu ake au ki Tāmaki Makaurau.

Kua noho au ki Ōtautahi.

I grew up in Tāmaki Makaurau (Auckland)

I have also lived in Ōtautahi (Christchurch)

Ko Alexia taku ipo. Nō Tāmaki Makaurau ia

Ko Collis taku whanau

Ko Todd taku Ingoa

Alexia is my wife, she is from Tāmaki Makaurau

Collis is my family

My name is Todd

Figure 1

SS Ruahine

My great grandmother Mabel Chitty came to Tāmaki Makaurau (Auckland) in 1921 on the SS Ruahine (Figure 1) after her fiancé was killed in World War II. She was the one of the first of my family who was recorded coming to Aotearoa (New Zealand). Her daughter Winifred married into the Ferguson family, a prolific dairy farming family who made their living in dairy farming along the edge of the Tāmaki river. They then purchased land in East Tāmaki along Jeffs Road where my mother was raised, who then bought land in Onehunga where I was raised. Our family have few ties outside Aotearoa, so I count myself as belonging to this country, even though I have no direct indigenous ancestry. The land my family has owned in Aotearoa however, was not European in origin, but was first occupied by Māori. My family has a history of great benefit from the colonisation of Tāmaki Makaurau, and of the removal of Māori from the best parts of the land, even if we never directly took part in it.

The reason I can call myself a New Zealander today is because of the colonial ancestry I come from. This, appropriately, is an uncomfortable place to find myself. I have placed myself in this history so that this design research might better explore the impacts of this colonisation. As I have discovered and considered my history I have begun placing myself as an ally to Te Tiriti o Waitangi (The Treaty of Waitangi), partnering with Māori through this. I do not claim to be an expert in this region but a novice exploring how I might develop architectural practices that engage with indigenous knowledge and Māori to better work alongside them for the wellbeing of all in Aotearoa.

Foreword

Text by Amanda Yates on behalf of He Puna Kāinga-Ora Housing and Urban Wellbeing Lab.

We are living in a colonising era of planetary ecological crisis as climate and oceans heat, mass extinctions occur, plastic pollution encircles the globe, industrial agriculture mines critical soil reserves, and global pandemics rage. Contemporary cities are key producers of much of this ecological degradation - but cities also produce and are produced by cultural collaboration and innovation. Urban communities are now leading system change, making changes in housing, neighbourhood and urban systems that improve the wellbeing of people and planetary life-support systems. This transformation is evident as zero-carbon buildings, energy and transport infrastructures proliferate, as biodiverse urban parks and food commons are championed, and as culturally sustaining and socially connecting urban papakāinga (housing cooperatives) are formed. Circular city cultures and infrastructures are forming as supermarkets stock plant-based, rather than oil-based, plastics, for consumers to compost at home; or as increasing numbers of citizens turn to plant-based diets and sustain local regenerative farmers. As these changes – whether ultra-local, or city-wide – take place so urban culture makes a turn towards the zero-carbon, circular economy, 'living' eco-cities necessary for more sustainable futures.

In 2020, the building and cities section of the National Science Challenge funded research into urban transformation, Huritanga: Systems Change for Holistic Urban Wellbeing in an Era of Ecological. Distinctively, the research programme works with an expanded notion of wellbeing focused on the human and the more-than-human, the many entities that together make our living planet. Indigenous-Māori understandings of mauri ora as all-of-life wellbeing, or the vitality of the 'life-field' guide our mahi. Our contemporary context of ecological emergency makes a focus on holistic urban wellbeing particularly current and critical. The programme addresses the holistic wellbeing of social, cultural and ecological systems at urban, neighbourhood and housing scales. The research is place-based, working in collaborative partnerships with communities of change. Our foundational partner Te Tatau o Te Arawa (pan-iwi governance group linked with Rotorua City Council) is based in Rotorua; in Christchurch

key partners are the Ngāi Tahu Research Centre, Life In Vacant Spaces (LIVS), and Te Pūtahi, Centre for Architecture and City Making, and Christchurch City Council. The research has two key modes: transition tool development and small-scale case study experiments that test out actions for holistic wellbeing. The programme is co-developing holistic wellbeing tools with partners: a mauri ora holistic wellbeing data display that holistically visualises levels of mauri (life-field wellbeing) across an urban-neighbourhood scale and a wide range of indices including zero-carbon energy, biodiversity, social connection or isolation, cultural agency, financial, housing, energy or food security; and a mauri ora holistic wellbeing green compass, that communicates wellbeing approaches and sets the direction for transformative action (whether in the provision of walkable neighbourhoods, ecological infrastructure, local food production or culturally relevant co-housing developments or example).

He Puna Ora, AUT's regenerative urban action lab, has run externally engaged and research-linked studios (undergraduate or postgraduate) since 2012. The 2021 research thesis lab is He Puna Kāinga-Ora: a housing and urban wellbeing focused postgraduate research programme. This research lab links between the 'live' Huritanga urban wellbeing research and Hoahoanga AUT architecture's transformative pedagogy. Students are engaging with our key Huritanga research partner, Te Tatau o Te Arawa, on a Te Arawa (Ngāti Whakaue) owned land. The Thesis lab is oriented by Te Tatau's mauri ora housing and neighbourhood development compass – co-created with the Urban Wellbeing programme from a kit of parts. The students are developing collective research analyses, an individual research brief, a contextualised methodology, and a complex housing-focused design proposal that in some manner enhances socio-cultural-ecological wellbeing at housing and neighbourhood scale.

Glossary of Te Reo Māori

In this thesis several Te Reo Māori words have been used in exchange of their English translations. The following is a glossary of these words. Te Reo Māori names for locations, people, and organizations are not translated into English here, except where their English translations are more commonly used.

- Aotearoa — The Māori name for New Zealand
  Literally 'Land of the Long White Cloud'
- Awa — River, or waters
- Harakeke — Flax bushes
- Hikoi — Walk, or walking
- Iwi — Tribe
- Kākā — A species of native parrot
- Karaka — A species of native fruit bearing tree
- Karakia — Invocation, or prayer
- Kauri — A species of native tree
- Kererū — A species of native wood pigeon
- Kiwi — A species of native flightless bird
- Kōkako — A species of native bird
- Kōura — A species of native Crayfish
- Māori — Refers to the indigenous people of Aotearoa.
  Literally meaning 'normal' or 'usual'
- Mātauranga Māori — Māori knowledge
- Maunga — Mountain
- Maungakiekie — The Māori name for One Tree Hill, a mountain
- Mauri ora — Life force
- Mokomoko — Lizards
- Ōtautahi — The Māori name for the city and region of Christchurch
- Pākehā — Residents of New Zealand from European descent
- Papakāinga — Group housing or community housing
- Pekapeka — A species of native bats

- Rangi — Sky
- Tāmaki Makaurau — The Māori name for the city and region of Auckland
- Tangata whenua — Refers to the indigenous people of New Zealand
  Literally ‘People of the land’
- Te Reo Māori — Māori language
- Te Tiriti o Waitangi — The Treaty of Waitangi, often shortened to ‘Te Tiriti’
- Tī kōuka — Cabbage Trees
- Tino Rangatiratanga — Can mean ‘sovereignty’ ‘Self-determination’ or ‘independence’
- Tororaro — A species of native bushes
- Whakapapa — Genealogy
- Whanau — Family
- Whare — House
- Whare raupo — Grass house, or Grass hut
- Wharenui — Meeting house
- Whenua — Land

Introduction

As a species, humans are facing alarming global changes; increasing carbon emissions, rising global temperatures, and the loss of animal species, in recent history are at a scale comparable to a global extinction (Dirzo et al., 2014). These changes to the environment are compromising the sustainability of life on earth. This reality is referred to as the Anthropocene, a shift of climate globally instigated primarily by human action. To combat these crises, radical changes to the way societies operate need to occur. Every individual is responsible for their own role in creating regenerative practices that affect positive ecological change in their own area of influence. This thesis examines the role that architectural practice has in these crises, and how architectural design might create ecological regeneration through alternative design strategies.

This research takes the view that the Anthropocene is a product of the disconnected relationship of people within modern Eurocentric culture towards their immediate natural environments. A culture of disconnection inhabits everyday lives and separates humans from the natural through the prevalence of urbanised space, which largely remove natural systems from resident's immediate environments. While architectural designers contribute towards this system by providing designs that disconnect individuals, they also have a great opportunity to radically affect human relationship to more-than-human entities through the design of urban spaces. This thesis develops a new methodology of architectural design, referred to as Mesh Architecture, that provides a framework for designing in a way to enhance these relationships. The contexts of the Anthropocene, colonial culture, and indigenous relational ecologies, are discussed to provide framework for this strategy, as are existing architectural typologies demonstrating permeability, ecologically regenerative landscapes, and material vitality. Through these factors, Mesh Architecture is developed as a strategy of practice for architectural design. This is tested through a design proposal for a commercial centre located in Rotorua. Through the design research the question is asked, how can Mesh Architecture improve the wellbeing of more-than-human entities in New Zealand?

This thesis is structured as follows. Chapter one 'Contexts' investigates the Anthropocene as a symptom of the breakdown of human relationships towards non-human, natural entities. Through examining North American and Aotearoa indigenous people groups it is observed that a worldview of relationship towards more-than-humans in these cultures led towards ecologically regenerative

practices. Comparisons are observed between indigenous cultures and modern European ecological literature, which together inform a philosophy of relational ecologies. These contexts inform Mesh Architecture which is developed as a response to this research.

Chapter two ‘Typologies’ examines architectural designs that form the principles of Mesh Architecture. These typologies create opportunities for enhanced relationships between humans and more-than-human entities. Mesh Architecture is identified in the typologies of Japanese and South Pacific designs, which are designed with temporal and permeable characteristics. The designs of city parks are examined to explore how natural landscape spaces positively affect the wellbeing of people in urban environments. Examples of Aotearoa architecture are examined as designs of material vitality, which is a practice of ascribing metaphysical vitality to ‘inert’ entities. Mesh Architecture is then defined through these examples and presented as a manifesto.

Chapter three ‘Methods’ documents the development and testing of Mesh Architecture design practice on a papakāinga (community group housing) development in Rotorua. To develop Mesh Architecture as a design process, mapping is used as a method of discovering and expressing relationships between people and place. This is discussed through writings of modern ecological philosophers, and the mapping techniques of indigenous cultures of the South Pacific. Three mapping techniques are tested in Rotorua to explore the site of a potential architectural development. Through informational spatial maps, mesh diagrams, and mapped hikoi exercises, the project site is explored in a variety of scales and techniques.

Chapter four ‘Tests’ presents a conceptual architectural proposal which tests the design strategy of Mesh Architecture. The process of architectural design is developed through the understandings of ecological mappings and architectural typologies. A conceptual architecture of a commercial hub located in Rotorua is presented, and discussed in relation to how it has been designed through the manifesto of Mesh Architecture.

The findings of this design research demonstrate that implementing Mesh Architecture as a design strategy improves the holistic wellbeing of more-than-human entities in Architectural design through encouraging relationships between more-than-human entities to thrive within urban spaces.

Contexts

In this chapter the impacts of the Anthropocene are discussed, investigating how the climate has shifted since the beginning of European industrialised development. This in part stemmed from a move away from relational engagement with natural environments towards disassociation with natural environments, leading towards ecologically destructive practices in human cultures (Morton, 2012). These unsustainable practices stemmed from a Eurocentric cultural perspective that dominated many developed countries. These changes are considered in how they have affected the indigenous people groups of South Pacific and North American groups, changing how they are able interact with the environments they inhabit. The work of Morton is discussed as a western understanding of ecology, alongside indigenous cultural knowledge aligning to similar perspectives. These two perspectives are presented as a path towards reclaiming indigenous ecological practices, which is then adapted into the design strategy of Mesh Architecture.

Anthropocene

Coined by Crutzen and Stoermer (2000), The Anthropocene refers to the current geological era where human development has made such significant change to the environment that it is recognisable on a global scale. The term has now been widely adopted by the scientific community and is used to argue for more ecologically regenerative practices worldwide. More recent research supports this, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services ([IPBES], 2019) gives a detailed report on the state of environmental crises in their 2019 Global Assessment Report on Biodiversity. The document describes a planet where “nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide” (IPBES, 2019, p. 10). Through collating global research, IPBES show how natural environments have changed and are shifting towards human life becoming less sustainable; the rate of this increasing significantly over the last fifty years. For example, there has been a global reduction in biological diversity in animal and plant species, leading towards less resilience towards pests, pathogens and climate change (IPBES, 2019). Increases in global temperatures have accelerated, which is a direct contributor to the increase of extreme weather events and rising sea levels (IPBES, 2019). Global consumption and pollution have also increased significantly, marine pollution particularly has grown ten times over since 1980 (IPBES, 2019). Through platforms like this, anthropogenic effects on the planets climate have

become more commonly accepted in public discourse, as seen in the change of media discussion from debating the relevance of climate change towards discussions on how to mitigate it. As the effects of the Anthropocene continue to become more obvious, the urgency to address them has increased.

He Puna Kāinga Ora is acting to create positive ecological difference in this context, combating the effects of The Anthropocene through research programs such as He Puna Kāinga-Ora Housing and Urban Wellbeing Lab, which this thesis is part of. He Puna Kāinga Ora asserts that Urban environments are a major contributor to the factors of the Anthropocene through the removal of natural systems to make room for human-centric environments. The construction of these spaces are also a contributor to climate warming through the excess carbon produced within the architecture and construction industries, which account for 20% of Aotearoa's total carbon emissions (Hurst, 2020). However, He Puna Kāinga Ora affirm that these same urban environments have the potential to be a source of transformative change, due to the impact architecture has on the way residents within them live.

By acknowledging the role of human development in declining ecological health, a pathway towards regenerating the climate through architecture is opened. In creating and testing an architectural design strategy that works out of this understanding, built environments which regenerate the planet's climate can be achieved. Through the establishment of this strategy, this thesis aims to positively affect the impacts of the Anthropocene through architectural design.

Colonising Indigenous Worlds

It seems that climate change due to modern human development has been the primary factor in the degrading of natural environments. The shift from indigenous perspectives, which positively interact with their spaces, towards colonisation is discussed as a factor behind the trend towards unsustainable human practices.

As human civilisation has spread, energy production and carbon emissions have risen to cater for the growing population and energy demands in industrialised areas. As cities grow, they build over natural habitats and surrounding areas are developed for resource production. An instigator of these expanding environments has historically been European colonial empires. Sharing a common history throughout many areas of the developed world are stories of colonial empires invading pre-European civilisations, imposing their culture in place of the existing indigenous

culture. This is also New Zealand's story, which shares parallels with colonisation in North America. Through Kimmerer's Braiding Sweetgrass(2015) and Larsen and Johnson's Being Together in Place (2017), Northern American tribes and tangata whenua (indigenous people of Aotearoa) are shown to be irrevocably altered by the impacts of colonisation.

Kimmerer (2015) reflects on the impact colonisation has had on the culture of her indigenous ancestors, the Potawatomi, who are a native North American first people's group. Through western immigration into North America, the Potawatomi became displaced from their land and forced to adopt foreign cultures to survive (Kimmerer, 2013). Under pretence of progression and education their children were forced into European style schools (Kimmerer, 2013). Consequently, the Potawatomi culture and practices are disappearing as the knowledge of the language and cultural practices are in steady decline, with only nine people remaining who speak their culture's original language fluently (Kimmerer, 2013).

The concept of individual land ownership was a foreign idea to the Potawatomi, whereas in the colonial mindset, land is a commodity to own and make profit from. This mindset directly conflicted with the notions of the existing Potawatomi gift culture which views gifts as expected and containing responsibility. To the Potawatomi, a gift comes with a responsibility to the receiver to give back. This set up a relationship of reciprocity between people where each person becomes indebted to one another (Kimmerer, 2013). This gift culture was also how Potawatomi viewed land, as a gift to them that indebted them into relationship with the space they inhabited (Kimmerer, 2013). As this cultural belief clashed with the conceptions of western land ownership, immigrants imposed their tradition of individual land ownership and Potawatomi were forced to own land individually under the traditional European system, or face eradication (Kimmerer, 2013).

Potawatomi understand the earth through relationship, their language shows this by referring to 'non-living' elements like awa (rivers), and maunga (mountains) as alive and animate, not as things, but persons (Kimmerer, 2013). Through a difference in language, a completely different understanding of how to relate towards natural environments was expressed. It is improper use of the English language to refer to an awa or a maunga as a person, English transcribes a hierarchy between people being referred as a person, but awa being referred to as an object. This change became forced into Potawatomi culture as their own language became prohibited (Kimmerer,

2013). Through the forced assimilation of English, the Potawatomi understanding of relationship with their environments is being lost (Kimmerer, 2013).

The story of colonisation in Aotearoa has a similar narrative that can be seen through Waitangi. Te Tiriti o Waitangi (Te Tiriti, The Treaty of Waitangi) is the formal agreement between British Government and the various tribes of Māori in Aotearoa signed in 1840. Te Tiriti sets out agreements between the two parties acknowledging each other as equal partners in the governing of Aotearoa (Larsen & Johnson, 2017). From the perspective of Māori this was important in protecting their right to govern their land, and from British perspective it was important in establishing authority in Aotearoa as countries such as France were threatening to claim land for themselves (Larsen & Johnson, 2017). One tenet of this treaty was for Māori to retain Tino Rangatiratanga (self-determination, or sovereignty), however the British historically used treaty partnerships like this as a strategy of conquest, to extinguish the rights of indigenous groups (Ivison et al., 2000). While Māori understood Te Tiriti o Waitangi as pākehā (residents of New Zealand from European descent) offering them equal partnership, Britain understood the signing of te Tiriti as Māori acceding to the sovereignty of the crown (Ivison et al., 2000).The result of this in the following years was the removal of most Māori from their land as Europeans claimed ownership of property in Aotearoa.

Māori, In a similar way to Potawatomi, have a deep spiritual connection to place, understanding that mauri ora (life force) flows throughout all the natural world, and that all entities are connected (Yates, 2016). Relational whakapapa (genealogy) is not limited to human relatives but includes the natural environment. Maunga, awa and rangi (sky) are all part of an interconnectivity that frame belonging within being in place (Yates, 2016). This relationship to the environment, contains an ethic of care and an understanding of co-dependency towards the mauri ora of all within it (Yates, 2016). Removing Māori from their land then meant not just a removal from an environment, but from their ancestors, disrupting Māori at an intimate, spiritual, level. Both the Potawatomi and Māori are described through their intimate relationships to their environment, which were foreign to colonial mindsets. While both these cultures are surviving to a degree now, they are both subservient to the more dominant culture of European settlement. Appreciating the differences of these indigenous cultures can lead to dramatically new ways to engage with the land inhabited; a culture based on this relationship could become a path towards healing broken people groups and environments. This understanding of a relationship towards place is critical for the development of an architectural strategy which affects the Anthropocene. Framing

architectural projects as an extension of a connection to place will create architecture that acts as a stage for relationships to occur. Adopting relational thinking allows built environments to embody an indigenous set of values that can positively impact the crises of the Anthropocene.

Relational Ecology

Morton (2010) in The Ecological Thought, explores a relational worldview through the metaphor of mesh which connects all entities and concepts together as one organism in a complicated web of inter-relationships that affect and rely heavily on one another. This mesh establishes a relational ecology that understands humans as co-dependant with natural entities. In a colonial worldview, a distinction exists between human and non-human, which has allowed a level of hierarchy to be established over non-humans (Morton, 2012). A mesh ecology asserts that there is no dominance or separation, but that human and non-human entities have equality with each other. The members of this mesh include humans alongside animals and plant life, but extend to contain non-living entities such as maunga and awa, and stretch to include the entities of social structures, societies, political groups, and economies (Morton, 2012). All these separate entities work together to influence and affect one another in the mesh. This philosophy informs the use of the term more-than-human in this thesis which refers to all these vast-spanning entities and understands them as inherently co-dependant to each other.

These philosophies are aligned with the cultural beliefs of the Potawatomi culture who see non-humans as equal to human, and with Māori who see mauri ora through all entities. While Morton (2012) discusses relational ecologies from a western perspective, without explicit connection to an indigenous perspective, he appears to have arrived at the same conclusion where relationship to place is vital to achieving ecological balance. This Eurocentric approach towards relational ecology is critiqued by Todd (2016), an indigenous scholar, who notes the trend of western scholarship discussing a more-than-human ecological understanding without acknowledging the roots of this thought in indigenous knowledge. Scholars like Morton have taken the elements of relational ecology from these cultures without attempting to engage fully, leading to a more colonial approach which disregards the original culture (Todd, 2016).

By placing Morton's mesh within the traditions of indigenous cultures, such as the Potawatomi and Māori, this thesis aims to decolonize and allow a holistic understanding of relational ecology to impact design philosophy. For genuine ecological outcomes to be achieved, this mindset of connectivity needs to be adopted. Modern western architecture does not allow for relational living

within the typical designs of western cities, reinforcing a culture where humans are hierarchically separated from natural entities. To challenge this status, Mesh Architecture is created as a design strategy that prioritizes the interconnected relationships between person and place and regenerates wellbeing in both human and more-than human entities.

Typologies

In this chapter, architectural typologies are discussed to identify exemplars of ecologically regenerative works that can inform the development of Mesh Architecture. Three architectural design concepts have been identified for their ability to create relationships between place and people. Permeable architecture is used to enhance social and environmental interaction between spaces, shown in the architecture of both Japanese and South Pacific homes. Urban ecological landscapes encourage healthier relationships to take place in heavily urbanised environments, as in the urban park designs of SCAPE (https://www.scapestudio.com), a North-American design studio. Material vitality, by designing with a mauri ora mindset towards building materials, is seen in the buildings of Te Papa Tipu Innovation Park and Te Kura Whare. These architectural exemplars combine to inform the development of Mesh Architecture, which is presented as strategy of design through a manifesto of goals.

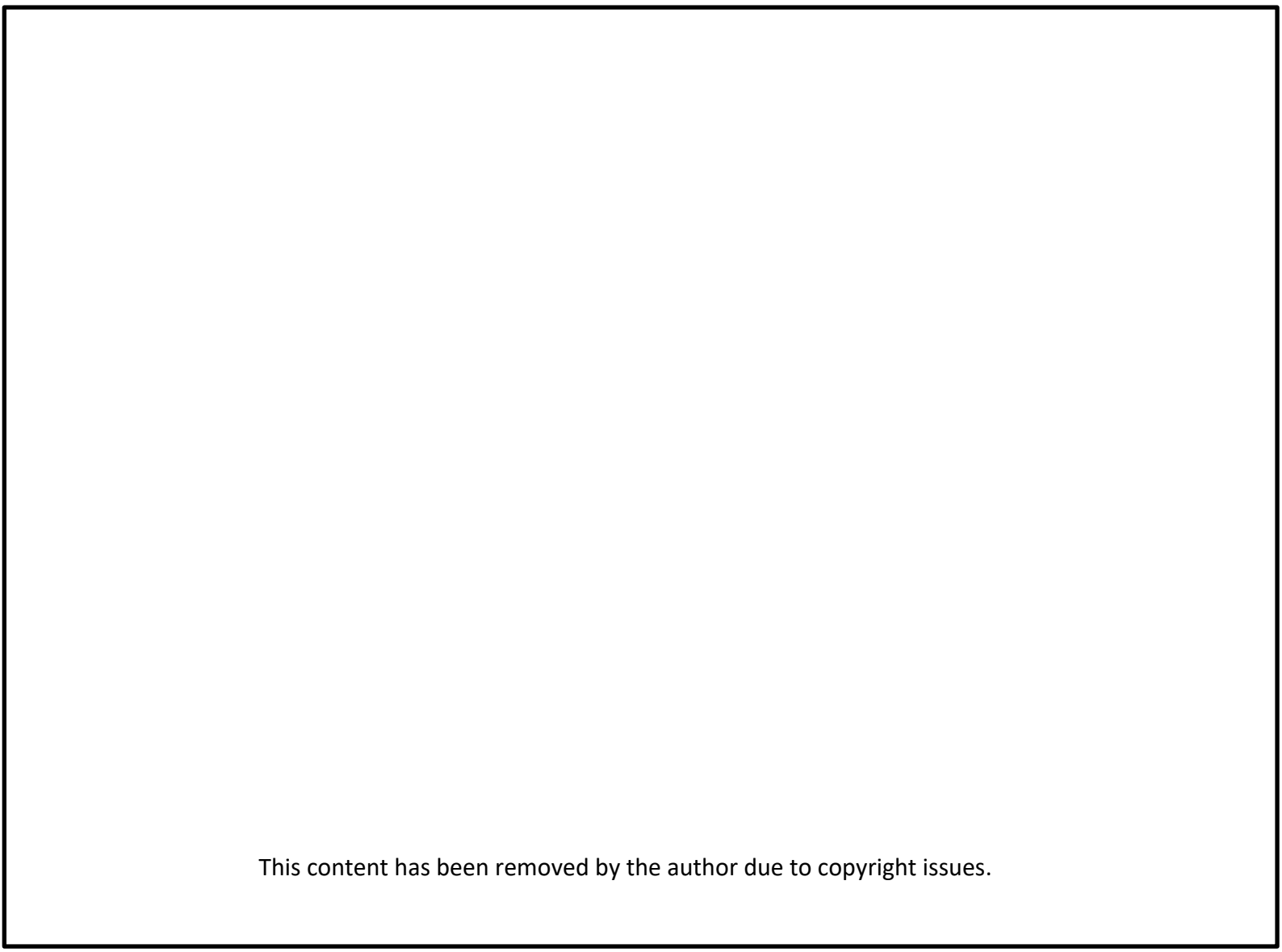
Permeable Architecture

Traditional architecture of the South Pacific is characterised by its spatial qualities of permeability. Austin (2020) describes the typologies of various South Pacific culture's architecture as permeable within the interiors, and permeable through to the outside. Comparing the structural qualities to those of traditional boat construction, Austin notes that the technologies between constructing structures and ocean vessels share great similarities. As the building techniques of these cultures emulated their vessel construction, a particular architectural form was established that tended towards connectivity. Generally, the buildings found in traditional cultures in the South Pacific were built to be single room pavilions where spaces are not segmented through internal partitions as they typically are in western designed homes (Austin, 2020). Throughout South Pacific cultures, buildings were not used to segment spaces apart from each other, but to construct an environment of connection, or relationship, to the outside and to each other, as seen in Figure 2.

McKay and Walmsley (2005) describe Māori and South Pacific architecture as underperforming in the qualities which define western architecture, but instead exemplify unique qualities of flexibility and openness, responding to natural elements. Structures like the Samoan falé, consisting of one permeable interior open to the elements on all sides, allows for vastly different experiential qualities. This permeability of space allows for a building to be a mediation between interior and exterior, while not separating the two (McKay & Walmsley, 2005).

Figure 2

Traditional Samoan Falé



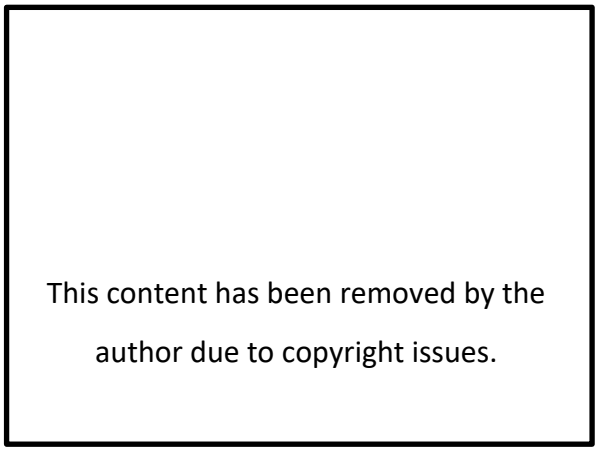
Note. This Samoan falé is a single open permeable room remining semi exposed to external elements, which is typical of much South Pacific architecture. From “Architecture of an Ocean,” by M. Austin, 2020, *Architecture New Zealand, 2020*(6), 28–35. Copyright 2020 by AGM, a division of BCI New Zealand.

An example from Aotearoa is the whare raupo, see Figure 3, a small grass reed hut used in Aotearoa until the 1950s (McKay & Walmsley, 2005). In this design, walls and roof are the same element, doors and windows are replaced by thin flaps and the ground is left bare. This difference from European timber homes shows alternative priorities in designing built environments. The whare raupo exemplifies mutability between interior and exterior, allowing users to experience

the qualities of change through the effects of weather and time. This kind of design enables far greater relationship to a place through experiencing environments with the senses. Hearing and feeling the building react to wind and rain, and smelling the natural materials of earth and grass enable a connectivity to the immediate environment (McKay & Walmsley, 2005).

Figure 3

Whare Raupo



Note. Whare raupo are traditional Māori structures made mostly of grass, allowing a great deal of relational connectivity to natural elements. From "Pacific Space: The Pacific Conception of Building," by B. Mckay and A. Walmsley, 2005, *Idea Journal, 6*(1), 61-71 (https://doi.org/10.37113/ideaj.vi0.196). Copyright 2005 by B. Mckay and A. Walmsley.

The tendency towards spatial relationships that engender relationships is crucial for the success of Mesh Architecture as a strategy. Western designed homes have leant towards private secluded rooms disassociated from each other, leading towards designs which remove the chance for incidental relationships, favouring privacy over community (Evans, 1997). Mesh Architecture moves against this by adopting permeability. The architecture of the South Pacific is more receptive to natural elements, allowing interaction with materials and with wind and rain. Mesh Architecture must adopt a similar strategy, allowing the inhabitants of a space to experience natural environments and incidental relationship through the architecture.

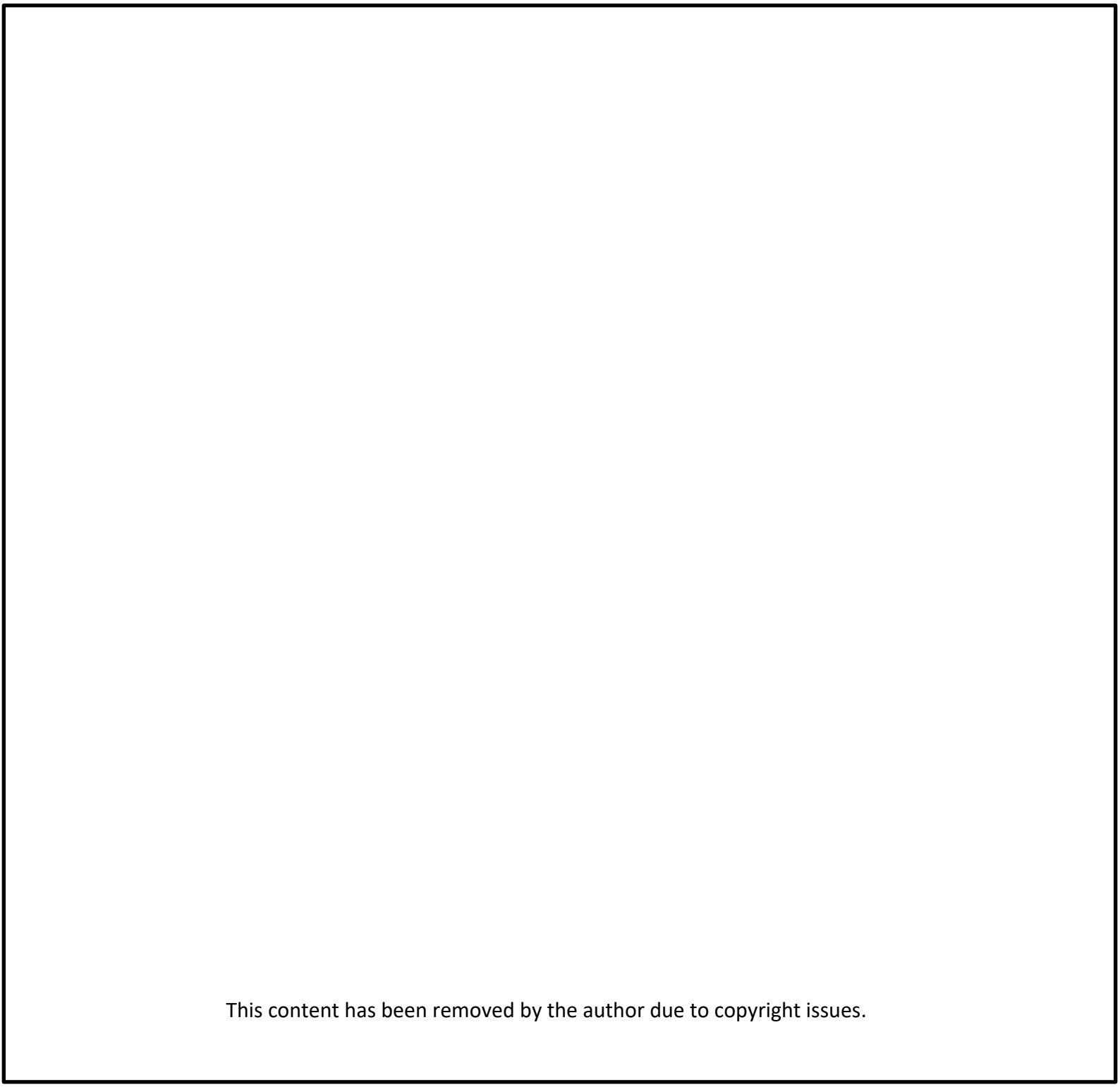
A modern example of permeability can be seen in Japanese designed architecture. Taylor (2016) comments on how Japanese designers tend towards creating spatial qualities that allow for permeability through spaces, while western architects tend towards permanence and solid form, creating monuments and solid masses. This tendency can be observed in how Japanese architects

tend to talk about their architectural practice. Akira Yoneda (Nuijsink, 2012) states that “once you start putting architecture on a plot like solid mass the space around the site will become nothing but negative” (p. 110) and “while western culture aims to protect humans from nature, Japanese culture is open to nature and accepts the ephemeral transition around it” (p. 110). Sou Fujimoto (Nuijsink, 2012) comments “If you rigidly divide inside and outside, you completely miss out on the richness of all gradations in between” (p. 146) and Kuzuyo Sejima (Nuijsink, 2012) comments that “it’s a bit scary that people can only feel comfortable in a closed space” (p. 59).

These Japanese architects produce work that challenge the notions of closed exterior forms typical in western homes. Their designs have pronounced lightness and visible interaction between interior and exterior, allowing for greater visual communication between public and private spaces. For instance Hojo, a home design by Akira Yoneda (Nuijsink, 2012), shows extreme permeability, as shown in Figure 4. This home is transparent throughout but graduates towards privacy through several screening elements which mediate a gradual shift between the exterior and interior.

Figure 4

Hojo by Akira Yoneda



Note. Hojo is typical of many Japanese designed homes in its approach towards radical permeability. From *How to make a Japanese house = Nihon no ie no tsukurikata,* by C. Nuijsink, 2012, NAI Publishers. Copyright 2012 Cathelijne Nuijsink, NAi Publishers, Rotterdam.

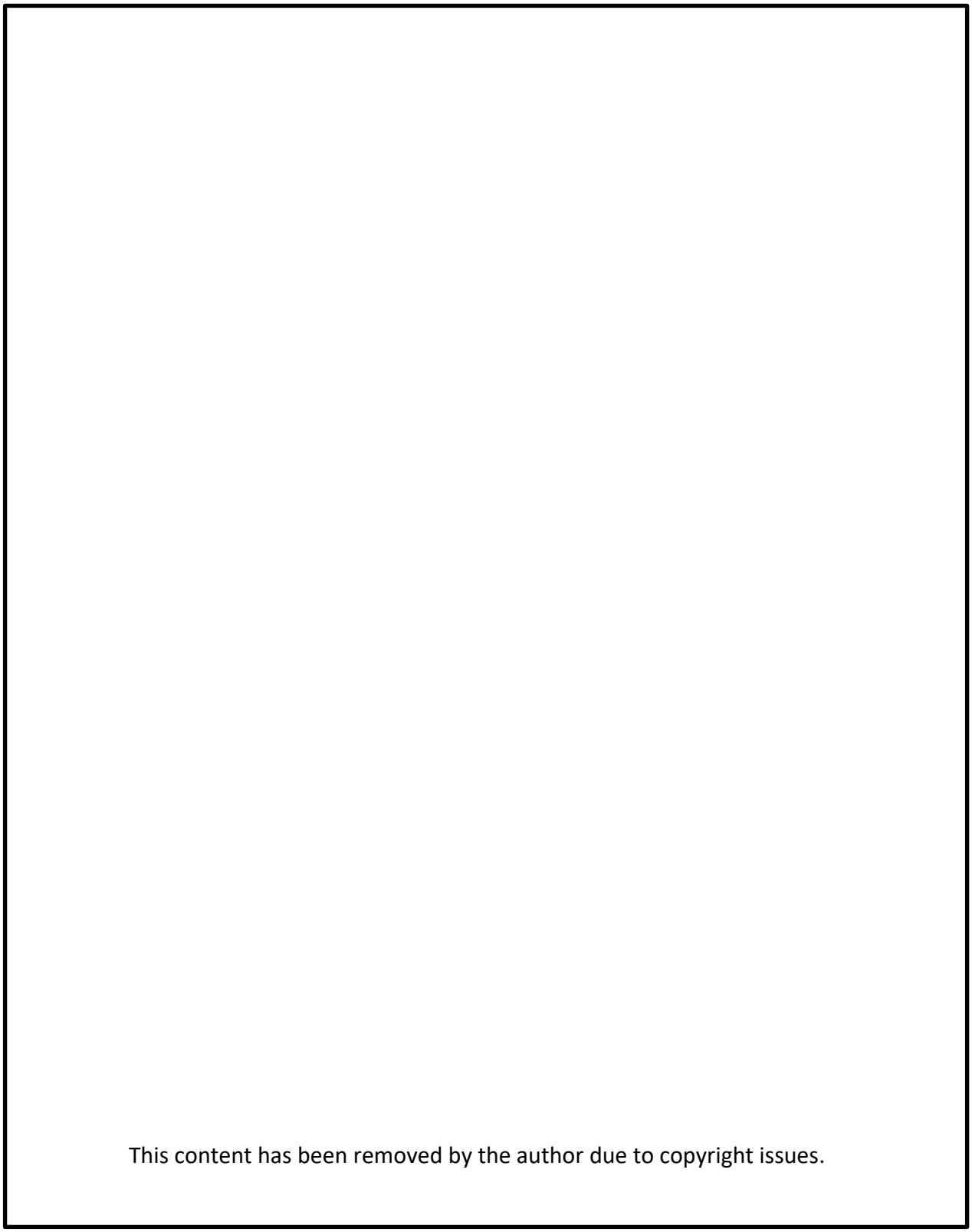
Permeability can be seen especially clearly in the works of the Japanese architect Shigeru Ban. Ban (2001) designs contemporary architecture informed heavily by a knowledge of traditional Japanese architectural languages, primarily in how internal/external transitions are staged, and in the temporality of materials. Japanese tradition has universal space – a continuous open area that appears unrestricted (Ban, 2001). Seasonal changes can be accommodated by these open areas through the adjustment of moving screen external walls which change the experience of internal spaces (Ban, 2001).

In Naked House (Figure 5) Ban has adapted traditional spatial qualities into a contemporary design. The home is a large single-story space, with just one internal wall at the rear of the house separating bathroom and laundry spaces from this open area (Pollock, 2001). Within the large double height open interior room are custom built mobile rooms. These contain private sleeping spaces which can be positioned anywhere in the house and opened entirely to fully connect to the main living space, or disconnect as needed (Pollock, 2001), see Figure 6. The only other separation element is a thin curtain which can be pulled in front of the nominal kitchen space to separate it visually from the remainder of the room (Pollock, 2001), shown in Figure 7. Externally the building appears quite closed. Unlike a falé, Naked House has solid external walls, however these are revealed to be translucent sheets made from polyethylene packing materials which allow a great deal of light through, while retaining privacy and enhancing the connectivity within the space towards natural sunlight (Pollock, 2001), see Figure 8.

Ban's concept for the design of this house was to create a fluid and dynamic interior experience where individual space was retained but could be moved and changed to create experiential habitats adapted by the residents (Pollock, 2001). Each box serves as a private retreat within the house – each person given agency over a small space while sharing the whole. Naked House creates a family home where activities are not segregated through closed rooms, removing privacy as a fixed necessity throughout the space. The use of these architectural elements all promote connection over separation.

Figure 5

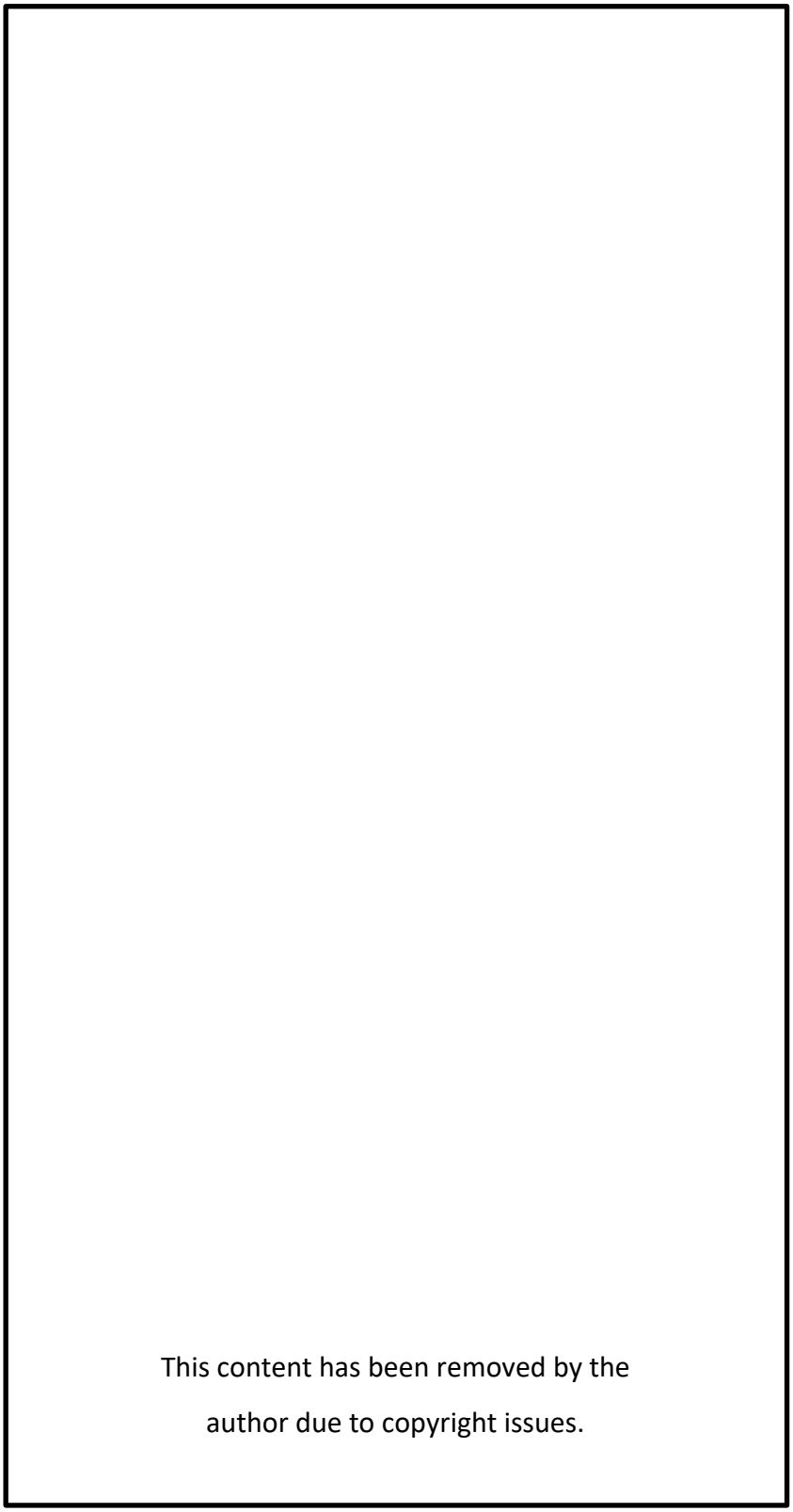
Interior of Naked House



Note. Inside Naked House is a single open area with no dividing walls, the space promotes connectivity over isolation. From Naked House / Shigeru Ban Architects, by Archeyes, 2016, (https://archeyes.com/naked-house-shigeru-ban/). Copyright 2016 by Hiroyuki Hirai.

Figure 6

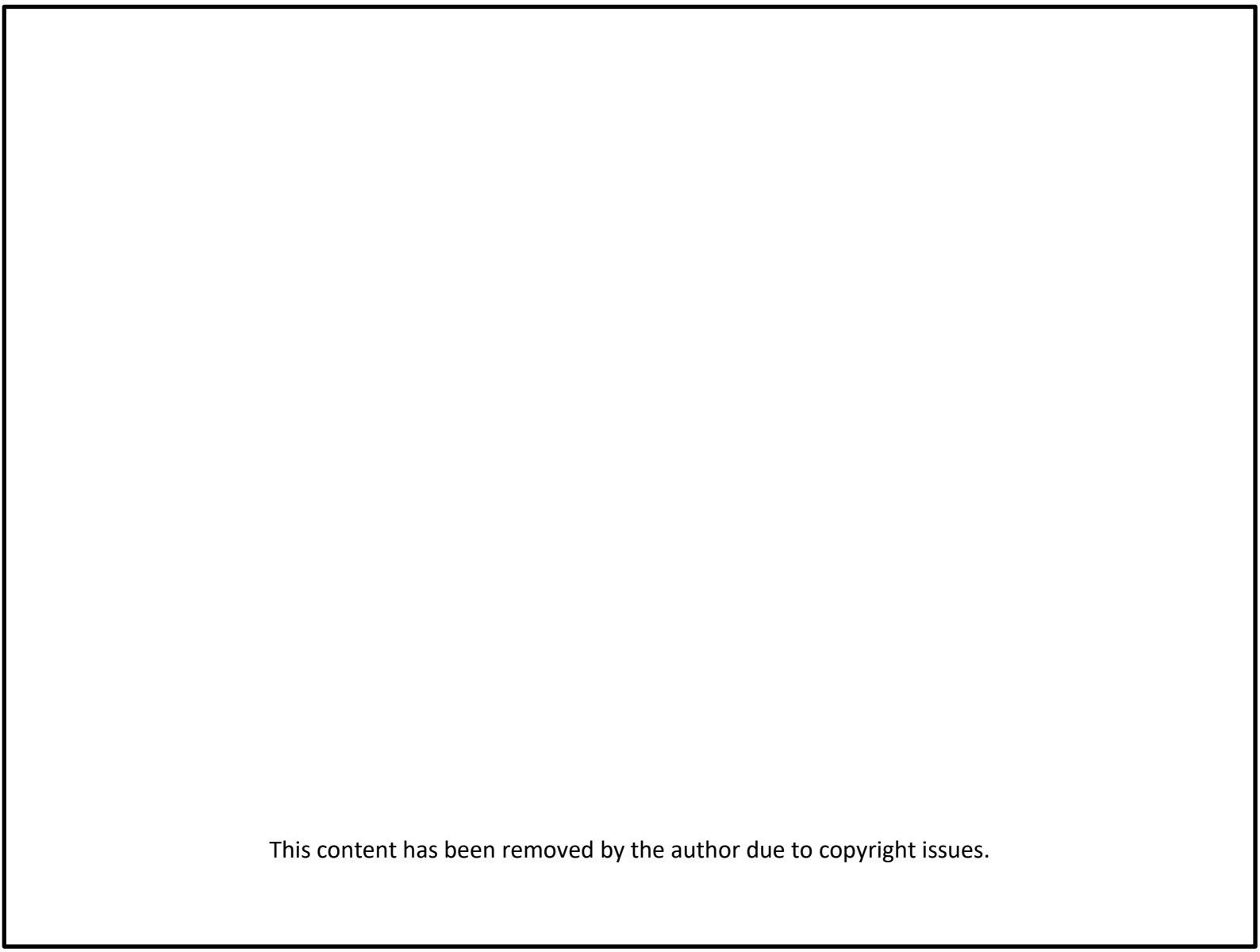
Isometric floor plan, Naked House



Note. The mobile rooms in Naked House can be freely manipulated through the open space to suit the users. From Naked House / Shigeru Ban Architects, by Archeyes, 2016, (https://archeyes.com/naked-house-shigeru-ban/). Copyright 2016 by Shigeru Ban Architects.

Figure 7

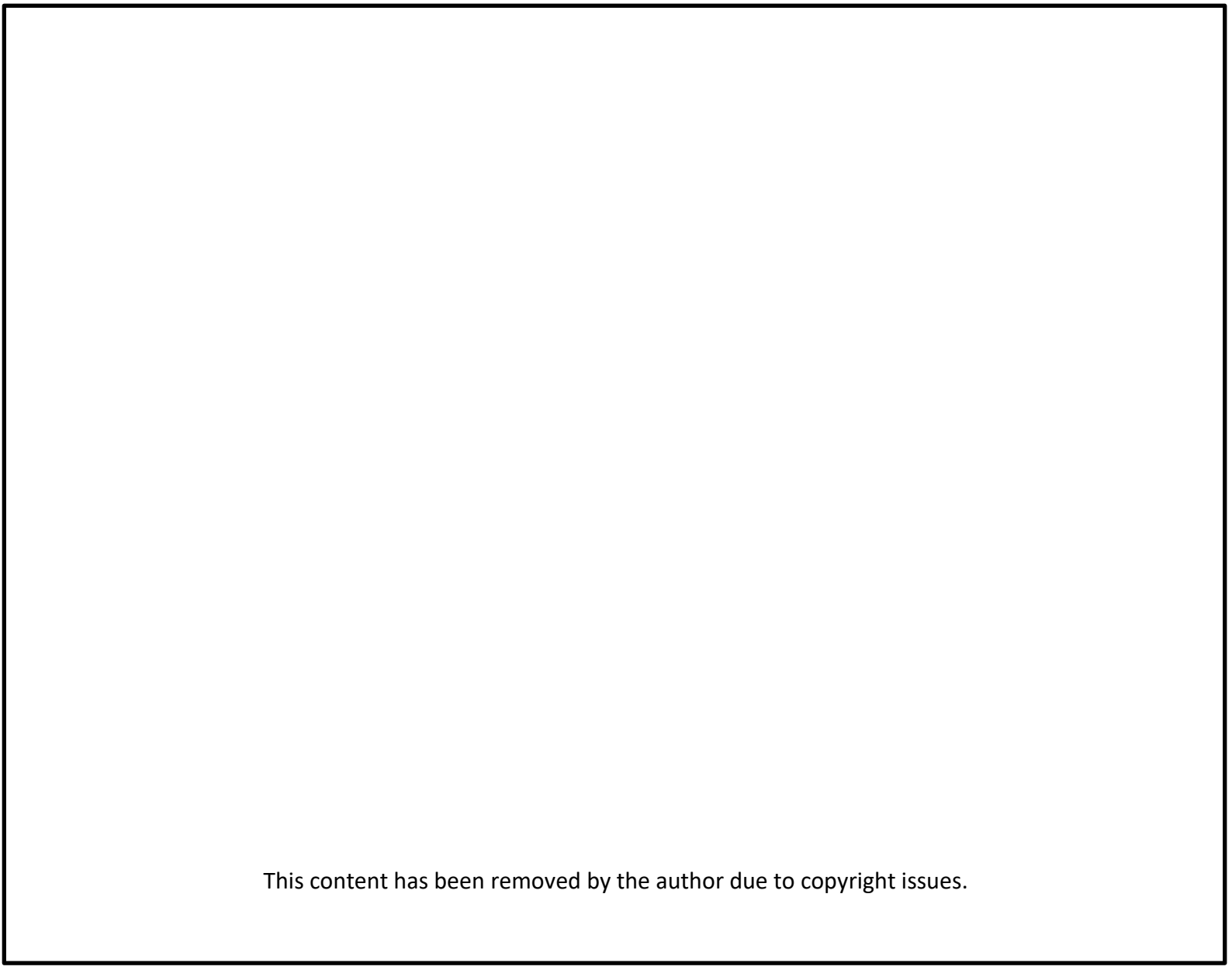
Kitchen curtain, Naked House



Note. To give the kitchen space the ability to stay private but keep permeability between areas, a suspended curtain is used for separation. From Naked House / Shigeru Ban Architects, by Archeyes, 2016, (https://archeyes.com/naked-house-shigeru-ban/). Copyright 2016 by Shigeru Ban Architects.

Figure 8

Exterior of Naked House



Note. The solid external walls use semi-transparent structure to allow natural light to permeate while keeping privacy. From Naked House / Shigeru Ban Architects, by Archeyes, 2016, (https://archeyes.com/naked-house-shigeru-ban/). Copyright 2016 by Hiroyuki Hirai.

Japanese design and South Pacific tradition share similar spatial features. Tendency towards open spaces, permeable mediations to public and external spaces, and an appreciation for the effects of time on a structure, link these traditions to each other. Permeable and temporal qualities are vital to the formation of Mesh Architecture as a design strategy. Western architecture tends to disassociate from creating malleable open environments, while Mesh Architecture needs to deliberately open internally and externally, creating opportunities for relationships between humans and the more-than-humans on site. Through its spatial qualities, this architectural strategy will allow for greater relationality towards natural environments within typically closed urban environments.

Urban Ecological Landscapes

The intent of Mesh Architecture is to improve the holistic wellbeing of all more-than-human participants within a development. An example of this in Architecture is explored through the urban park designs of SCAPE, a North-American Urban planning and architectural design studio, who create landscape architecture that regenerates ecological systems within an urban setting.

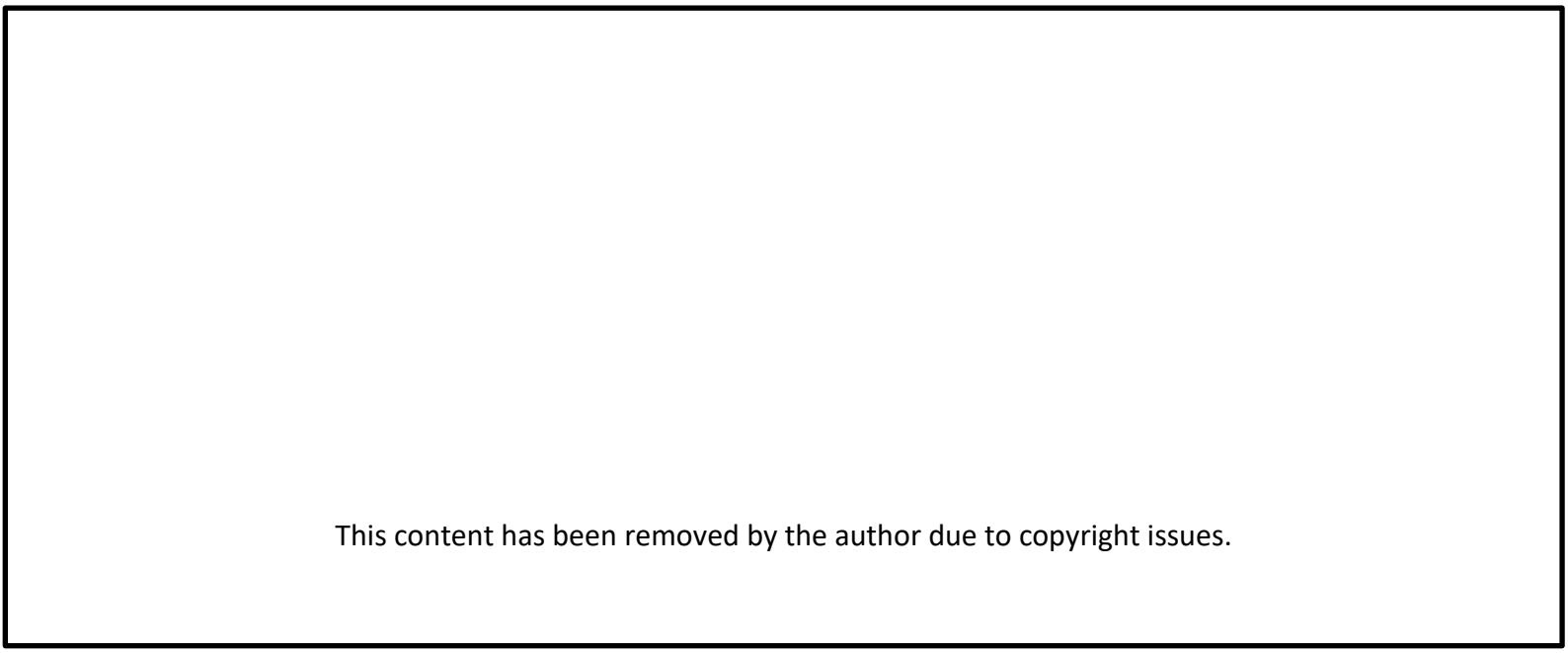
Natural parks within cities already act as restorative agent for the human residents in urban environments. In Kuala Lumpur a study by Mohamad and Hussein (2021) investigated the perception of green environments in heavily urbanised areas, and found the predominant use of parks was “green therapy” (p. 69), through using space to improve mental and physical wellbeing. Research has shown that park spaces in urban cities are used to renew the people using them, reducing stress levels, promoting healing, and increasing overall well-being (Mohamad & Hussein, 2021). These kinds of artificially created natural environments do allow some natural flora and fauna to flourish as a by-product of their created habitats, however SCAPE designs landscape architecture with wider impacts. By combining a biophilic design strategy along with regeneration of natural systems, SCAPE creates spaces which link experiential connection with ecological system regeneration. Their city park designs create landscape architecture that improves the ecological wellbeing of local natural systems at risk in heavily urbanised spaces. The studio is dedicated to making genuine change to the environment, not being content to simply design enjoyable spaces for humans. By framing urban spaces within the regeneration of natural ecologies, SCAPE creates public architecture where citizens can engage with natural systems in their environment (Orff, 2016).

SCAPE demonstrate this attitude of ecological regeneration in Town Branch Commons, a large landscape proposal for the city of Lexington, Kentucky (Orff, 2016) which daylights an awa running through the city centre incorporating a range of activities spread throughout. Being termed a daylighting is slightly deceptive, as while large portions are exposed, there are large sections underground allowing for foot and vehicle traffic movement over. The intention for the design was to create a landscape that reintegrates the natural flow of water into the fabric of the city (Orff, 2016). By creating pockets of landscape spread throughout the city centre, SCAPE integrates public engagement with the ecological features of filtering and cleaning rainwater through the city centre. Exposing the awa in parts expresses the natural karst topography underneath, which follows a pattern of flowing above and below ground. This is designed into the park which allows a genuine expression of the local ecology in the design (Orff, 2016). SCAPE have interacted with water to allow the users of the space to create meaningful relationship, designing the health of these water systems into the design drivers of projects. In this way SCAPE have adopted a stance of relational ecology, designing a co-dependent system between people and their environments.

Throughout the Town Branch Commons, the environment moves from a light landscape intervention linking suburban communities and existing pathway trails into a fully developed daylit stream within an expanded natural park through the city. Between this are water filtration services, public performance stages, and shared community gardens. These areas throughout the park create an active path through the city, allowing a connection to the river ecology as it runs through the centre of the urban space, see Figure 9. The park is designed to connect inhabitants back to the natural ecologies of the place but, importantly, the actual health of the water in the city is expressed and treated through the project (Orff, 2016). Incorporated within the project are filtration gardens which treat rainwater by removing contaminants before it flows into the ground (Orff, 2016). The park also provides spaces designed to be flooded, improving the quality of water during the expected flood seasons in the lower edge of the park (Orff, 2016).

Figure 9

Town Branch Commons



Note. This section of Town Branch Commons shows the karst river topography expressed in-between hardscaped pathways and planted gardens. From *Towards an Urban Ecology*, By K. Orff, 2016, The Monacelli Press. Copyright 2016 by SCAPE.

SCAPE have created a design that connects ecological factors, urban spaces, and human communities, which are integral aspects of Mesh Architecture. It is not enough to create permeable spaces that connect person to place, but the architecture must actively work to regenerate the health of existing more-than-human entities in that place. Designing architecture within a larger urban landscape intervention will allow for a greater impact of this regeneration.

Material Vitality

Through mauri ora all things are connected. Whakapapa (genealogy) is not limited to human members but includes the natural environment. Maunga, awa and rangi are all part of an interconnectivity that frames belonging to a place as integral to being (Yates, 2016). Mauri ora understands a relationship to the surrounding environments, and an ethics of care towards the entities within it (Yates, 2016). Austin (2003) talks to this in relation to wharenui (Māori meeting house) design. The structures themselves are simple buildings from a western design perspective, but through a Māori cultural understanding are rich metaphysical representations. The ridge beam is not just a piece of wood, but it is the spine of an ancestor, and the rafters of their ribs. Sleeping

inside this space is likened to sleeping within a stomach, the building being a protector and guardian of space (Austin, 2003). This application of mauri ora in architecture is understood as material vitality, which is literally understanding materials as having inherent vitality, as more than inert or dead.

Material vitality as a design strategy leads towards architecture that intimately connects to its environment, which is demonstrated in the building Te Kura Whare, see

Figure 10. Yates shows that as the design process aligned itself to mauri ora, the tenets of residing in immanence with the natural environment led the designers to adopt regenerative practices through the architectural design (Yates, 2016). Mauri ora informed the project, including how materials were collectively made by community members, and how locally available materials influenced considerations for construction (Yates, 2016). The tradition expects that natural resources like construction materials are treated with respect. In traditional practice the use of these materials includes practices such as acknowledging the materials and reciting karakia (invocations) which affirm the vital essence of these materials (Yates, 2016). This practice reveals how mauri ora informs a relationship between Māori and the natural resources they work with.

Figure 10

Te Kura Whare

This content has been removed by the author due to copyright issues.

Note. Entrance to Te Kura Whare, the architecture expresses Māori Ora through the attention to vitality of materials in construction. From A Ngā Tamatoa perspective on Māori architecture, by R. Alexander-Tu'inukuafe, 2015, Architecturenow (https://architecturenow.co.nz/articles/rameka-alexander-tuinukuafe-ona-nga-tamatoa-perspective-on-maori-architecture/). Copyright 2015 by Dean Carruthers.

Material vitality is present in Te Kura Whare through mauri ora, and through the Living Building Challenge (International Living Future Institute, 2019) an architectural design challenge which encourages architects worldwide to design in radically ecological ways. Through the design process, the architects aligned themselves with the goals of the challenge, which utilized material vitality from a more western perspective (Yates, 2016). The design challenge contains six petals which each interrogate the design to ensure that a constructed building operates as a holistic

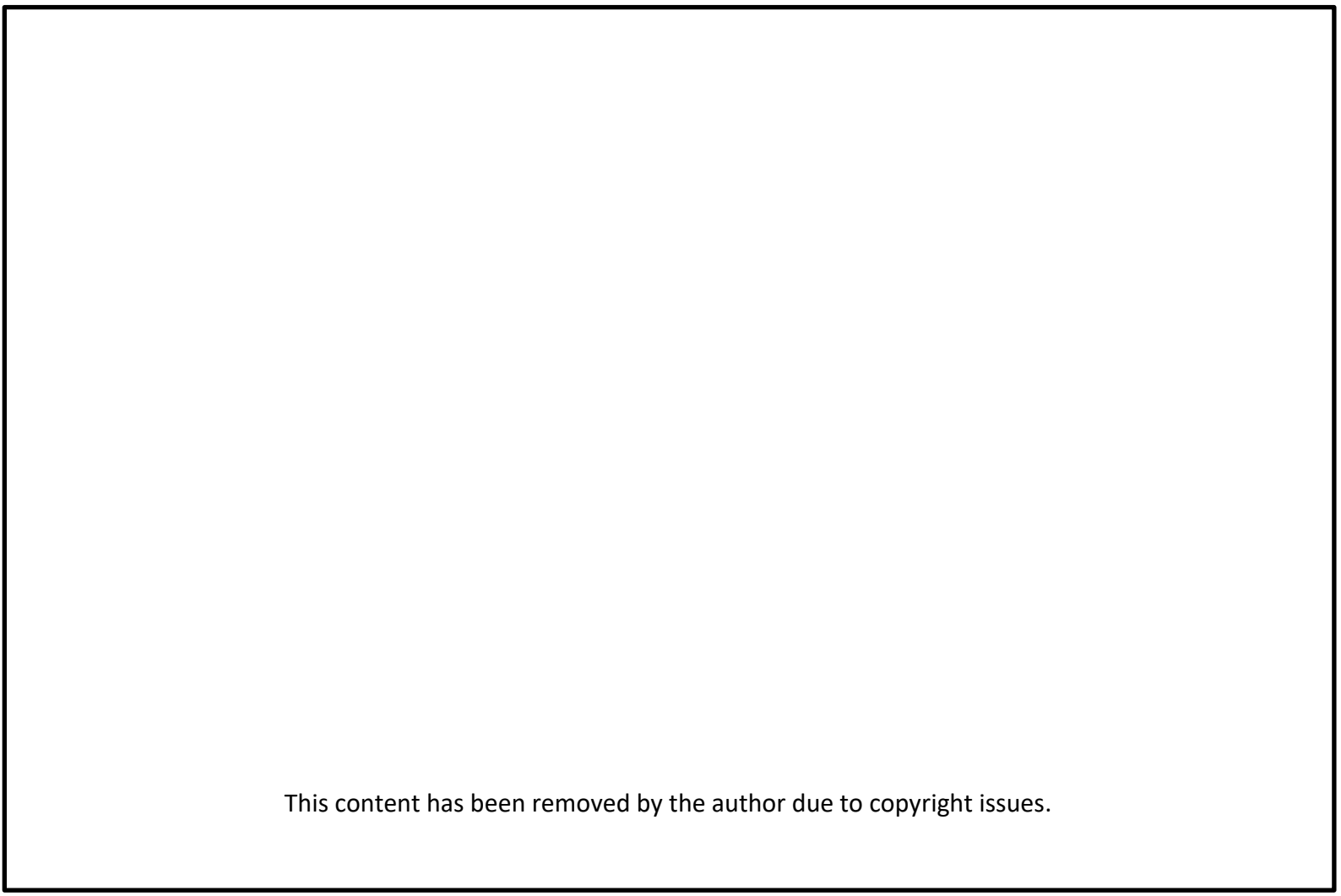
regenerative agent. One petal engages with the nature of construction materials, which asserts that a true living building needs to be constructed from materials produced with minimal or negative carbon emissions, containing little or no toxic chemicals, and ideally produced locally from materials that can be found near or on site (International Living Future Institute, 2019). All this ensures that construction materials from creation through to demolition have not just a neutral impact, but improve the state of the environment. The focus on local materials is two-fold, ensuring that the emissions of transporting materials can be eliminated, and that connection to local community can be established (International Living Future Institute, 2019). These tenets align with the first design driver of Te Kura Whare, mauri ora. While The Living Building Challenge approach to material awareness is a more western approach than a mauri ora understanding, it achieves a building design that asserts material vitality through the attention to agency each construction element has.

An additional example of material vitality in Rotorua is the Scion head office, Te Papa Tipu Innovation Park, designed by RTA Studio and Irving Smith Jack Architects, see Figure 11. The exposed structural timber diagrids are the focal point in the design, which are diagonal structural elements made from laminated timber (Barton, 2021). These diagrids form most of the structure, acting as both structural support and a device of dividing spaces. The empty frames create partitions between private offices above, and the public café at ground level, offering partial separation and visibility through the building (Barton, 2021). This is used throughout to create a visibly open space with physical separation, due to the thickness of the timber members, yet allows obscured vision through wide gaps, see Figure 12. This spatial design is reflective of the permeable designs of Shigeru Ban; like his architecture there are loose separations between spaces, the diagrid acting more as an indicative barrier not a total physical separation.

Scion's goal was to create a truly sustainable approach to building – engaging as much timber as possible to trap carbon within the building material making a net zero carbon production over the building's life span (Barton, 2021). Through Te Papa Tipu, Scion have demonstrated an appropriate ecological construction response which also links the structure itself immanently to Rotorua. Celebrating the timber results not only in the practical ecological objectives but links to the local forests, which asserts the agency and vitality of its primary building material. The architecture reflects genuine ecological relationship, acknowledging not only the global ecological concerns, but the expression of relationship towards specific local environments.

Figure 11

Entrance to Te Papa Tipu Innovation Park



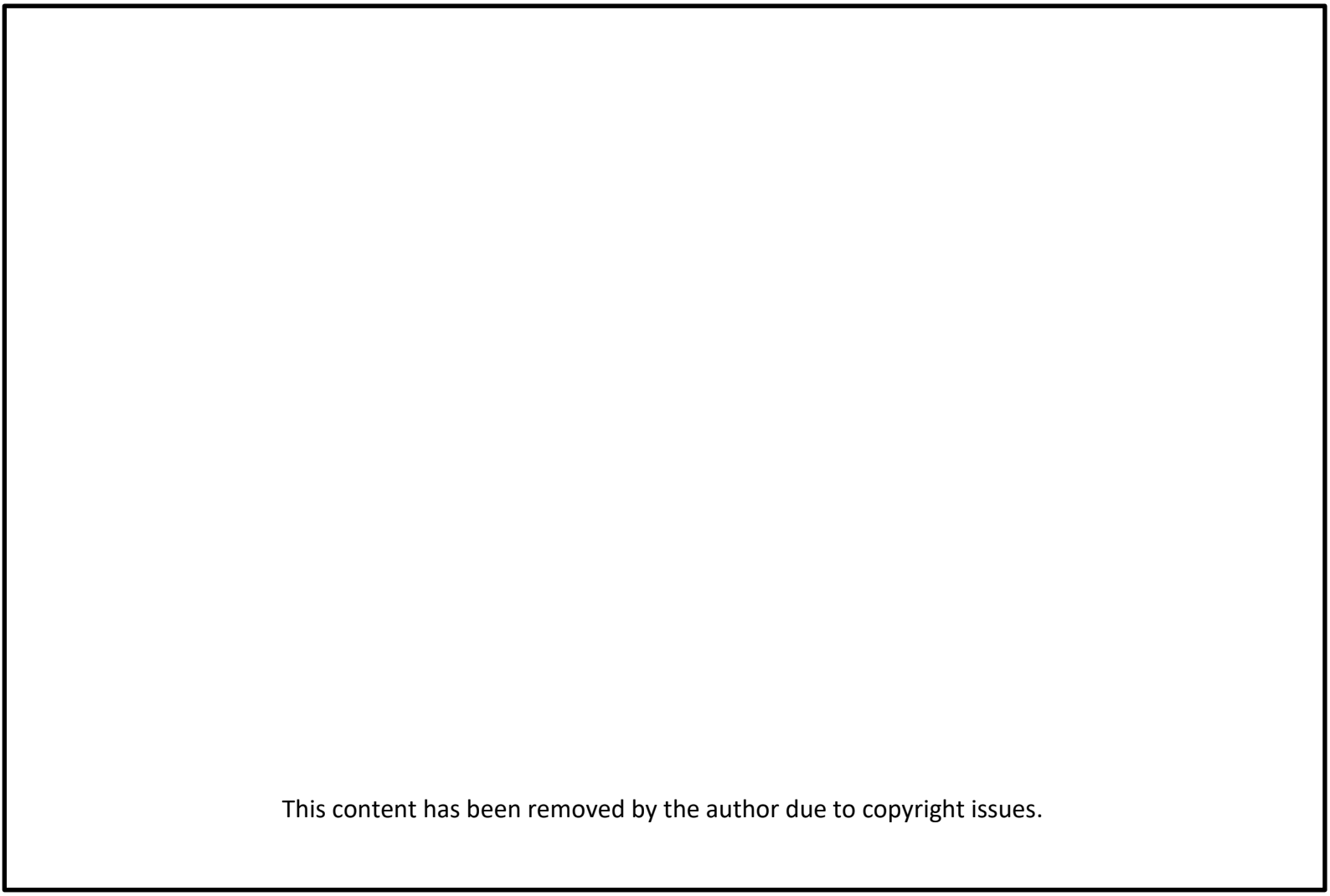
Note. The entrance to Te Papa Tipu Innovation Park shows the exposed timber diagrid through from the interior. These demonstrate connection to the timber forestry in Rotorua. From "The Technology of Trees," by C. Barton, 2021, *Architecture New Zealand, 2021*(2), 54-64. Copyright 2021 by AGM, a division of BCI New Zealand.

The vitality of materials, as seen through the lens of a two-fold immanence, is crucial in the strategy of Mesh Architecture. Adopting this stance affects the design strategy in physical and metaphysical ways, as both the practicalities of carbon emissions and the vitality of construction materials are considered. The choice of materials cannot be simply default decisions but must be carefully determined for their appropriateness in the immediate location. Each element of a building then is understood both as an ecological element, acting on its environment, and as a vital life force, containing the energy of relation to its place. The architectural strategy becomes one

that engages with construction materials past their practical use and looks to see the wider impact on the environment. The constructed space can become more genuinely attuned to the nature of indigenous architecture, being that of interconnection to the innate vitality of each building element.

Figure 12

Interior Atrium of Te Papa Tipu Innovation Park



Note. Inside the structure, timber diagrids are used to indicate separations between space without creating solid walls. From “The Technology of Trees,” by C. Barton, 2021, *Architecture New Zealand, 2021*(2), 54-64. Copyright 2021 by AGM, a division of BCI New Zealand.

Mesh Architecture

This thesis has developed Mesh Architecture as a design strategy to impact the effects of ecological crises through architectural design. This is presented here as a manifesto, a series of six statements aligning the criteria of Mesh Architecture with the discussions on cultural contexts and architectural typologies.

Ecological regeneration

Mesh Architecture must be ecologically regenerative to positively impact the environment. To combat the loss of global biodiversity, architecture must actively work to increase biodiversity in the local environment. To combat the global warming condition, architecture must actively lower global carbon production through the design and whole life use of the structure.

Decolonisation within urban environments

Mesh Architecture must participate with indigenous peoples to decolonise urban environments. Wellbeing cannot be exclusive to a dominant western culture but must be specifically embrace indigenous communities. Mesh Architecture participates in this through designing architecture that allows for the expression of non-European culture within cities.

Enhance relationships between more-than-humans

Mesh Architecture must create environments that enhance relationships between human participants, and relationships towards more-than-human participants. The architecture must be designed within a relational ecology of all more-than-human entities which rely on the wellbeing of each other.

Relational spatiality through permeability

Mesh Architecture asserts relationship through spatial permeability. The design must allow for permeable occupation of environments outside of a binary understanding of interior and exterior; encouraging incidental encounter through spaces of connection and communication.

Regeneration of more-than-human entities

Mesh Architecture works actively through landscape to regenerate more-than-human entities, within urbanised space. The mesh influences a landscape design that weaves natural and built

environments through each other and promotes the sustainable existence of both in the same space.

Attention to the mauri ora within materials

Mesh Architecture is designed with attention to the mauri ora within materials, acknowledging their vitality. Materials are more than commodities but have a voice that can connect person to place. Each material also has an embodied ecological cost which is considered critically within its whole life cycle in how it effects a global climate.

This is Mesh Architecture's design strategy. Building this understanding through examining existing exemplars has led to a rich understanding of what a genuinely ecologically regenerative architecture could be within the crises of the Anthropocene. To test this strategy, a proposal is designed for Ōwhata, Rotorua, to demonstrate how Mesh Architecture design can encourage regeneration.

Methods

The practice of mapping a site of potential development is commonplace in architectural design, and serves as an overview of the features, opportunities, and constraints of a piece of land. These site maps are used to inform a design process so that architecture can accommodate the identified existing features. Here, the strategic principles of Mesh Architecture are applied to this common practice. Through a discussion on ecological mappings, a methodology for site mapping within a strategy of Mesh Architecture is developed. This methodology is tested through three methods, informational spatial mapping, mesh mapping, and hikoi (walking) maps. Each methodology investigates the site of a papakāinga (community group housing) development in Rotorua where a real-world project is currently being developed.

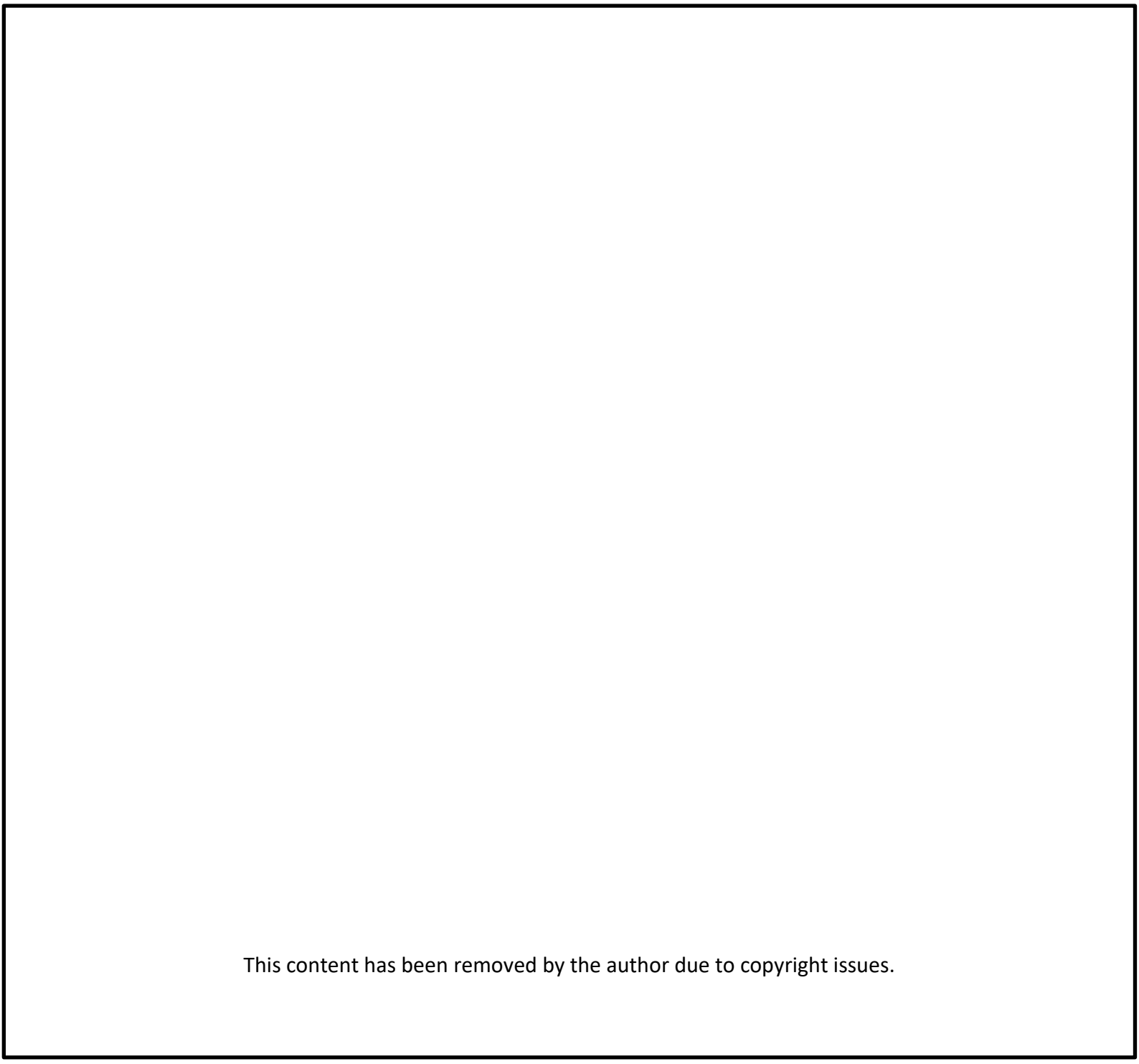
Ecological mappings

The practice of mapping is essential to Mesh Architecture because this methodology is a practice of discovering and expressing relationships in relation to place. This theory is discussed through Stay's design thesis Ecosophies (2017), the philosophical writings of Bateson (2000), and the exploration of indigenous South Pacific mappings of McKay and Walmsley (1969).

Stay (2017) engages with the theorist Bateson (2000) to rationalise the approach of using expanded contextual mapping as a design tool in urban planning. She has formed her study around the concept that mapping is a tool which discovers and defines relationships in a site. By mapping the site of her design research, she has graphically demonstrated the existing relationships in place between natural ecologies. Rather than starting a design project from the generation of spatial forms, Stay begins by discovering existing ecologies and describing their relationships through a series of maps. Through this practice, Stay has designed a more genuine Architectural response that enhances ecological systems. A key difference in Stay's work to traditional architectural mapping is the wide range her mapping extends to; the site not ending at the boundaries of the intended design location, or the legal limits of property, but her series of ecological diagrams describe relationships spanning the entire region of Tāmaki Makaurau, see Figure 13.

Figure 13

Ecosophies,Maap of Manukau Harbour



Note. Stay has combined several map layers together over the site of Tāmaki Makaurau, showing a wider understanding of the ecologies here. From Ecosophies: Field/Mesh/Transversality, by H. Stay, 2017 [Master's Theses, Auckland University of Technology]. Copyright 2017 by Hana Stay.

Bateson refers to this expanding of the scope of a site as an informational approach to understanding ecology (Bateson, 2000). An Informational approach is where the boundaries of an organism do not define the edge of study but focus on the connections that organism has to others (Bateson, 2000). An informational mapping approach then is where connections and interrelationships form the focus of the study, rather than focusing on the single site itself. Stay has engaged heavily with this informational approach to expand the scope of her site by discovering relationships over such a wide area.

In the works of both Stay (2017) and Morton (2010), human and non-human ecologies are seen as interconnected. The scope of these relationships are challenged, demonstrated to be far wider in scope than a simple site diagram can explain. In this way Bateson's theories are seen in Morton's defining of a mesh. The mesh acknowledges each entity, placing humans within a web of interconnected relationships (Morton, 2012). Mesh Architecture is then inherently connected to the practice of ecological mapping, as the design strategy is directly interested in discovering ecological connectivity where humans are one part of a wide-spanning interconnected web of connectivity.

To expand on these discussions, McKay and Walmsley (2003) show how Māori traditionally approached a process of mapping through their different understandings of time and space. In examples of historical Māori maps there are dramatic differences to typical western style documents. Rather than oriented to North, the Māori maps were oriented south up, to show the journey of Māori to Aotearoa going up the page (McKay & Walmsley, 2003). Another difference is in the non-literal depiction of space on the maps. Examples show how landmarks with more importance were drawn bigger, and spaces that had little or no connections to the people were omitted or drawn smaller (McKay & Walmsley, 2003). These maps showed that Māori placed higher value on describing connections, rather than a literal description of the environment (McKay & Walmsley, 2003).

Mappings within Mesh Architecture adopts the stance of Informational mapping by focusing immediately on the relationships in a site. While typical architectural site maps will naturally tend towards describing certain kinds of relationships, Mesh Architecture encourages maps to look beyond traditional western approaches to understand how indigenous cultures might understand land. By adopting these perspectives the following tests of Mesh Architecture approach site mappings to discover wide-spanning more-than-human relationships in a site.

Papakāinga

To test Mesh Architecture through ecological mapping strategies, a real-world project has been determined which provides an architectural brief and physical location. This project is a proposal for a papakāinga in the eastern suburbs of Rotorua, a city built along the southern edge of Lake Rotorua in the upper North Island of Aotearoa. This papakāinga is a section of a larger development plan of Ngāti Whakaue who own the land this site is within. They, alongside Te Tatau o Te Arawa (Te Tatau), are the client of this development. Te Tatau are a pan-iwi (tribe) governance group in Rotorua, representing twelve Iwi trusts throughout the Te Arawa region. They act on behalf of these people to Rotorua council, as representatives for the interests of tangata whenua (the indigenous people of Aotearoa).

Te Tatau are concerned with the generation of wellbeing within Te Arawa and have developed a strategy for generating this through a series of goals in their 2050 vision statement (Te Tatau o Te Arawa, 2020). Throughout these goals, the themes of self-sufficiency, self-determination, sustainability, and resourcing come through. Te Tatau are interested in creating a future where individuals are given the tools they need to thrive, people are encouraged to forge their own future, and given the support needed to do so. There is a focus here on individual sustainability but also on success of whole communities. It seems that to Te Tatau, success is measured through the ability of each member of the community to have opportunity to thrive. Through enabling all people in communities to flourish and opening opportunities for learning and development, the holistic wellbeing of the people is encouraged.

Te Tatau have given an opportunity for He Puna Ora to assist in the implementation of these goals within the development of a papakāinga in Ngāti Whakaue land. The proposal for a papakāinga forms a small part of a larger urban development instigated by Ngāti Whakaue on their Māori owned land seated on the eastern suburbs of Rotorua, shown in Figure 14. This development is an ongoing process of developing existing forestry, farmland, and quarries, into residential housing. Within this wider development plan is an indicative location for a papakāinga that serves as the real-life location for He Puna Ora's conceptual design program to take place on. The exact definitions of what this papakāinga will consist of are unspecified, other than the need to align with the goals of Te Tatau to create holistic wellbeing in housing.

Figure 14

Ngāti Whakaue Development Masterplan

Note. This architectural development plan of eastern Rotorua shows the extent of residential development planned for the region. Plan provided to He Puna Ora by Te Tatau for the purposes of this study.

Mapping Methodology

The location of this papakāinga is used to test Mesh Architecture through a series of site mappings which investigate the mesh ecology of the site in Rotorua to discover and describe relationships between more-than-human entities. This method uses the strategy of Mesh Architecture to test approaches to site mapping that align with a relational ecology approach to design. Through informational spatial maps, mesh maps and hikoi maps, the site of Rotorua is mapped to show the wide scope of existing more-than-human relationships in place. These tests demonstrate how

Mesh Architecture as a strategy for site investigation leads to novel discoveries of more-than-human ecology relationships. Through evaluating each in turn it is shown that no method gives an adequate understanding of the range of existing relationships, but together the tests create a holistic understanding of relational ecologies.

In the following sections there is collaboration of work between several students. Please refer to the Acknowledgements section (p. vii) for further detail on how this has been implemented.

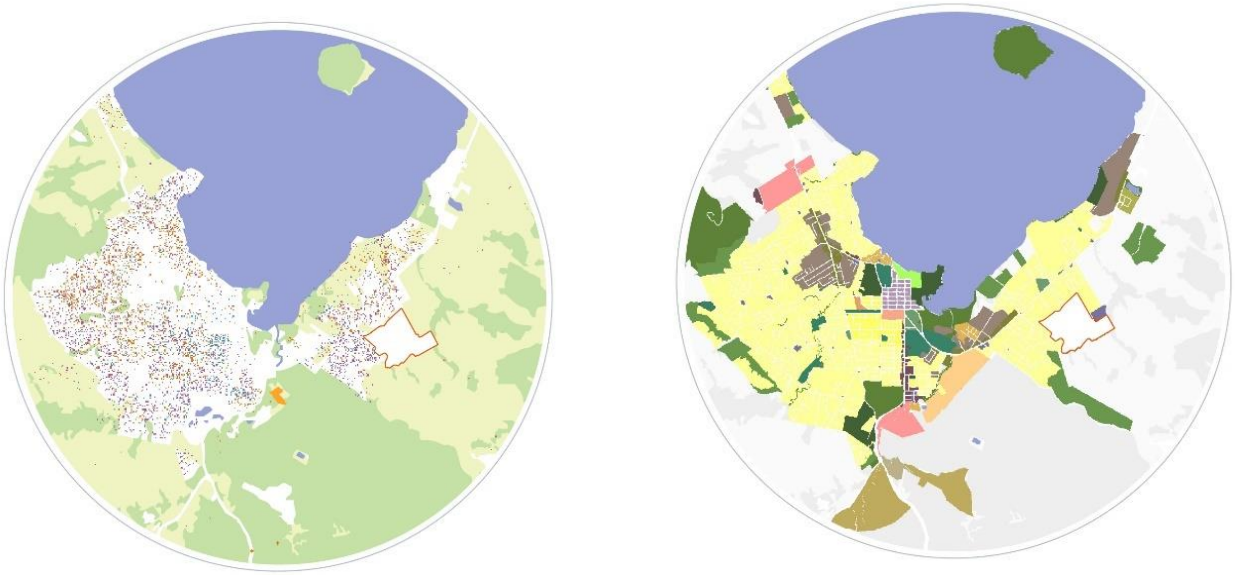
Informational Spatial Mapping

The first test of Mesh Architecture was performed through informational spatial mapping. Through exploratory research, each student of He Puna Ora set out to discover the varied ecological factors existing in Rotorua. This research consisted of research into the ecologies of Te Arawa combined with outputting visual maps which described the ecological factors and entities discovered. As maps were produced, they were shared collectively and used to inspire further research and mapping in the group. This process was repeated several times until a sufficiently large body of work was gathered that described a wide range of ecological relationships in Rotorua.

These maps were an effective way of exploring relationships. By translating research data into maps, data was easily visualised and discussed. The approach of collectively exploring research assisted in creating a wider range of maps, which give a wider understanding. Stay's work in Ecosophies (2017) engages heavily with this method of mapping. Her area of interest was mapped out through many layers which combined to describe a rich understanding of ecological and social factors. Using this as a model for testing, Rotorua was also mapped out in multiple layers to create a wholistic understanding of the site. For example, Collis investigated population density and ethnicity distribution in Rotorua city, see Figure 15, Yates-Francis mapped areas of Māori significance and areas of Māori land ownership, see Figure 16, and Dumagan researched areas of deforestation and soil quality surrounding the city, see Figure 17. These do not constitute the extent of mapping performed but are an example of the range of research avenues pursued.

Figure 15

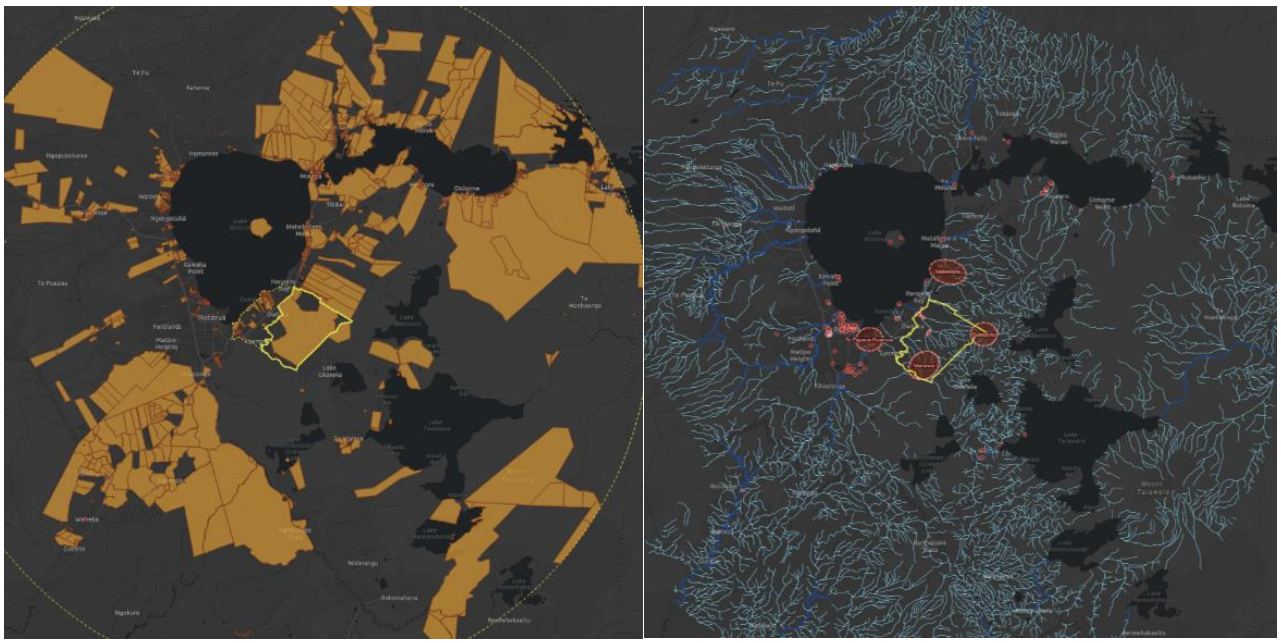
Informational Spatial Maps, Created by Collis



Note. These spatial maps describe population and ethnicity throughout Rotorua city.

Figure 16

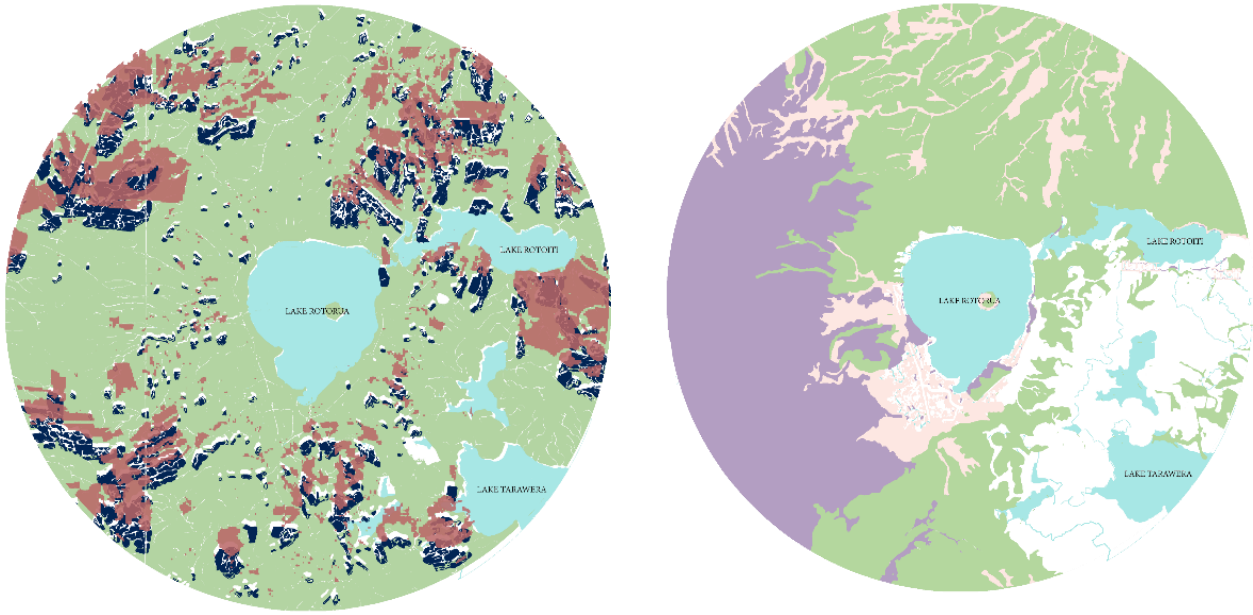
Informational Spatial Maps, Created by Yates-Francis



Note. These spatial maps describe Māori Land Ownership and Significant Cultural Areas surrounding Rotorua.

Figure 17

Informational Spatial Maps, Created by Dumagan

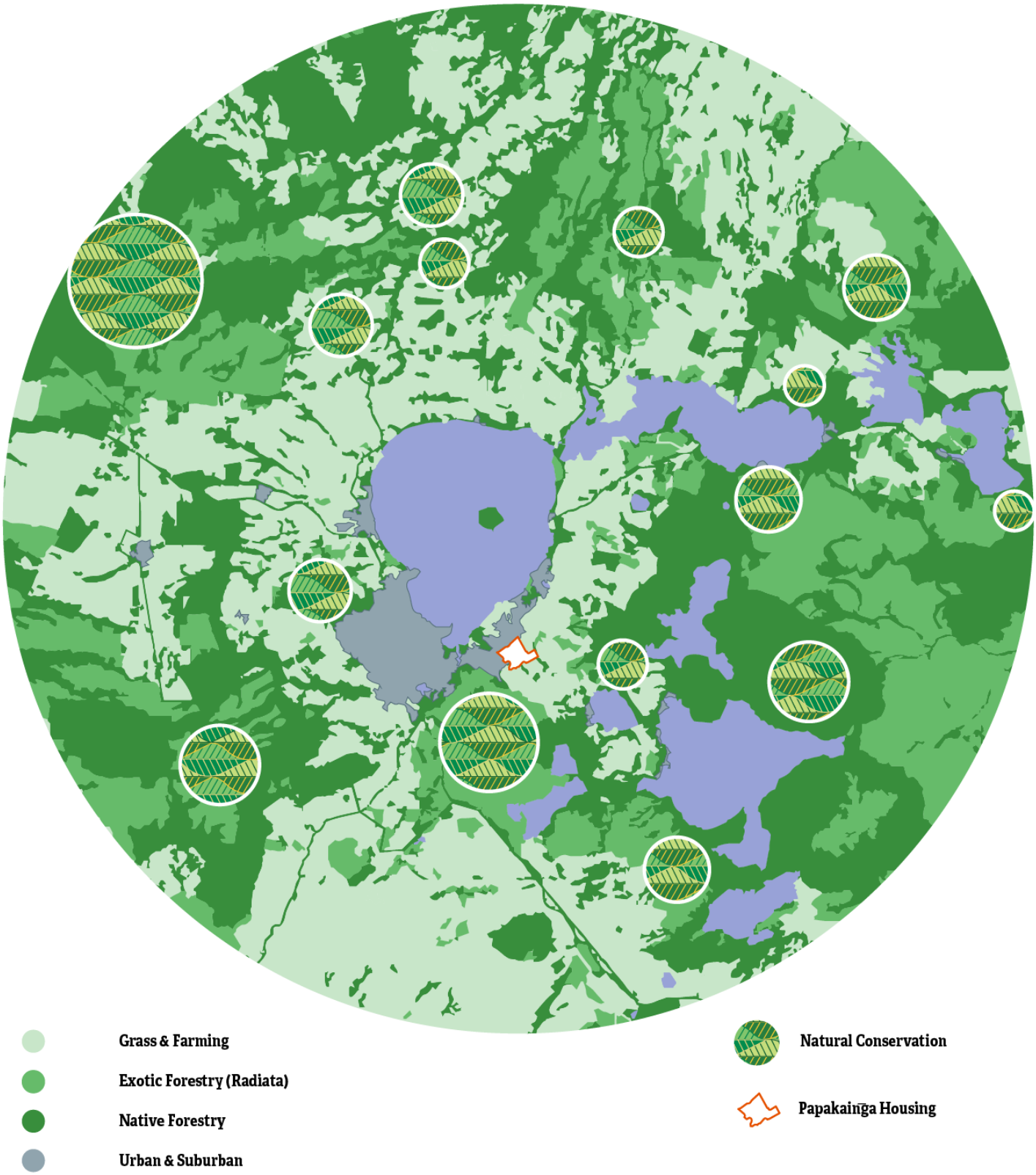


Note. These maps describe areas of deforestation and quality of soil surrounding Rotorua.

Through this process many key insights about Rotorua were gained. Maps of waterways combined with research of the ecological health of the awa and lakes in the region described how the many awa surrounding Lake Rotorua contribute towards its health. These were compared with another series of maps investigating the general use of the land surrounding the city. This comparison demonstrated the relationships between human urbanism and health of water in Rotorua, showing how the spread of urban spaces contributed towards the declining health of Lake Rotorua. Through farming and agriculture, the spread of urbanism removed much of the natural space around inlets, see Figure 18, the inlet streams have been contaminated with bacteria, and through human use of the lake, pests have invaded and disrupted native ecologies. see Figure 19. Through this test, each group member made decisions about which information to include to create maps that tell narratives about relationships. This created the risk of certain relationships being lost and their relevance not included, so a further test of Mesh Architecture through mesh mapping addressed this concern through an approach of hyper-inclusivity.

Figure 18

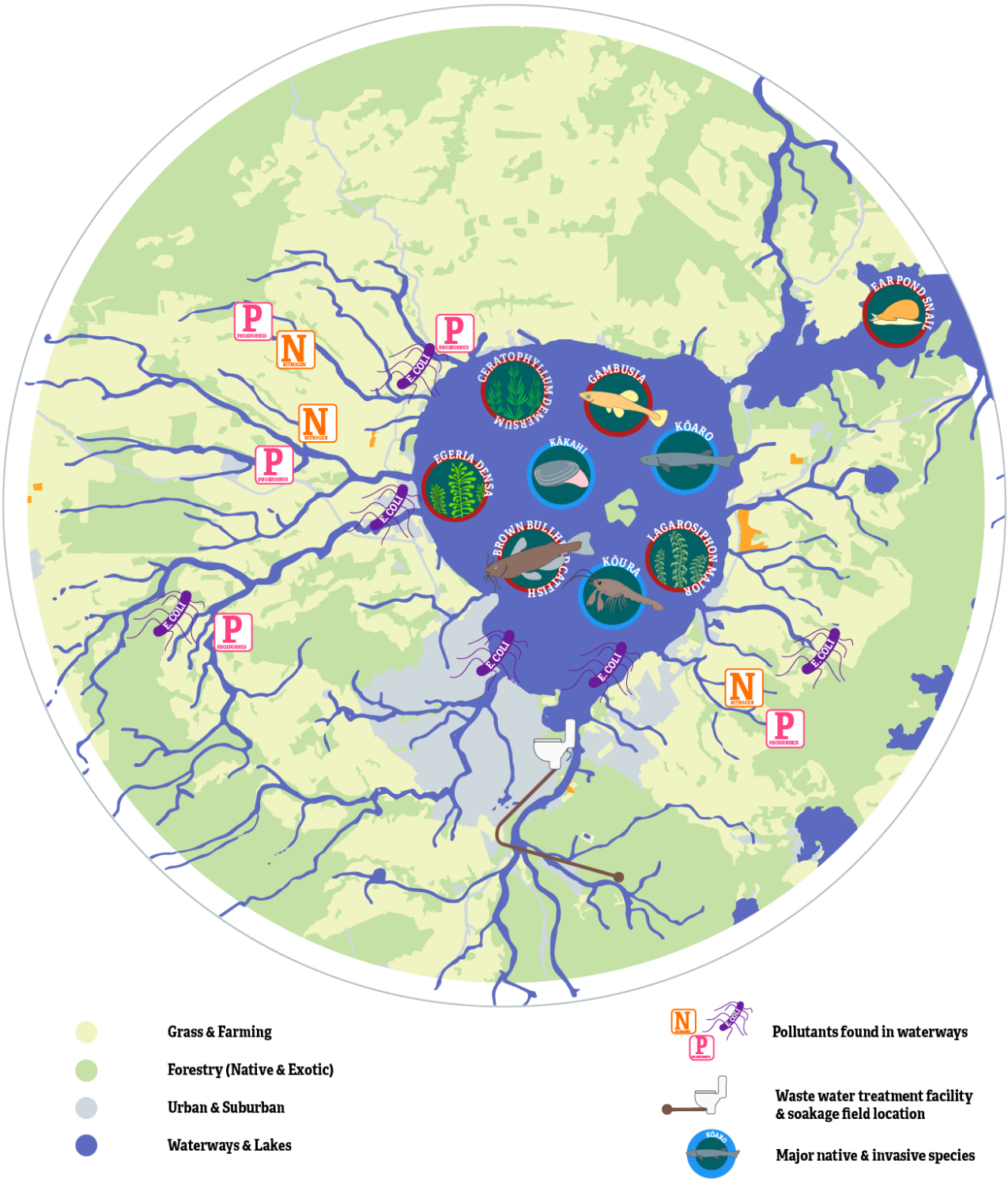
Informational Spatial Map, Created by Collis



Note. This map describes areas surrounding Rotorua featuring the types of land use, including areas of forestry, farming, and urbanized spaces.

Figure 19

Informational Spatial Map, Created by Collis



Note. This map shows the landcover of Rotorua directly surrounding the city, overlayed with information on awa and sites of noted contaminants in the water.

Mesh Mapping

Mesh Architecture was further tested through a process of mesh mapping. By diagramming their own individual area of research, Badimayalew, Collis, Dumagan, and Yates-Francis created a relationship diagram of their area of research. These maps were combined into one large mesh diagram which connected their individual area of study to each other and to the wider entities affecting the design research. This resulted in the mesh map seen in Figure 20 and Figure 21 which show the vast array of relationships and entities at work in the site. Each member described their individual research by creating a map of their topic of research, linking each entity, ecology, and concept to each other to describe the web of interconnected more-than-human relationships they were working with. Key ecological factors of the lake and forest were linked to the ecologies of tourism and global climate. The natural entities of the native koura and introduced pests were linked to colonial empire expansion and the native iwi groups. Acting as a physical example of Morton's mesh**,** this map enabled a view of the more-than-human entities at a global scale, describing relationships in the site wider than informational spatial mapping was able to explore.

This method was influenced by the design research thesis of Sharma (2020). Sharma developed a methodology of loose diagrammatic mind mapping which linked related entities, relationships, environmental and social factors, placing each together in a web of connected information. This mapping methodology radically challenged the scope of her thesis project to include relationships reaching far beyond the boundaries of her physical site restraints(Sharma, 2020). This technique was adapted for this testing of Mesh Architecture, being used here to describe the relationships the site at Rotorua holds to global ecologies. Within this map, each actor was given size and location, not defined by spatial relevance, but by significance of relationship. The map visually described links between the predominant forces guiding the project scope, and the existing relationships in place.

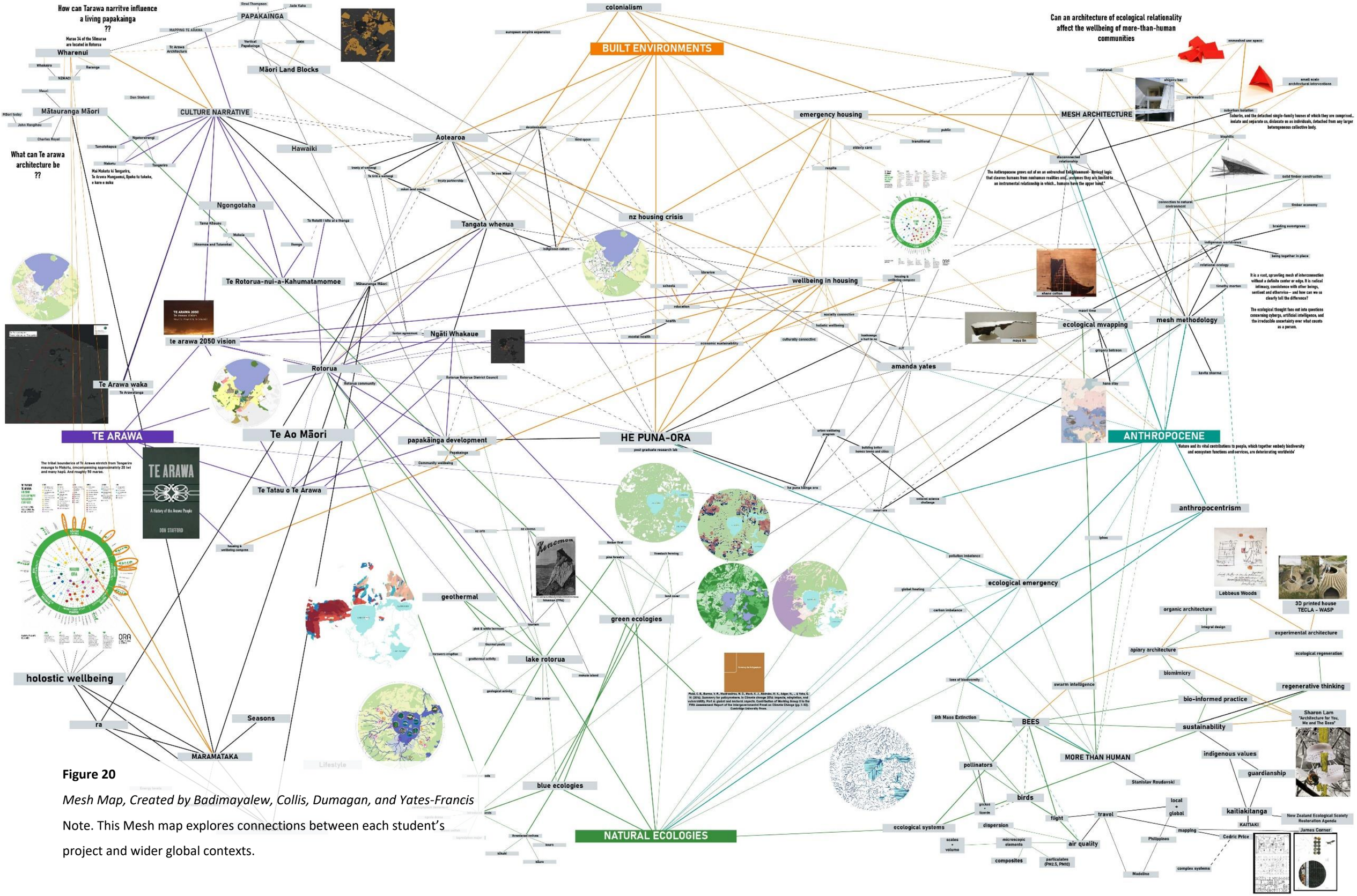


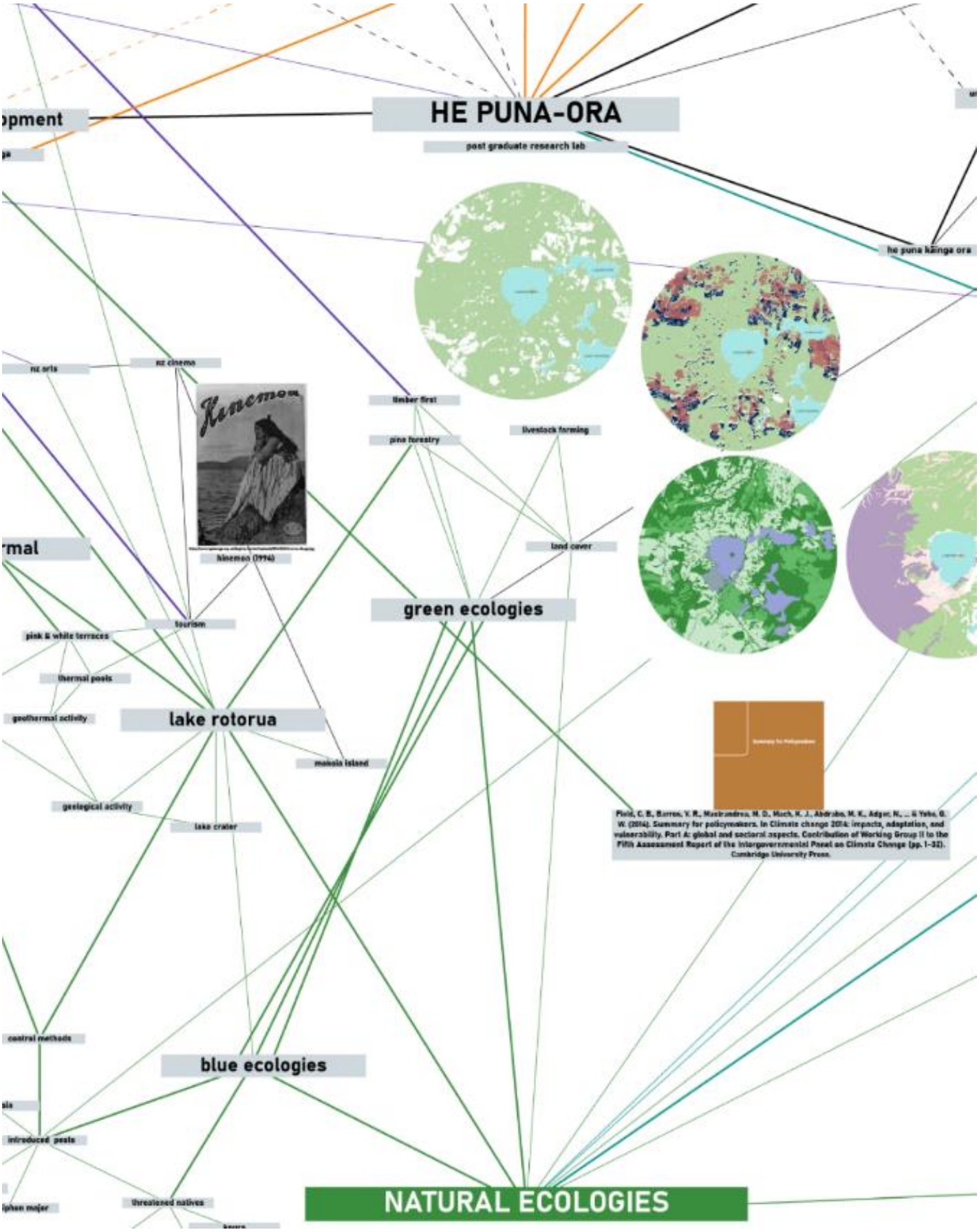
Figure 20

Mesh Map, Created by Badimayalew, Collis, Dumagan, and Yates-Francis

Note. This Mesh map explores connections between each student's project and wider global contexts.

Figure 21

Mesh Map Detail, Created by Badimayalew, Collis, Dumagan, and Yates-Francis



This mapping technique was effective in linking previously unseen factors to each other. Creating an all-inclusive diagram, mesh mapping encouraged connections, and spurred thinking towards how each factor influenced each other. For instance, Rotorua's tourism industry, influenced by the European colonisation and the Fenton agreement (Boast, 2011) was found to be linked integrally to the forests surrounding the city. The city and its environment are in complicated relationship, where humans are in deep connection to the health of the natural features through forestry and tourism industries, but also the cause of so much detriment to these spaces in the anthropocene. By placing all actors together and examining the existing relationships, these connections were able to be formed.

The testing of this mesh map excelled in connecting entities to each other but was less successful in accurately describing these connections. Mesh mapping encouraged discovering the relationships of global concerns, and larger conceptual influences of a site, while discouraging the exploration of immediate local factors. To address this limitation, the final mapping test investigated the hyper-local at a smaller scale through hikoi.

Hikoi Mapping

The third test of Mesh Architecture was performed through hikoi mapping. The term refers to a process of creating maps from photographed hikoi journeys through a site to document an experience at human scale.

The first hikoi map covered the path of the Waingaehe awa that is currently accessible to the public, travelling from Lake Rotorua to the proposed papakāinga. This map documented the experience of hikoi through this journey. Photos were taken intermittently that described the atmosphere of moving through these paths, documenting the typologies of buildings, infrastructures, and natural features. The photos have been arranged geographically to show how the environment of each location changed during the movement from the suburbs towards Lake Rotorua, shown in Figure 22. The findings of this hikoi map led to a discovery, that in the eastern suburbs of Rotorua, a clear divide separates the environments on either side of Te Ngae Road, a primary transit route towards Tauranga which runs parallel to Lake Rotorua. The change in environment was clearly noticed, as was the inaccessibility of crossing that road. Pedestrian crossings do exist, but were found slow to use and far apart. This divide also extended to natural features. The Waingaehe awa changed dramatically either side of this road, which acted as a barrier to the awa which excluded natural entities that cannot, or will not move over.

Figure 22

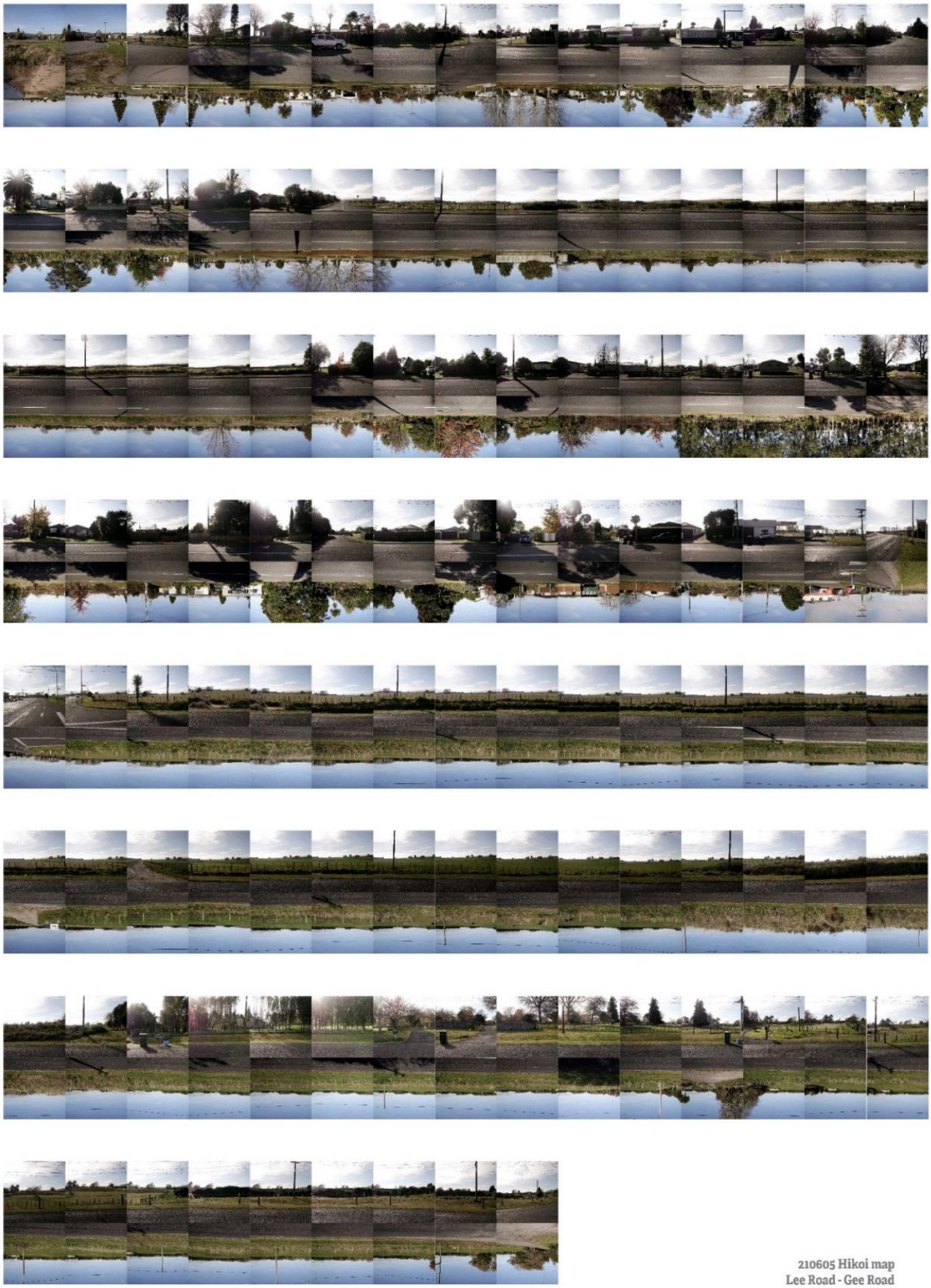
Hikoi map 1

Note. This hikoi map documents a journey from the edge of Rotorua to the Papakāinga site.

The second hikoi map followed a more structured approach to photomapping. Following the path of accessible routes from the site of the proposed papakāinga to Lake Rotorua, several hikoi exercises were completed. During each route a series of photos was taken every twenty steps to depict the human scale experience more accurately as the photographer (the author, Collis) moved through the environment. Each street was traversed once in each direction, and the photos collated as posters to show journeys isolated from any geographical mapping representation, see Figure 23 and Figure 24. These paths followed the path of human access between the papakāinga location and Lake Rotorua to show the clear delineation between each side of Te Ngae Road, describing the relationship this roadway has to the entities surrounding it. Observed in this map, Te Ngae Road is the centre of suburban sprawl, seen in the quick disparity of architecture experienced when moving towards and away from the road, see Figure 25.

Figure 23

Hikoi map 2, Lee Rd, Gee Rd



Note. This hikoi map documents a journey from the suburbs close to Lake Rotorua into the farmland where the Ngāti Whakaue papakāinga is planned.

Figure 24

Hikoi map 2, Owhata rd, Te Ngae rd, Wharenui rd

Note. This hikoi map documents a journey travelling through Te Ngae Road, showing the disparity of ecologies each side of the transit route.

Figure 25

Hikoi Map 2 Detail, Owhata rd, Te Ngae rd, Wharenui rd

These maps revealed an intent focus on urban travel routes in this area of Rotorua, at the expense of natural ecological systems. Within the experienced urban travel routes there are natural features which remain in the form of large, planted trees, and grassed landscape, however this dissipates closer towards Te Ngae Road, and within the road itself is a complete segregation of all natural ecologies. Human activity in eastern Rotorua is entirely focused on this urban route.

Examining these multiple pathways reveals that the urbanism does very little to engage human activity with natural environments and disallows relationship between the natural entities either side of Te Ngae Road. Disconnected relationships can also be observed in how Waingaehe awa is engaged with through suburbia. The urbanised pathway along roadways are well established and maintained to encourage human use, allowing for substantially easier transit through the roads, however the pathway alongside the Waingaehe awa is completely underdeveloped; the path here is entirely overrun with weeds, and is clearly unmaintained, evidenced by the accumulation of rubbish throughout the river.

The discoveries found by these hikoi maps allowed for a greater engagement with more-than-human entities as they appear to the human level experience. New discoveries were found that revealed disconnected relationships between entities in place. From an aerial perspective, the awa and roadways seem to interact and move over and below each other, while when seen from a human perspective, roads disrupt and disengage the awa. In this way these hikoi maps complement the larger scale mapping tests by offering smaller scale interactions directly with ecologies. These maps are constrained in their practice by the small area of land they cover, but as an additive to the previous mapping tests help to form a more holistic understanding of Rotorua. Together with spatial and mesh maps, the Hikoi tests form an inclusive picture, helping to further engage with identified more-than-human relationships.

Throughout these three mapping exercises, Mesh Architecture has been tested to demonstrate how architectural site investigation could be enriched to assist in the design for more-than-human entities, by employing mapping through the lens of relational ecology. It was discovered through this that an inclusive approach to site investigation was effective when all three methods were used together. By exploring Rotorua through a variety of scales and forms, a range of more-than-human entities were discovered, along with the relationships each of these had to one other in place. The entities and relationships discovered here feed directly into the testing of Mesh Architecture through architectural design.

Test

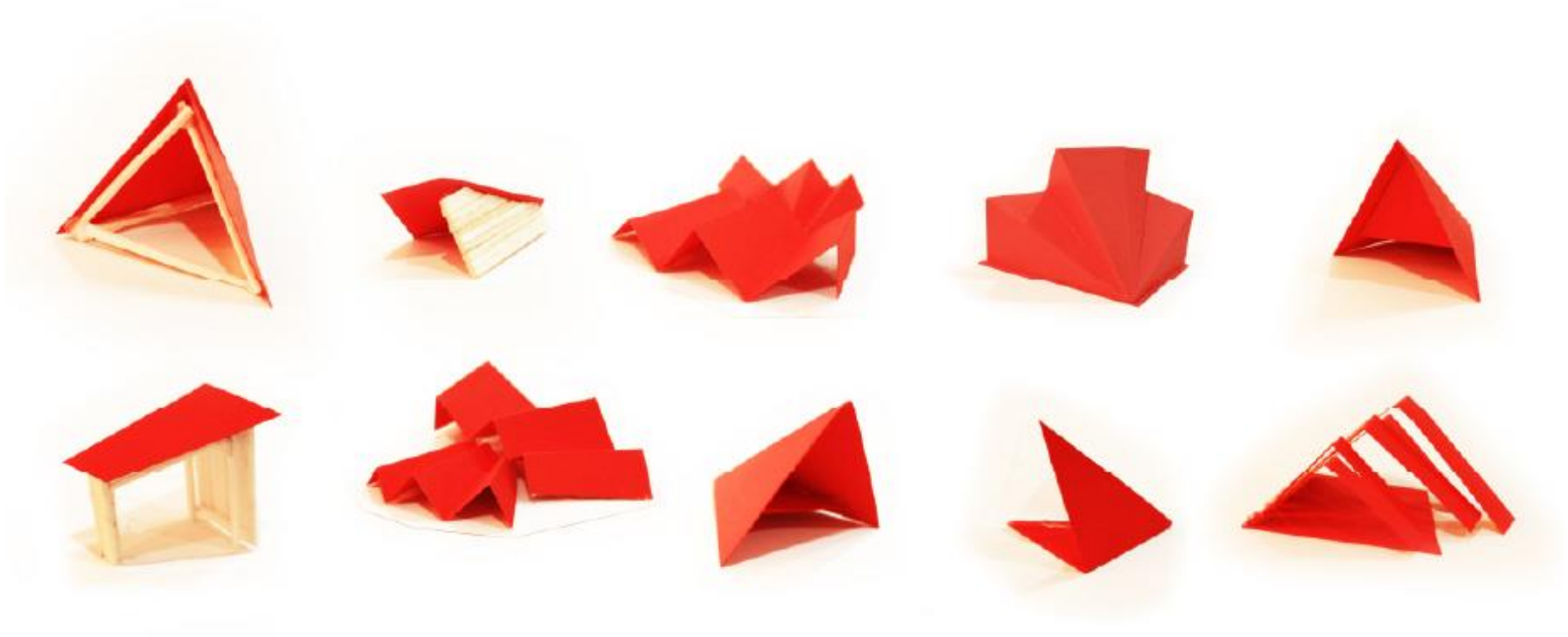
Alongside the process of developing Mesh Architecture and testing this strategy through mapping methodologies, Mesh Architecture was simultaneously tested through a process of architectural design. Both research and design were developed in tandem, each responding to the other. Through the design drivers of permeability, urban ecological landscapes, and material vitality, the architectural design was strengthened and refined to better address the goals of the research. This culminated as a resolved architectural design. Through this exercise, Mesh Architecture is evaluated in its goals to improve the wellbeing of more-than-human entities.

Concept Generation

To begin, an architectural design was created to form an initial response to the requirements of the project provided by Te Tatau. Architectonic figures were generated to begin cultivating a design language, see Figure 26 and Figure 27. These spatial explorations were used to test concepts that could later be applied to more formal structural design. These architectonic tests developed into an architectural proposal termed Big House, as shown in Figure 28. This design consists of community style housing with some small opportunities for business spaces, located in a typical suburban setting. The layout of the programme on the site was centred on the concept of Hikoi; incorporating a public pathway through the length of the site, connecting to a roadway and footpath at each end. In this way the development connected spaces in a suburban setting, promoting interaction between residents of the area. As existing architecture typologies were examined to develop Mesh Architecture, it became clear that while the initial architectural proposal allowed for some engagement between areas, the design needed to be adjusted to work with the criteria of the developing design strategy. Nonetheless, the theme of Hikoi has remained central to the design concept through to completion; this theme being reinforced by the development of Mesh architecture.

Figure 26

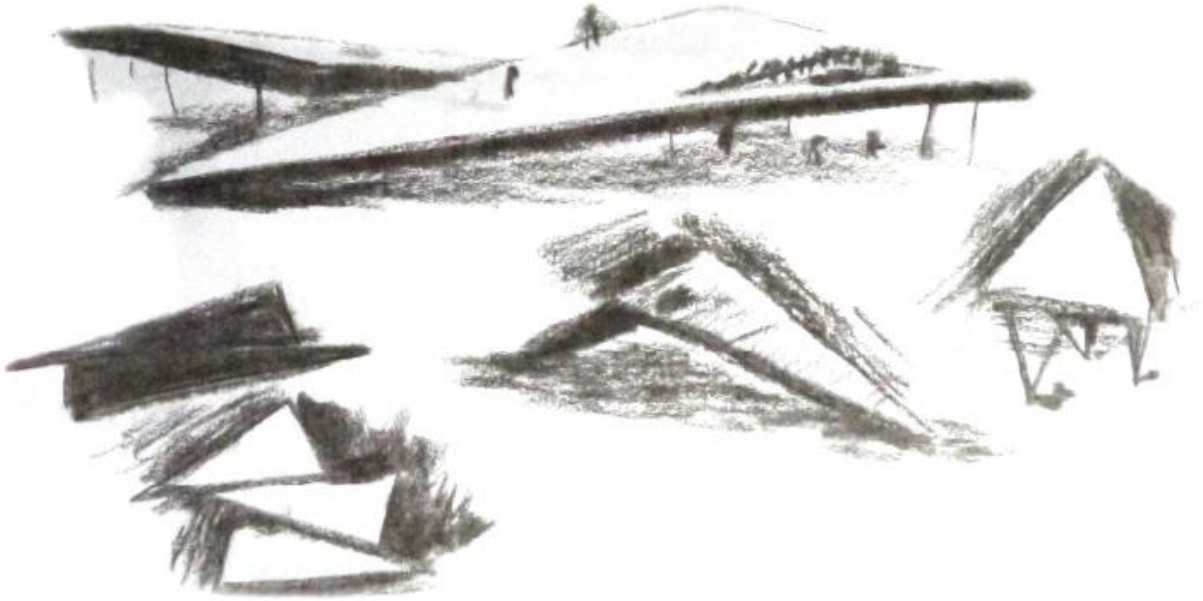
Architectonic Figures



Note. These Architectonic figures are part architectural concept design and part tectonic tests of structure. By testing ideas unconnected to real-world constraints first, these figures can assist in generating spatial ideas and structural forms.

Figure 27

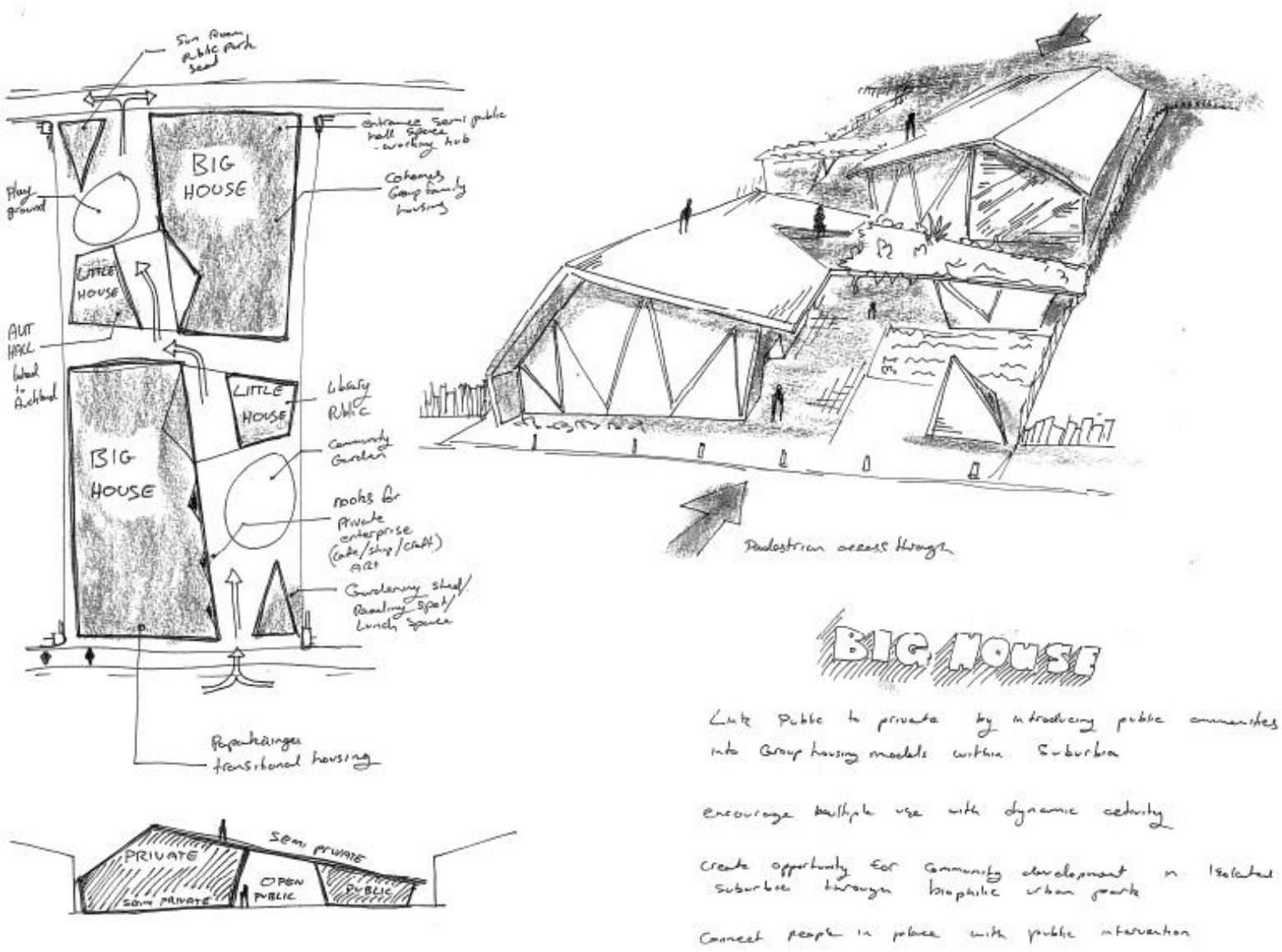
Tectonic Concept Sketches



Note. Drawing on the architectonic figures for inspiration, initial architectural concepts were generated.

Figure 28

Big House Concept Sketches



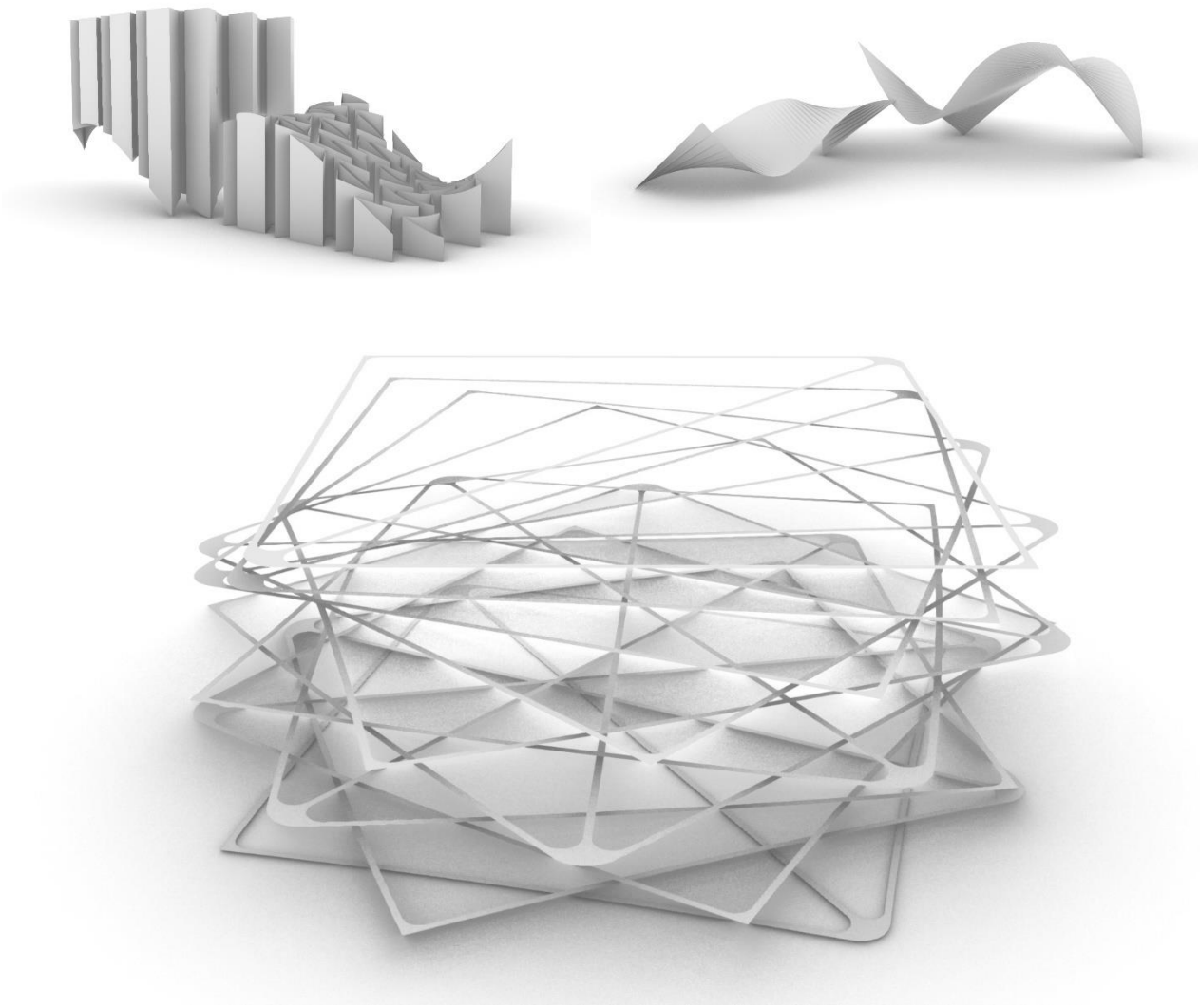
Note. This design for shows a residential development incorporating hikoi through from end to end of the site. This initial concept evolved signifigantly, but the central theme of hikoi remained through to design completion.

Permeability

From examining the architecture of the South Pacific and Japan, permeability became a major driver for design. This resulted in the development of design language to allow far more connection through permeable forms. To move away from the solid forms of the initial design, a series of digital architectonic figures were generated to develop a visual language inspired by radical permeability, see Figure 29.

Figure 29

Permeable Architectonic Figures



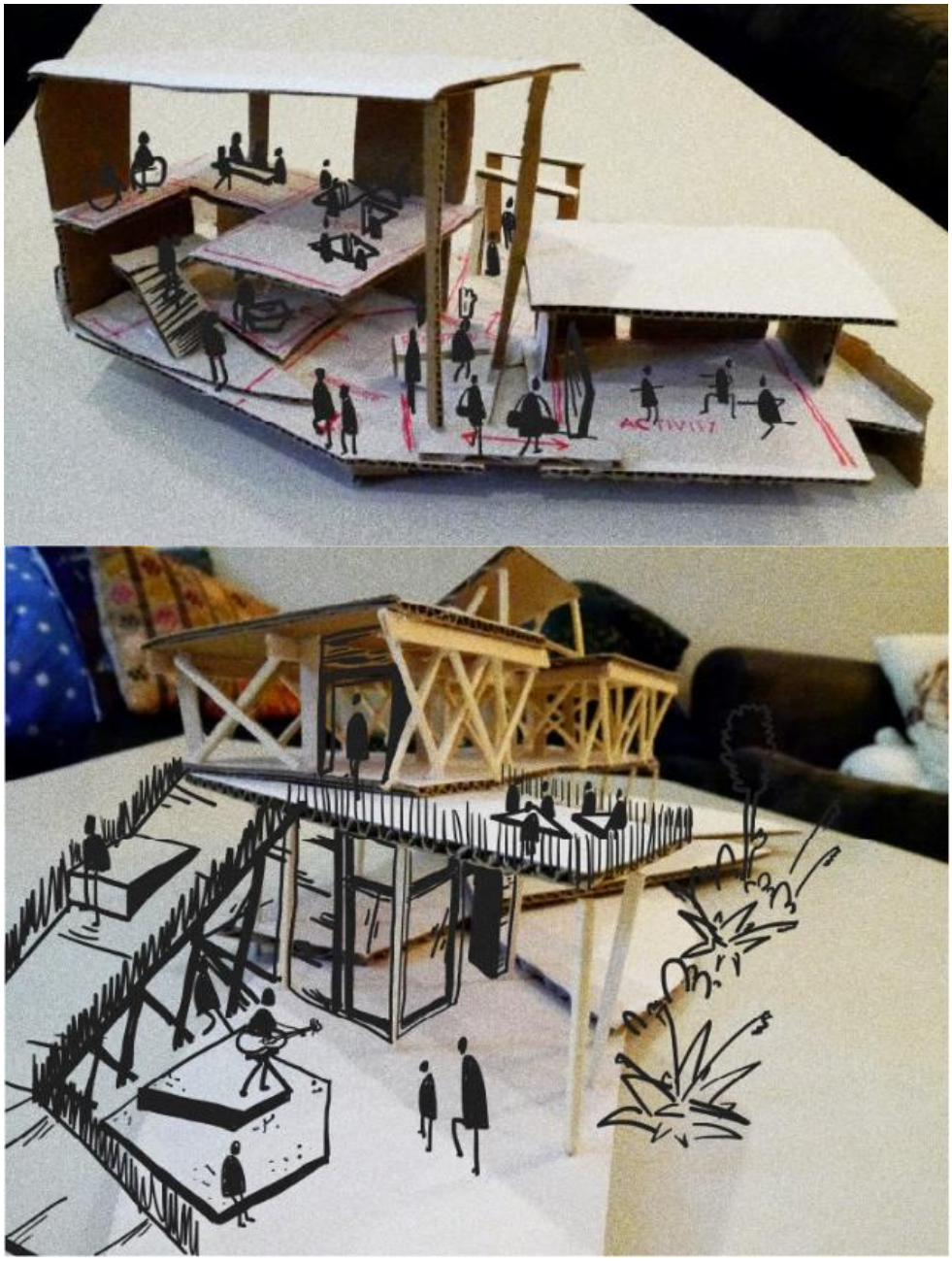
Note. These digital architectonic figures moved the architectural design towards developing a more permeable design language.

Permeability was also tested through investigating space-planning to create more relational connection through the use of the architecture. Robin Evans (1997) explains how the development of corridors in residential architecture led towards separating people, removing incidental encounter and promoting isolation. A similar phenomenon was observed in the testing of hikoi maps, where roadways promoted vehicle traffic over human experience and removed possibility for incidental human encounter. Using Evans theory on space planning as a prompt, the planning was adapted to remove pathways between spaces, replacing this with a strategy of placing pathways embedded within connected environments. Demonstrating this is a series of sketches

which test how alternative spatial arrangements might encourage interaction, see Figure 30 - Figure 32.

Figure 30

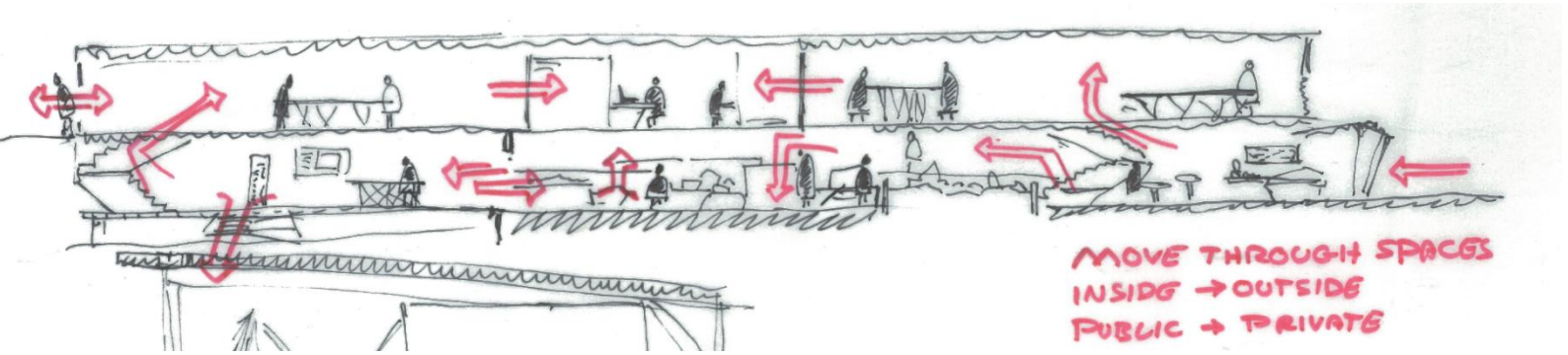
Testing Encounter Models



Note. These sketches over physical models imagine how a fully lived in building might function without separations of corridors between isolated spaces.

Figure 31

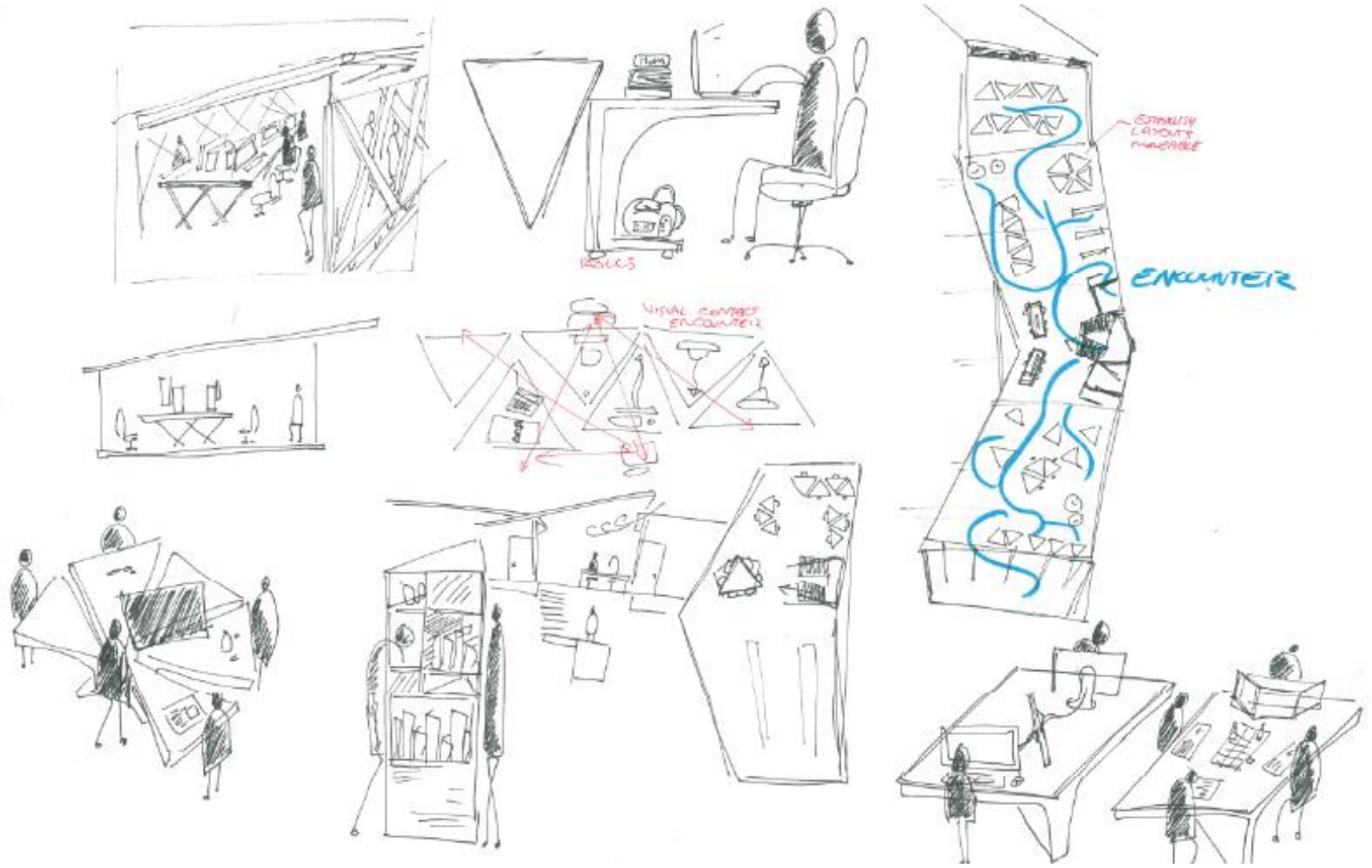
Testing Encounter Sketch 1



Note. This section tests how a pathway through the structure leads to incidental encounter as users pass through.

Figure 32

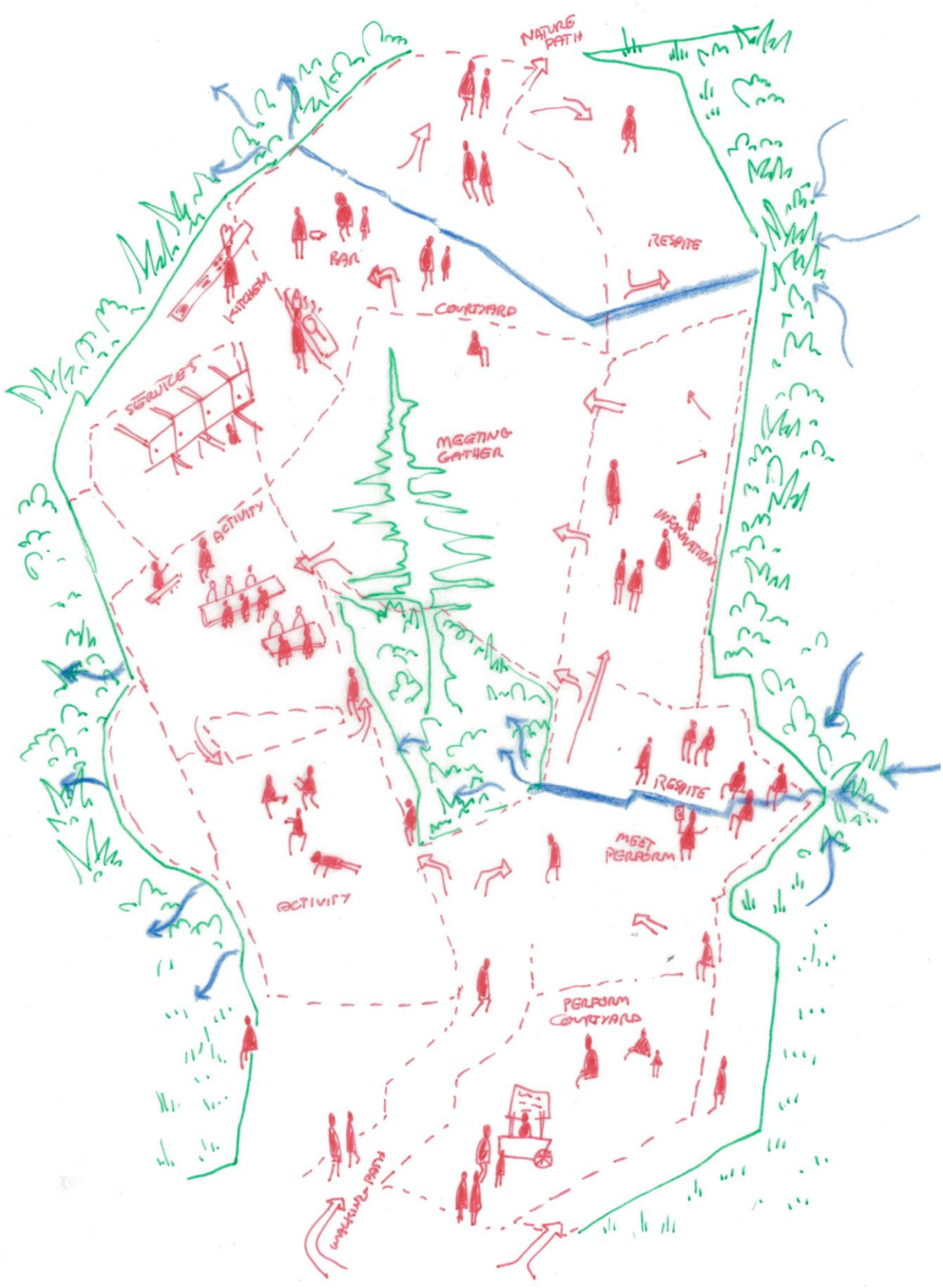
Testing Encounter Sketch 2



Note. This sketch investigates how a working environment might be designed for users to have more interaction. Custom furniture is integrated to promote visual contact and free movement.

Figure 33

Testing Encounter Sketch 3

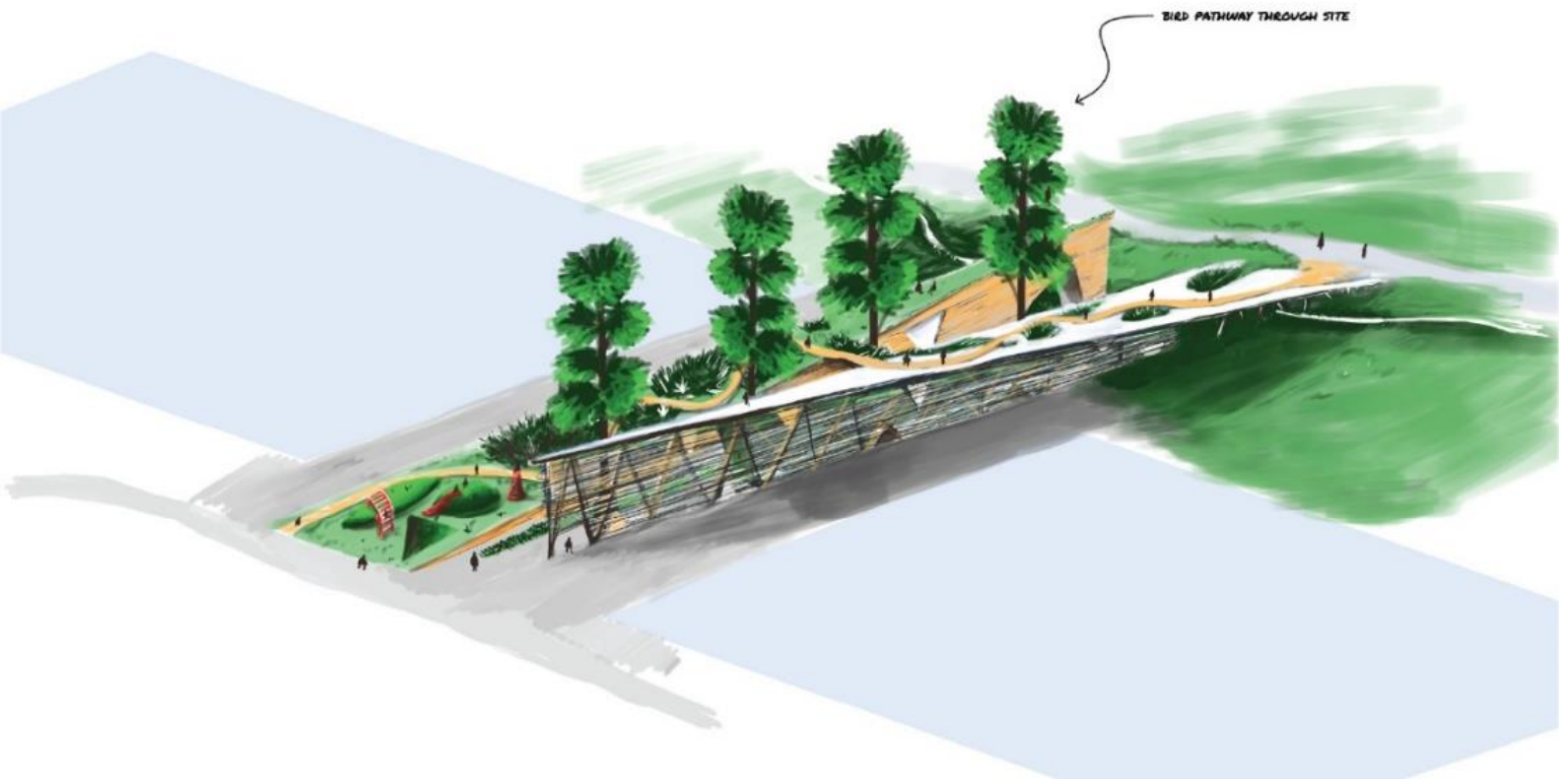


Note. This architectural plan has the architecture itself removed, showing only the human occupancy and movement to further test incidental encounter. The spaces are arranged connected to each other without any separate access to promote connection between users.

As the regenerative landscapes of SCAPE were examined, the design developed to include landscape treatment integrated with the architecture. An approach was tested which created seamless interactions between planting and structure, see Figure 34 and Figure 35. Roof gardens were used to incorporate large areas of landscape within the urban architecture, and large areas of native planting were placed through the design to encourage native wildlife to flourish, alongside grassed areas for human use. Large trees were planned through the central pathway to create an inclusive environment for more-than-humans, creating a pathway for wildlife to use which moved adjacent to human traffic.

Figure 34

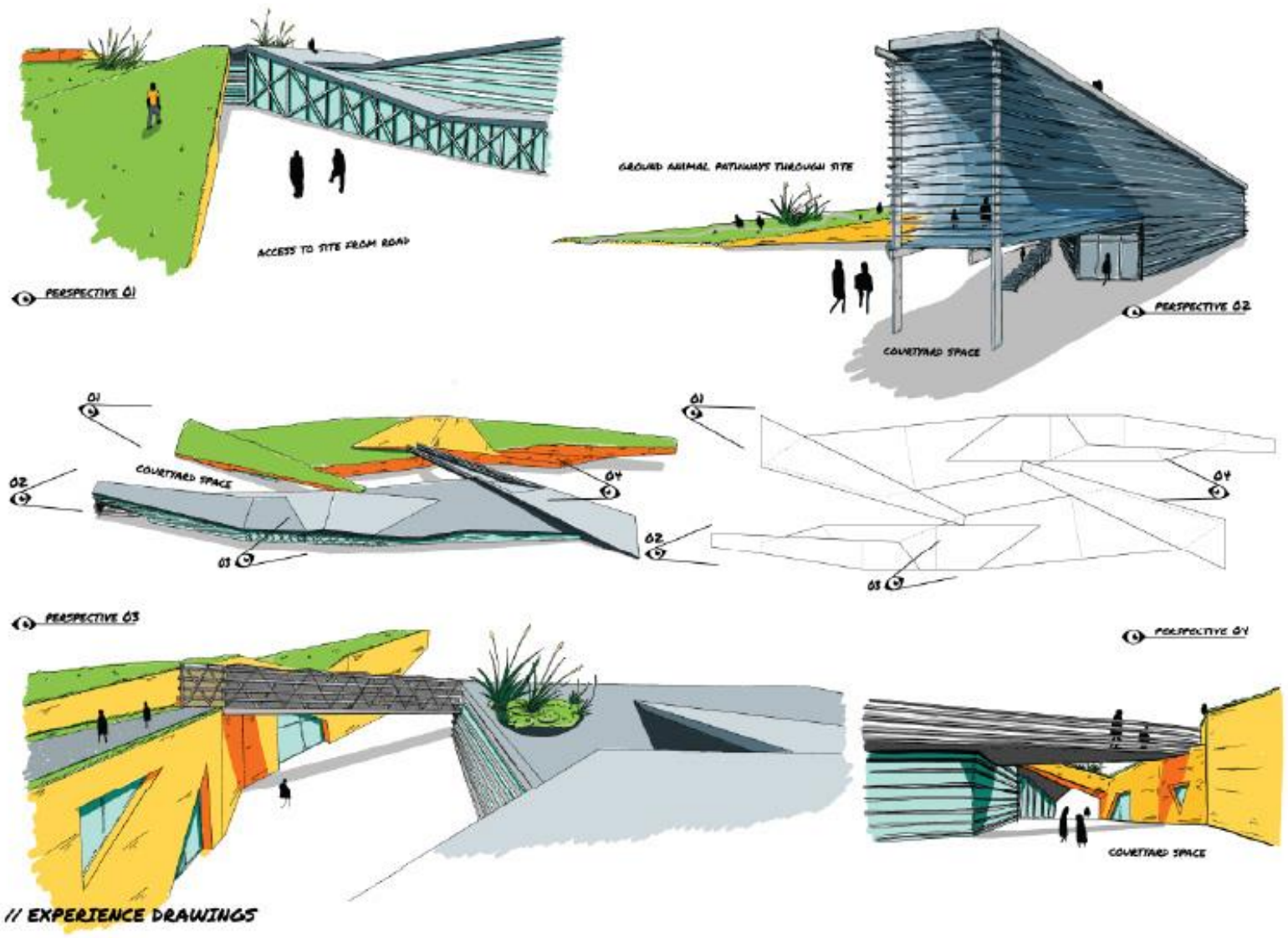
Developing Design Sketch 1



Note. This this design was developed to directly link suburban environments to natural ones as a literal bridge over the Waingaehe awa. Here the building is halfway between the urban environment and the landscape of the awa, bridging a connection between the two.

Figure 35

Developing Design Sketch 2



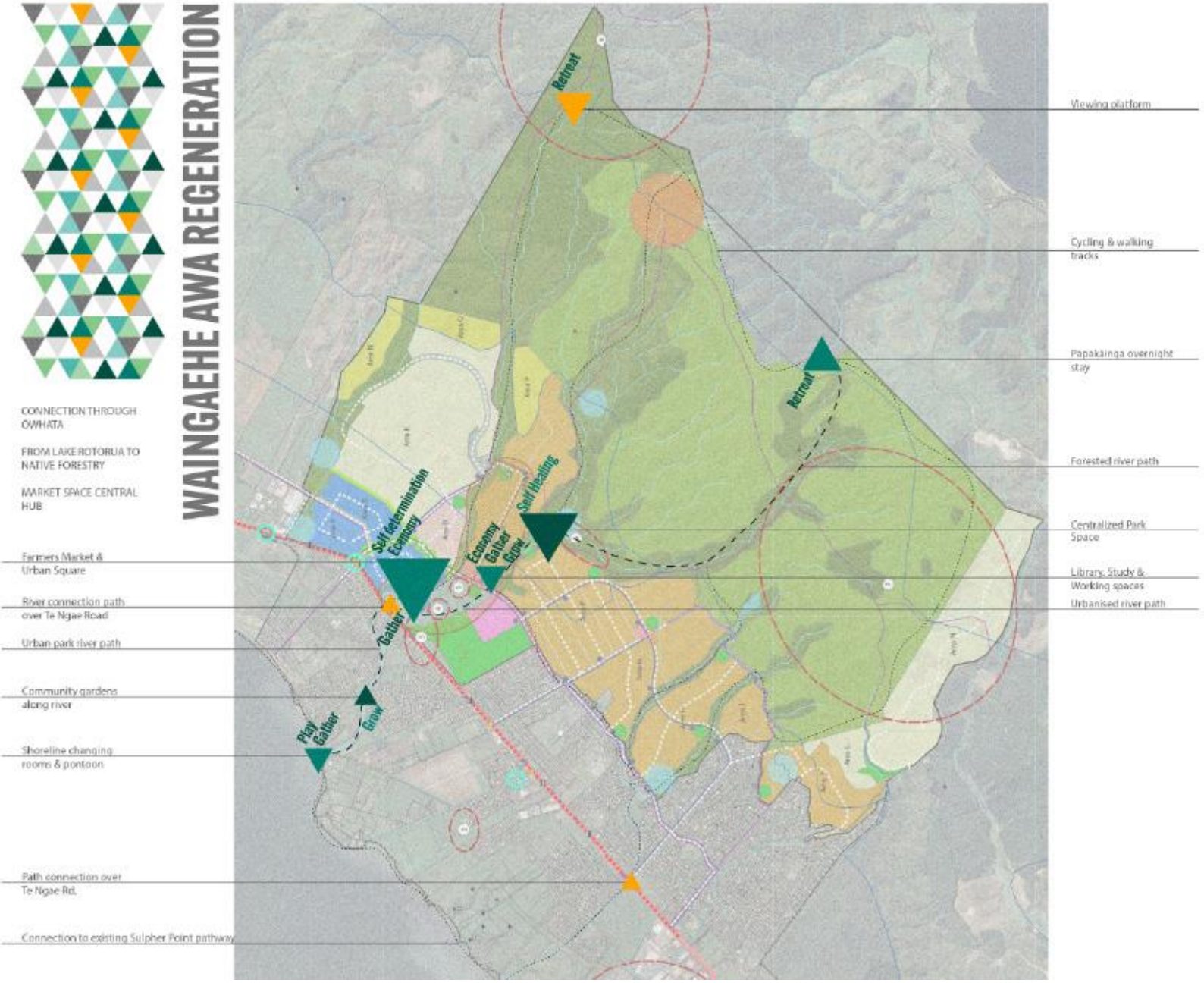
Note. These designs test a symmetrical response to dual occupancy. One building's roof primarily functions as a natural landscape for wildlife while the other features a hardscape for human occupancy. Linking these is a pathway travelling over both structures which meshes the separation of the two and encourages mixing between.

A wider strategy for regenerative landscapes was tested through an urban design for the Waingaehe awa pathway. Through informational spatial mapping, the nature of water health became a critical design driver for this architectural design. Tested through a process of moment sketching, see Figure 37, architectural designs engaged with the awa, spanning over as a bridge, and allowing interaction with the water. This developed into the design for a walkway programme

which spanned the length of the Waingaehe awa from the edge of Ngāti Whakaue land to Lake Rotorua, illustrated in Figure 36. The pathway design leveraged the primary architectural design as the centre of a wider ecological landscape that could impact the whole eastern Rotorua area. This design development informed how architecture might contribute to a wider ecological regeneration through integration with an urban plan regenerating the entire Waingaehe awa.

Figure 36

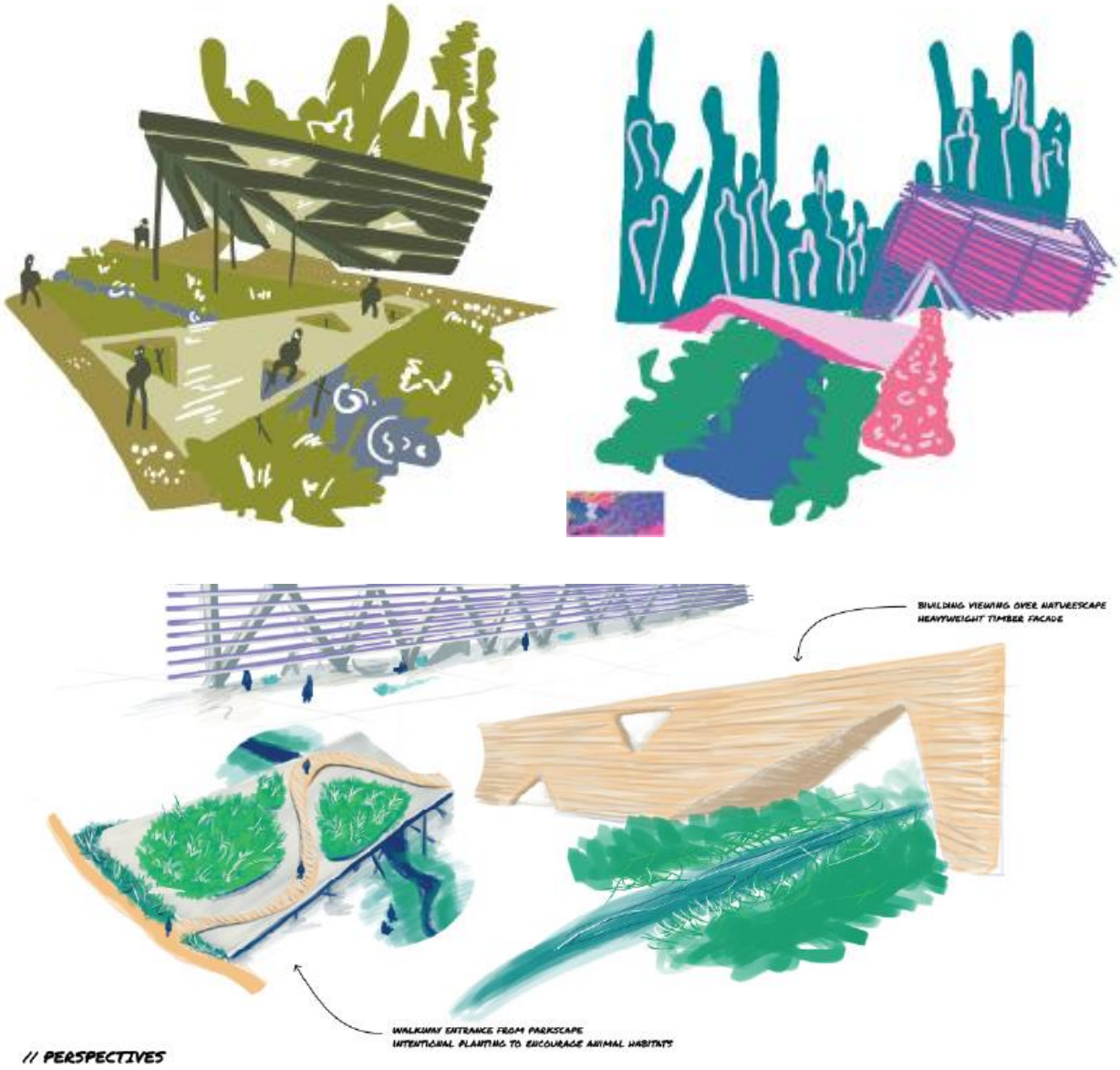
Urban Design Strategy Sketch



Note. A pathway through from Lake Rotorua into Ngāti Whakaue land. This concept focused on the Te Ngae Rd bridge architecture as the focus of architectural design.

Figure 37

Hikoi Architecture Exploration



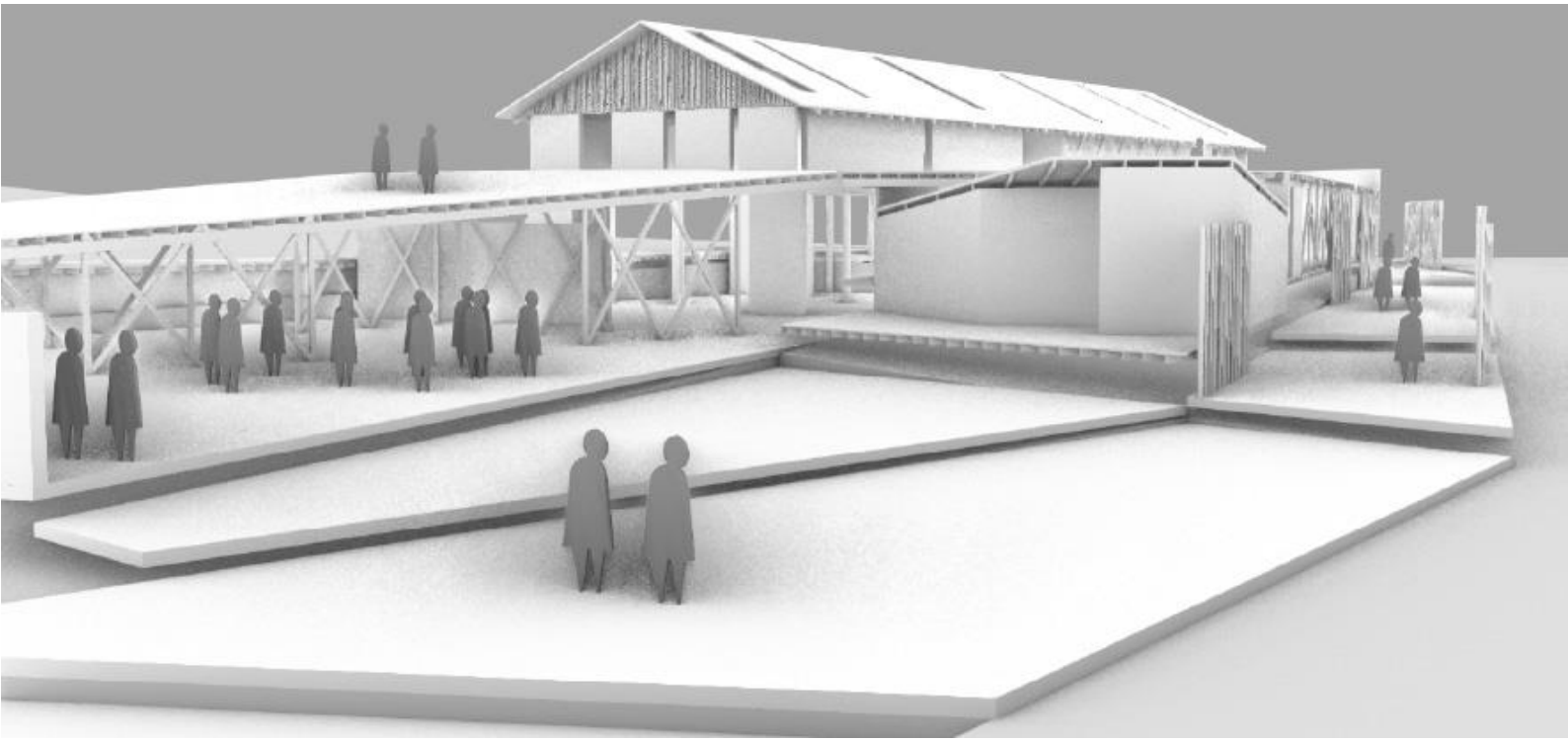
Note. Architecture that interacts with the river directly was an integral part of early design. As the ecological ramifications of building large scale architecture was deemed too invasive this was adapted into a hikoi interaction with the river, minimizing the impact of the architecture on vulnerable river-bank ecologies.

Material Vitality

As material vitality was examined, the architectural design language evolved to focus on the expression of natural materials, placing emphasis on incorporating mauri ora into the design language. Through testing mesh mapping, it was discovered that a critical material for Rotorua is in the timber forests. The health of forestry, construction industries, the awa, the lake, and the tourism industry, impact the health of each other. This observation was used to develop a design language of expressing timber members and joints to celebrate the role of the timber frame construction, see Figure 38. Timber diagrids were incorporated into the design to express a connection to Scion and the ecological timber developments they are involved with (Figure 39), and hikoi elements were paired with external screens of native timber posts to link the building to the existing forestry surroundings (Figure 40). Through this exploration the design language shifted towards a more permeable floating structure, which connected building to place through the materiality.

Figure 38

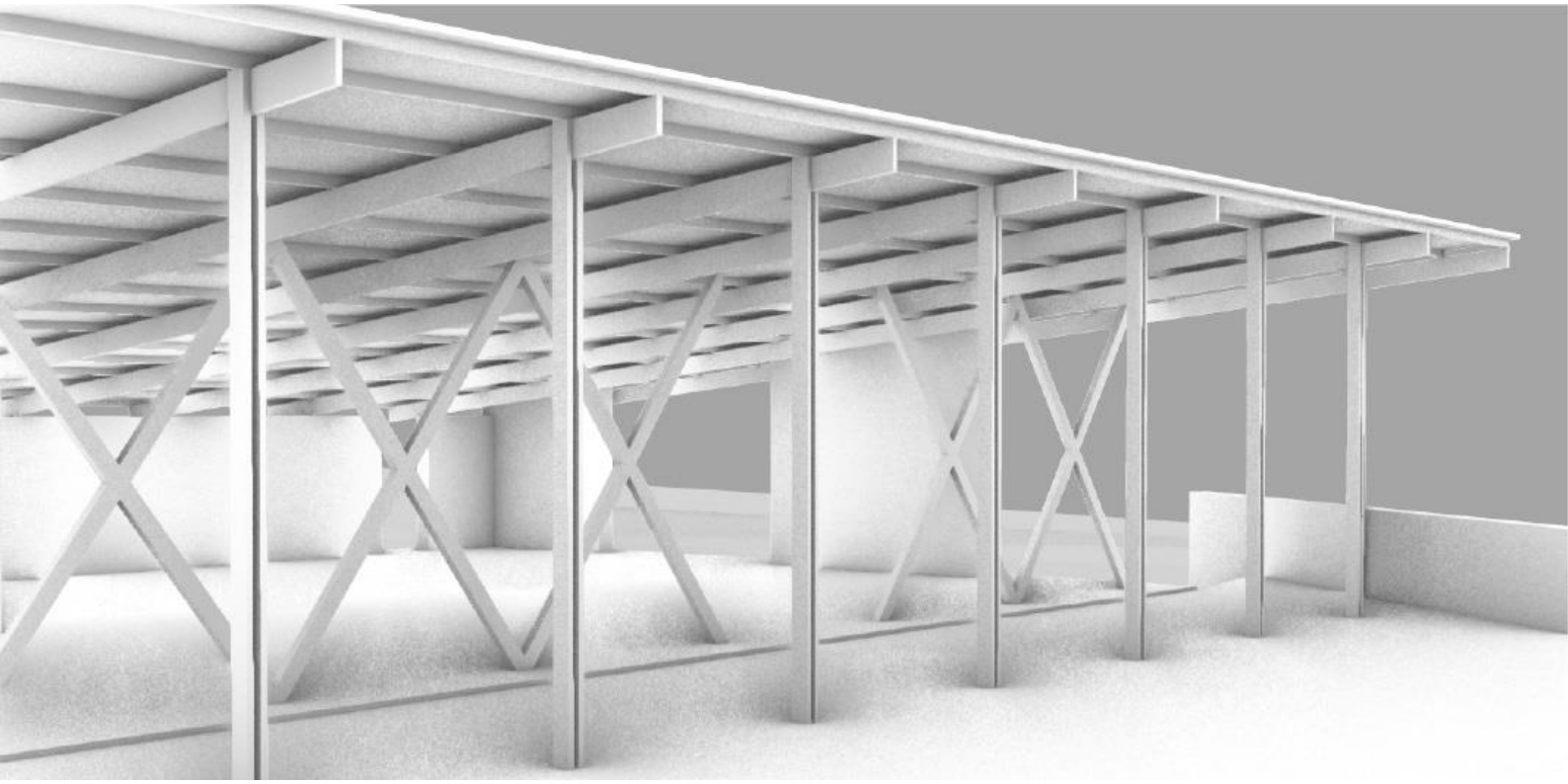
Developed Concept Perspective 1



Note. In this test, architecture was lifted above the ground and the timber framing elements expressed throughout to demonstrate material vitality.

Figure 39

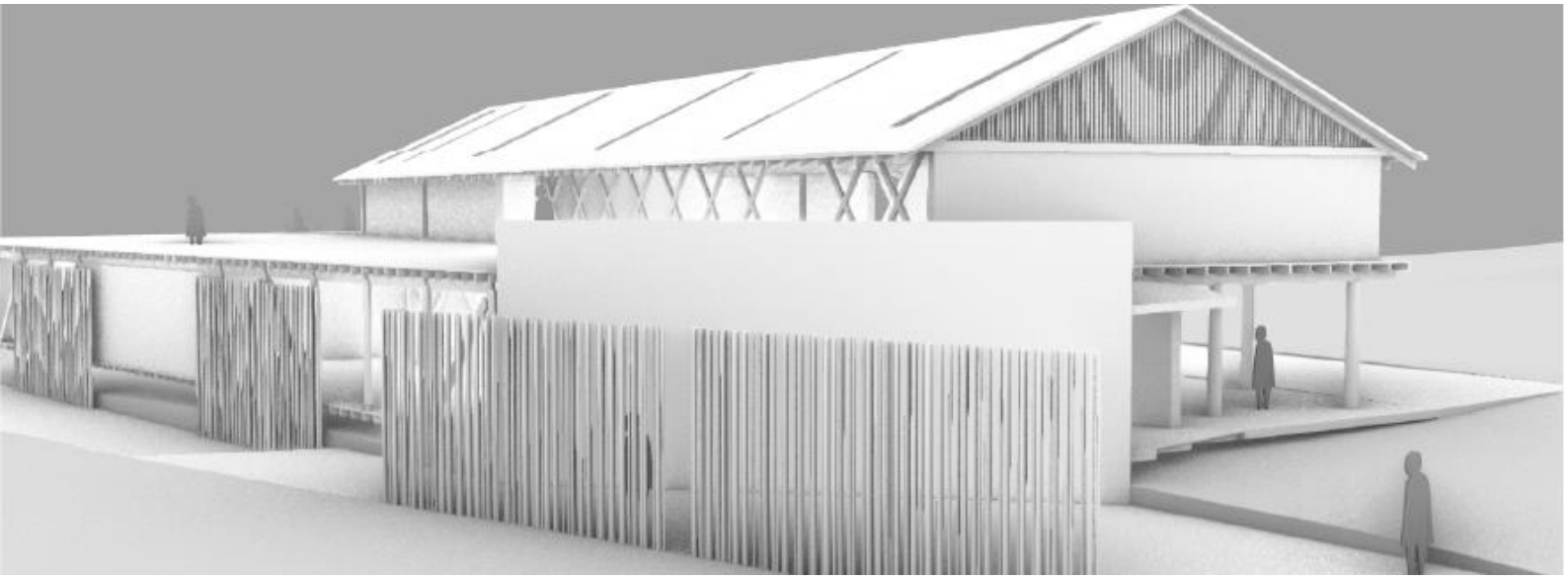
Developed Concept Perspective 2



Note. Timber diagrid structures and exposed timber framing stretched to the exterior of the structure to link the space more closely into the landscape.

Figure 40

Developed Concept Perspective 3



Note. Vertical timber screens were used to create a barrier on the walkway between architecture and landscape, this allowed a permeable interaction between these two spaces.

To increase the ability of the architectural design to link construction material to mesh relationships, construction and ecology were set together. This was tested through vignette sketches testing how animals, plants, awa, and people could thrive together in the same location, see Figure 41 and Figure 42. These sketches show how the architecture is not simply harvesting materials for use in the building but using timber to express a relationship to the natural ecologies. The construction elements physically connect through spaces occupied by humans and spaces occupied by non-human occupants. The same exposed timber elements are used internally and externally, creating a visual pathway of the materials from human occupied spaces to non-human environments along pathways into fully planted areas. Creating this connection allows the building materials to be linked intrinsically into the landscape interventions, which encourages users to understand the structure as linked into the surrounding ecological systems.

Figure 41

Vignette Sketch 1

Note. Here the pathway timber screens link the interior to the exterior through materiality. The planting permeates into the human pathway and vice versa.

Figure 42

Vignette Sketch 2

Note. Interior and exterior bleed together through the open air interior below the structure. This space is nominally separated through a diagrid structure but is fully open to experiencing the elements.

Waingaehe Mesh Architecture

Through a design process integrated with the development of Mesh Architecture, a detailed architectural design for Ngāti Whakaue was developed. Here this architectural proposal is presented as Waingaehe Mesh Architecture, which is discussed in relation to how the design responds to the design guidelines of the developed design strategy.

Waingaehe Mesh Architecture is a commercial architectural development placed parallel to the Waingaehe awa at the southern edge of the proposed Ngāti Whakaue housing development in Ōwhata, Rotorua. This architectural building is connected to a boardwalk hikoi track which moves adjacent the awa connecting this architectural development with several other Mesh Architecture designs, and with the designs for papakāinga developed for Ngāti Whakaue by Badimayalew and Yates-Francis. This boardwalk spans from the south-eastern edge of Ngāti Whakaue land through to Lake Rotorua.

Waingaehe Mesh Architecture is a split double-story building cut into the river-bank adjacent the Waingaehe awa. Refer to Figure 45, Figure 46, and Figure 47 for an overview of the architectural form. The building features two separate buildings of an eastern single-story structure and a western double-story structure which was level access to an adjacent roadway connected to Ngāti Whakaue's housing development. Refer to Figure 44 for an overview of how this architecture relates to the housing and to the Waingaehe awa. The separate buildings are connected by bridges over a central courtyard which connect the accessible roof spaces for pedestrian use, see Figure 43 for an exterior view. These roofs are largely planted, as are areas within the central courtyard and surrounding the structure. These feature predominantly native planting which have been designed to encourage conservation of native species throughout the commercial space.

Figure 43

Waingaehe Mesh Architecture: Perspective

Note. Here the two structures are shown connected through hikoi roof bridges over a central courtyard.

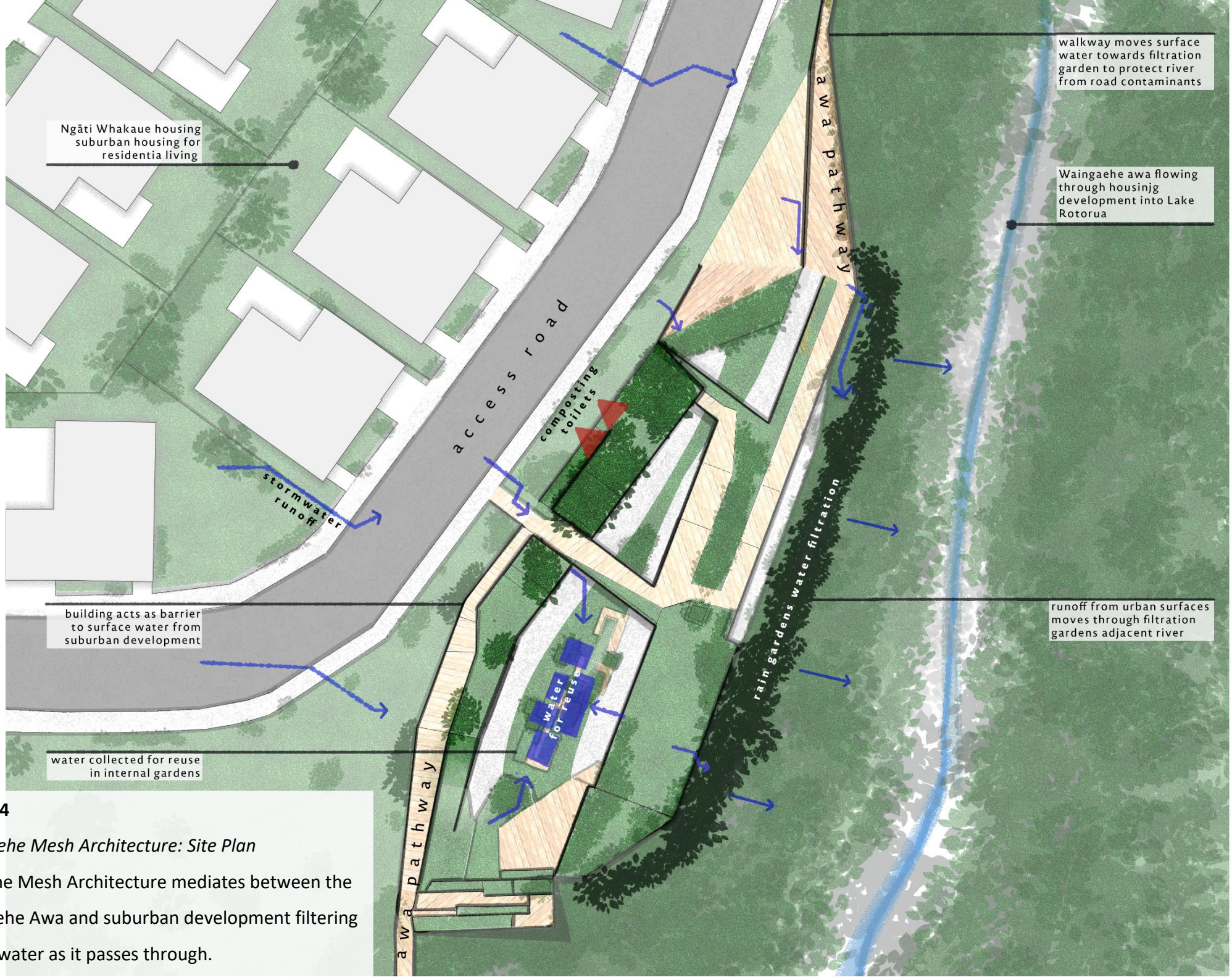


Figure 44

Waingaehe Mesh Architecture: Site Plan

Note. The Mesh Architecture mediates between the Waingaehe Awa and suburban development filtering surface water as it passes through.

Figure 45

Waingaehe Mesh Architecture: Form Model 1

Note. 3D rendered form model describing architectonics of the proposed architecture in relation to the ground contours of the Waingaehe awa.

Figure 46

Waingaehe Mesh Architecture: Form Model 2

Note. 3D rendered form model.

Figure 47

Waingaehe Mesh Architecture: Form Model 3

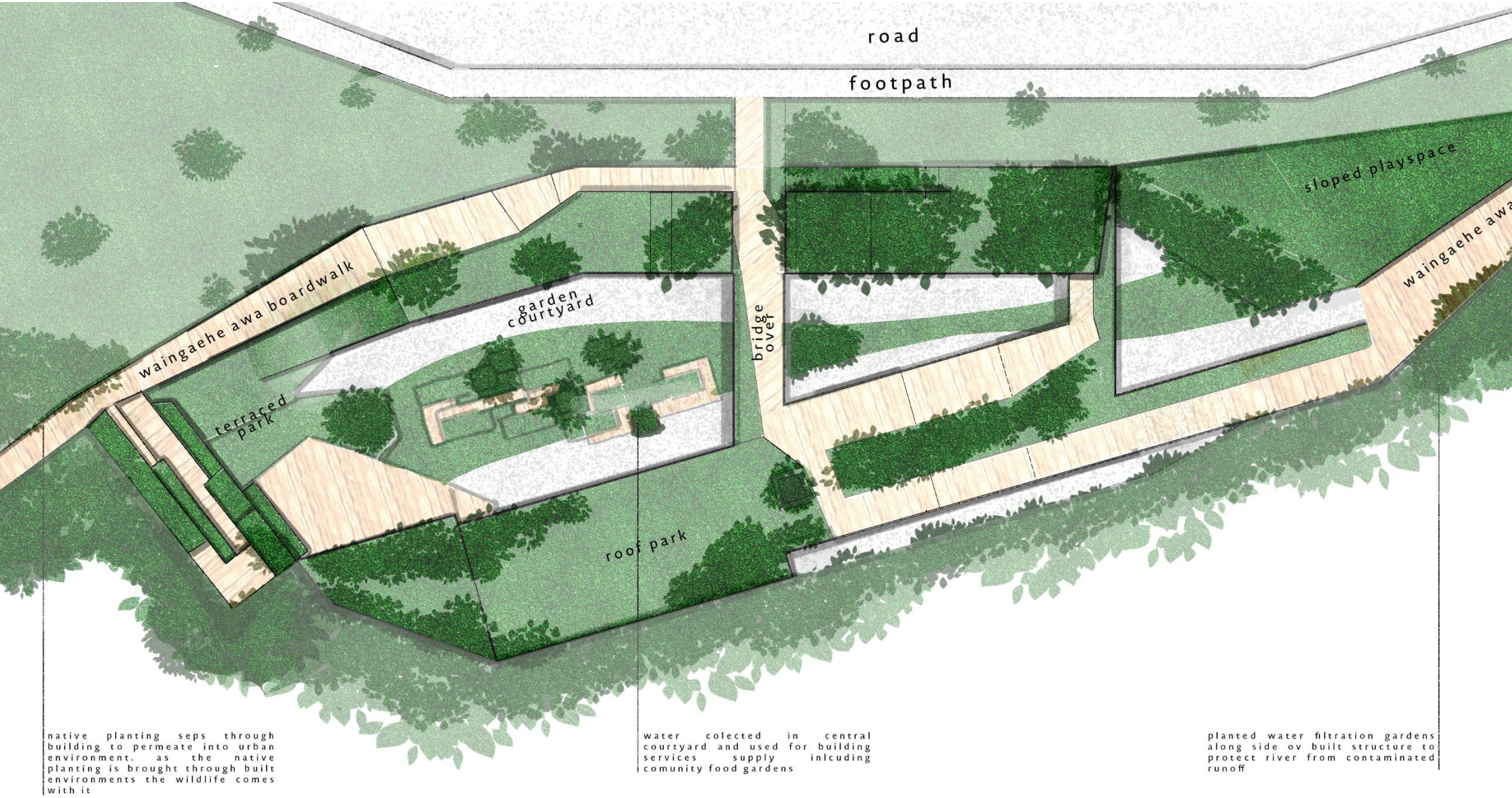
Note. 3D rendered form model.

The architecture integrates with the Waingaehe awa hikoi track by integrating this pathway into rooftop walking paths, this pathway moves through the architecture, over the walkable roofs, providing public access through the structure from each end, refer to Figure 48 which shows the pathway in plan. Connected to this pathway are public spaces such as a park environments, courtyards, community gardens, and a café. Connected from to these public spaces are then enclosed private working spaces, accessing these private areas is done through gradients where users move through public spaces to access private ones, encouraging incidental encounter as users move through multiple spaces to access the interior.

These spaces are further mediated by transitioning through outdoor and indoor spaces. The architecture shifts between enclosed halls intended for human activity and planted natural landscape. Between these are a range of halfway spaces that make up the bulk of the design, creating areas that question the distinction between landscape and interior space. Examples of this porous space planning design can be seen in Figure 49, Figure 50, and Figure 51. Moving through the site along the central hikoi pathway encourages encounters between users as they transition through natural landscapes to gain access to interior locations. The layout of this structure acts out Mesh Architecture by allowing a porous movement through landscape and enclosure. Users of the site are encouraged to move from suburban areas into an enclosed environment via a series of landscapes to enter fully human-centric environments. In this way, the design asks users to engage with more-than-human entities as they move throughout.

Figure 48

Waingaehe Mesh Architecture: Overhead Plan



Note. a continuous hikoi through landscape elements integrated with access into commercial areas can be seen from above. This public path moving through and over the buildings connect the wider Waingaehe awa hikoi strategy to the specific architectural design.

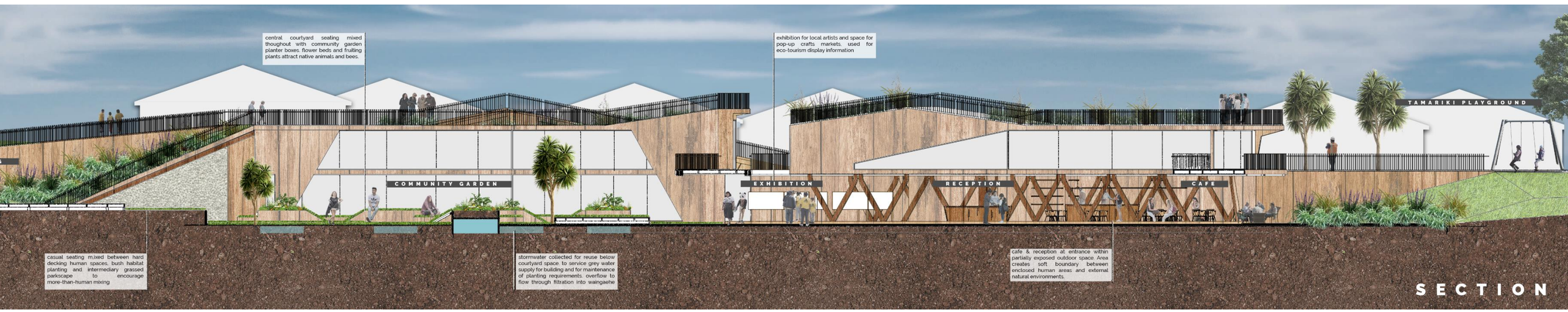
Figure 49

Waingaehe Mesh Architecture: Section 1

Note. Here the permeability of spaces towards open-environment interaction is placed alongside the permeability of the architecture towards water. The water flows through the structure mirroring the way human movement flows through the site.

Figure 50

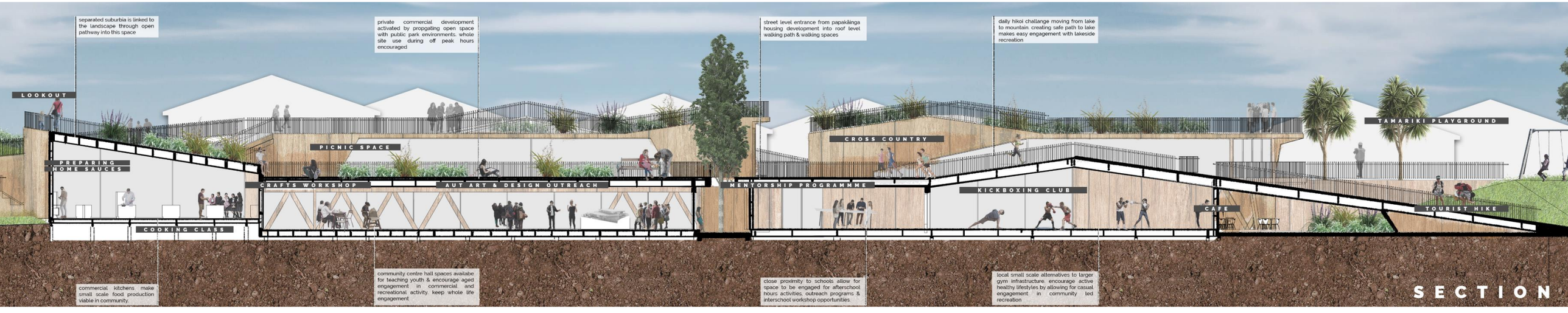
Waingaehe Mesh Architecture: Section 2



Note. Throughout the design, spaces open into this central courtyard which incorporate casual and non-programmed areas for visitors and more permanent tenants to mix.

Figure 51

Waingaehe Mesh Architecture: Section 3



Note. Access to internal working spaces is located through areas featuring native planting, encouraging users to interact with natural environments daily.

Waingaehe Mesh Architecture: Programme Strategy

The use of the development is a range of commercial activities, interwoven with a public accessway connecting users of the site with the hikoi track. The architectural proposal sits within a papakāinga, but from investigating the vision of Te Tatau for the future of the region, the programme for this proposal moved away from designing housing itself. Observed in the goals of Te Tatau was the intent for self-sufficiency, self-determination, and commercial sustainability to be encouraged in the wider communities of Māori in Te Arawa. Here in Ngāti Whakaue's papakāinga this architectural proposal addresses that goal not by providing housing, instead creating a centre for community commercial sustainability. This centre allows for the success of community business by encouraging a range of local small-scale enterprise. This is designed through a range of loosely planned spaces which each work towards the goals of creating an environment which promotes economic opportunity and ecological regeneration. This is described in Figure 52.

Figure 52

Waingaehe Mesh Architecture: Programme Design

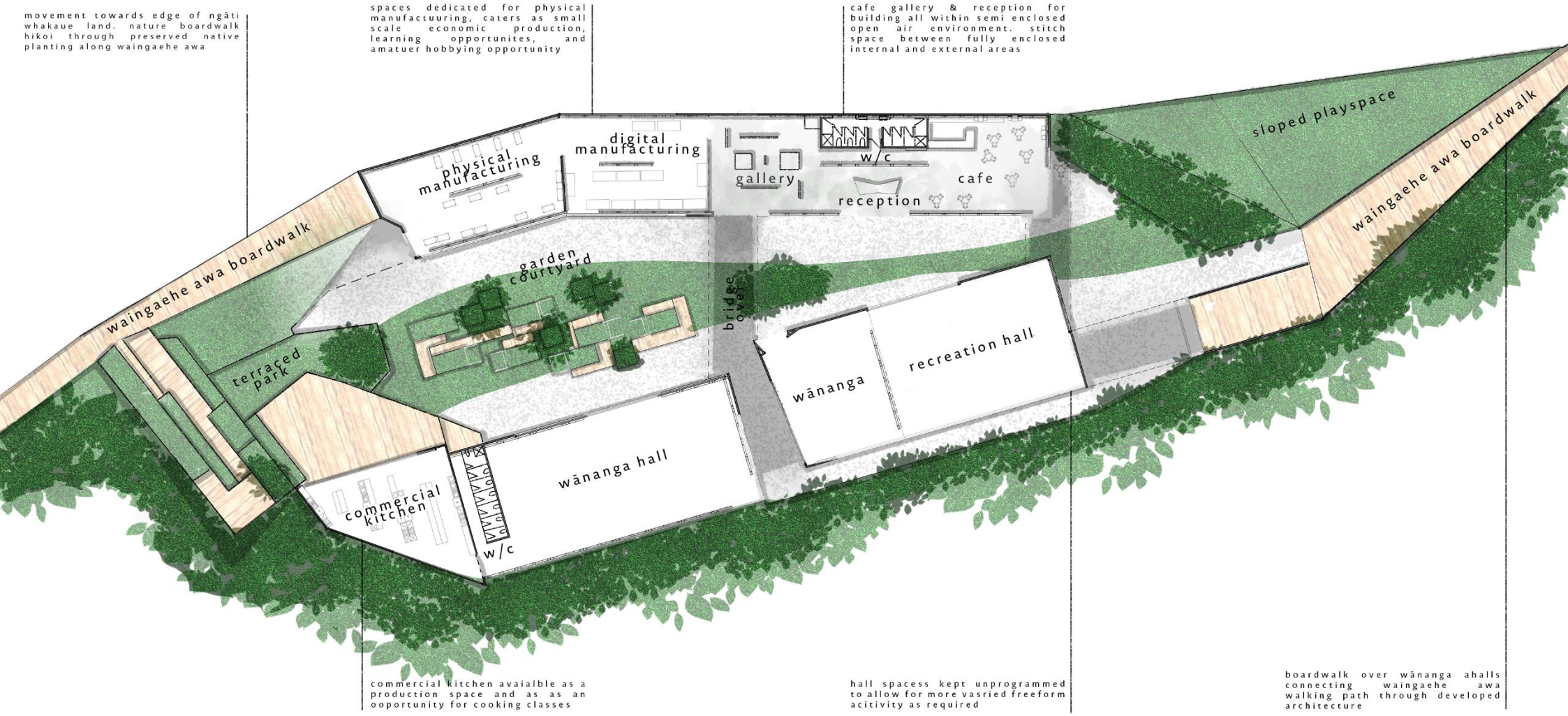
Note. This diagram explains the programming of the design, each activity catered for connects to a development of economic opportunity, and ecological regeneration.

The multiple spaces within the architecture support a range of commercial activities, the intent being that members of local communities can easily use these spaces for small scale businesses or short term economic opportunities. The spaces on the single-story building are large open halls which would suit activities such as exercise classes, teaching workshops, small sporting clubs or used as venues for office workshops or conferences. These spaces are connected to a commercial kitchen which could be used for cooking classes or used to cater for events like weddings, see Figure 53 which shows the layout of the lower floor. Opposite this are spaces for more specific activities. Near the entrance is a dedicated space for a café, which is placed here to encourage public engagement with the site, and behind this is a reception area which hosts a space for a curated gallery environment. This is intended for community artists and workers to display and sell their work. Finally, there is an enclosed maker-space, an area dedicated to creating objects through either digital manufacturing (3D printing or laser cutting) or through traditional fabrication techniques such as carpentry. This space is available for hard material classes such as woodworking or could be used by artists and makers.

The spaces in the upper floor are intended as co-working spaces for computer-based businesses or study areas, see Figure 54 for this plan. In this area large open environments are provided for working, which do not feature any intermediate separating walls. Here users are encouraged to work within environments that encourage a high degree of incidental encounter. These spaces are intended to cater for working professionals, but also for study groups of students, and for meeting spaces, allowing a range of users to mix here. Moving out of this space connects directly to the Waingaehe awa Hikoi track, connecting casual movement to the formal office environment. Connected are spaces above the lower floor which act both as a public park environment, and as ecological regeneration through areas of intentional native planting. These spaces also continue over the roof space of the office environments, refer Figure 55, which mesh these traditionally isolated spaces to a large range of encounter and connection.

Figure 53

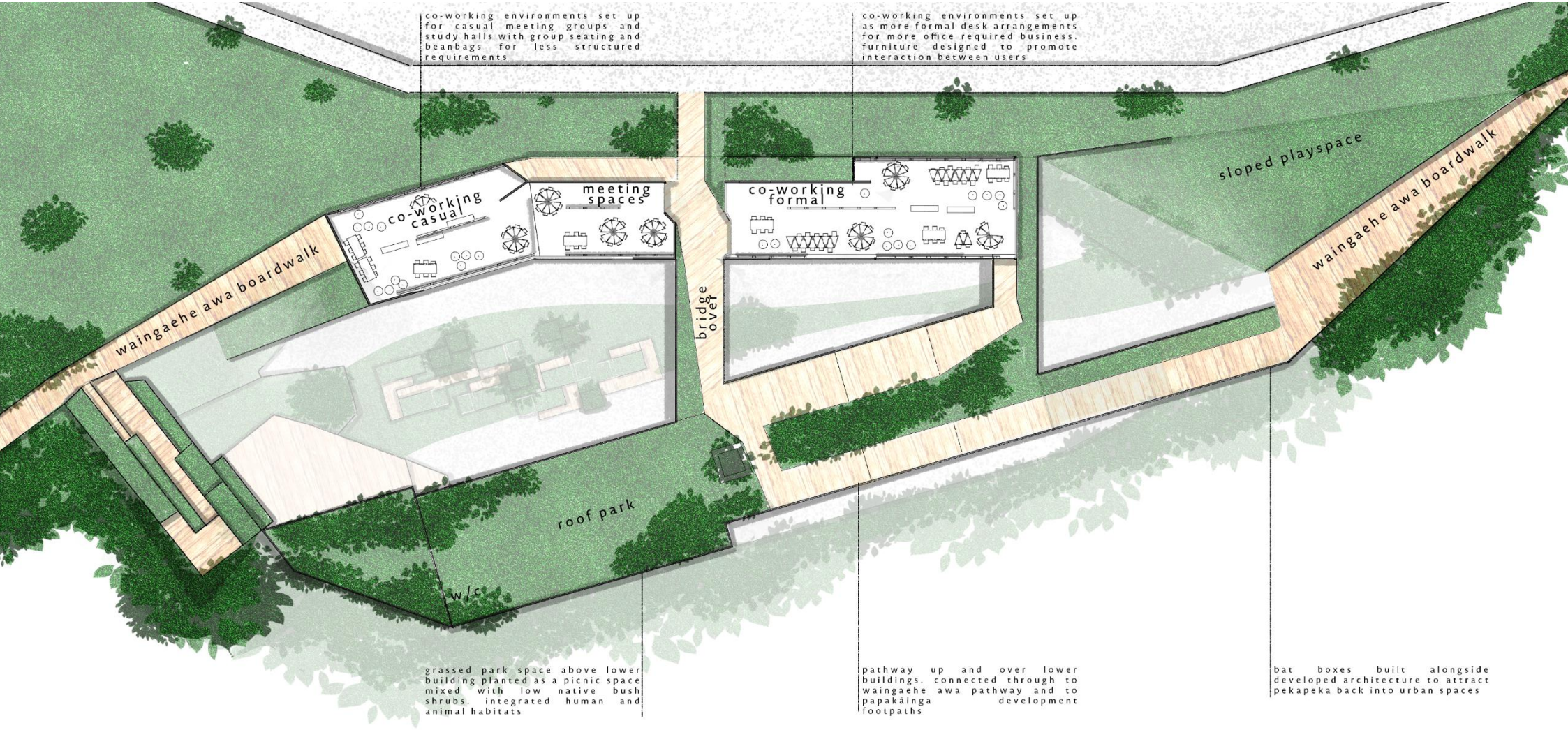
Waingaehe Mesh Architecture: Lower Floor



Note. The lower floor plan describes the interaction of public courtyards with open halls and manufacturing spaces. A planting strategy stretches through this courtyard, connecting ecology through the whole design.

Figure 54

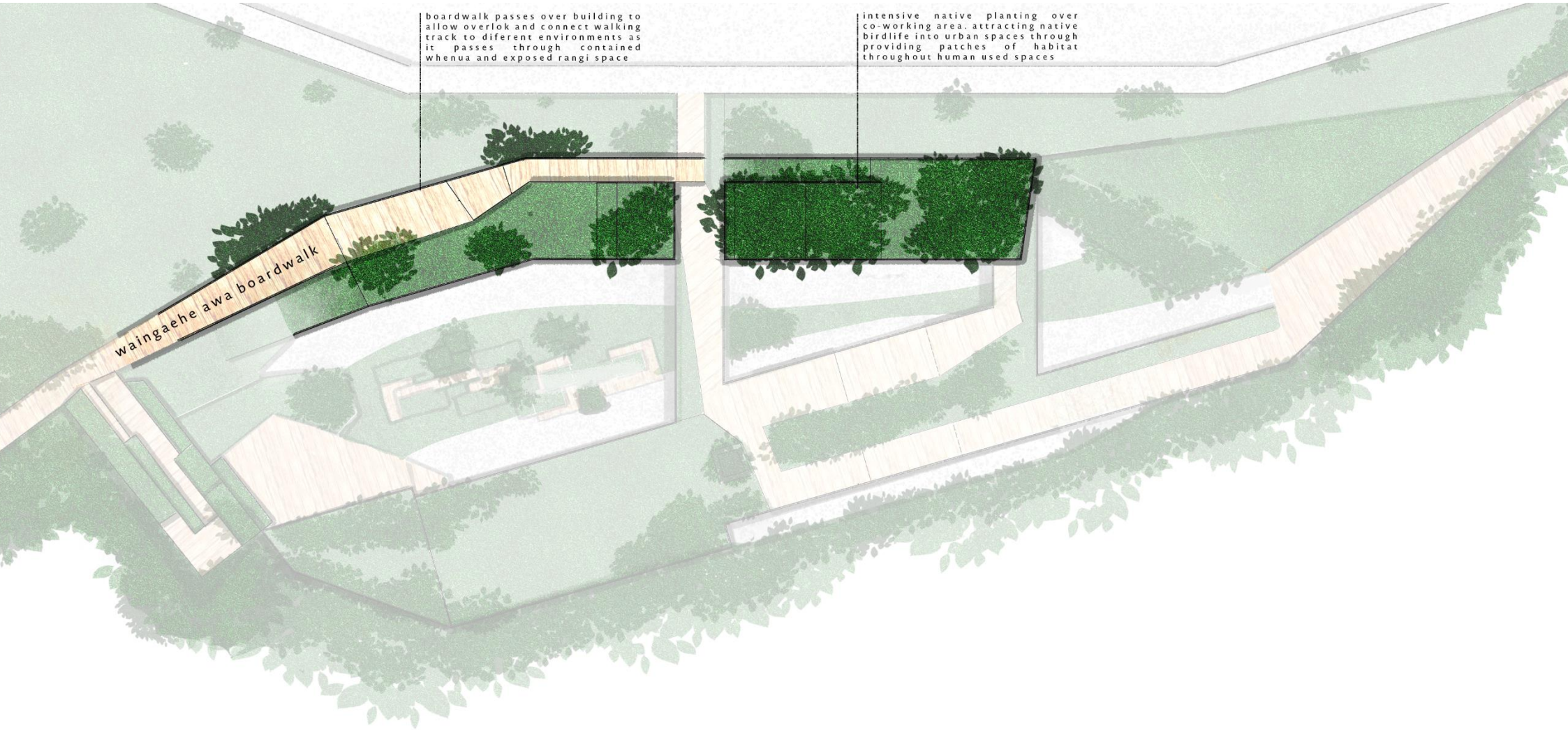
Waingaehe Mesh Architecture: Upper Floor Plan



Note. The upper floor plan describes the connection of the hikoi track with more formal working areas. These traditionally closed environments are connected to the pathway to encourage the most connection here.

Figure 55

Waingaehe Mesh Architecture: Roof Plan



Note. Rather than the walking track moving around the edges of the structure, here the walking path stretches over the roof of the architecture to completely mesh the development in the movement of this path.

Beyond these programmed areas, open landscape spaces have been created to allow for multiple uses. The large courtyard space at the centre of the building has been designed to support art markets or fairs. Designed into the landscape spaces throughout the site are locations where food & beverage carts could inhabit, allowing for the public landscape to have a relationship with business to bring people into the site, increasing the effectiveness of economic endeavours on the site.

By offering a range of small, flexible spaces, the kinds of opportunities encouraged are small scale or part time business. This scale of business is more appealing to the members of a community who do not have the ability or resource to manage a full-scale business in the central city, but also need more space than their personal home provides. Through this open but small programme, the building engages directly with the people living close to the site and encourages their economic wellbeing by providing opportunities for local economic growth. The intent of this program is to encourage the economic stability of the people within the papakāinga and surrounding suburbs. By doing this the architecture creates a relationship with the people in its place by encouraging the wellbeing of the patrons and the site through their engagement with each other.

Waingaehe Mesh Architecture: Hikoi Strategy

The architectural proposal itself sits within a design for a much larger urban design proposal which spans the length of the Waingaehe awa and incorporates the designs of each He Puna Ora papakāinga proposal. While the specific location of the proposed papakāinga has been given through the masterplan provided by Ngāti Whakaue, refer to Figure 14 on page 34, the findings from ecological mappings have informed an alternative proposal for the location of this development. Each student within He Puna Ora has provided an architectural proposal for the same papakāinga project, and collectively, a papakāinga centred development along the side of Waingaehe awa was proposed, which runs through the development. This larger development is pictured in Figure 56. This plan shows how the three separate design proposals from Badimayalew, Collis, and Yates-Francis are linked with each other through a path from Lake Rotorua to the edge of Ngāti Whakaue land, connecting the papakāinga to a pathway spanning the length of Waingaehe awa. The papakāinga proposal does not sit on its own but is part of a larger strategy to regenerate the awa through the planted river pathway which travels from the edge of Ngāti Whakaue land to the edge of Lake Rotorua.

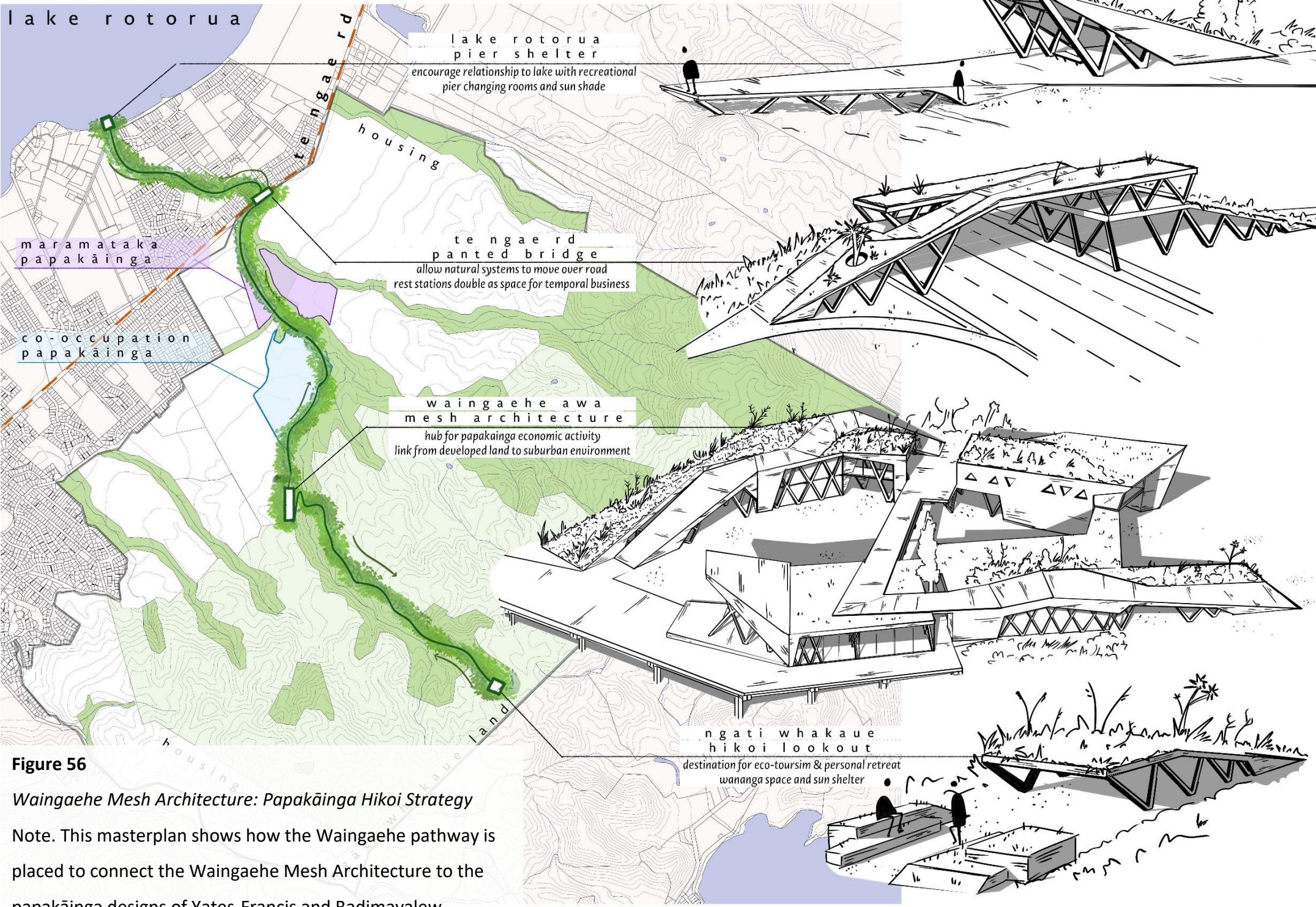


Figure 56

Waingaehe Mesh Architecture: Papakāinga Hikoi Strategy

Note. This masterplan shows how the Waingaehe pathway is placed to connect the Waingaehe Mesh Architecture to the papakāinga designs of Yates-Francis and Badimayalew.

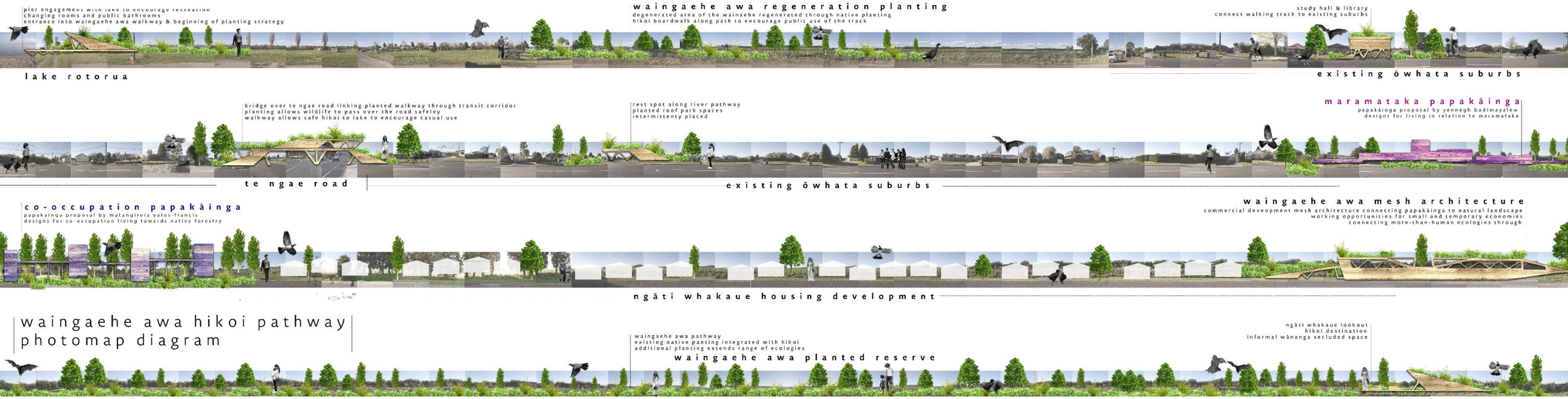
This pathway is designed to sit within a planting strategy which creates a strip of native planting alongside the pathway from lake to mountain. In this way the project aims to bridge the disconnection observed by the division of Te Ngae Rd in the environment. Designed along this pathway are several architectural projects which assist in integrating the pathway with the landscape planting strategy. At each station, architecture is used to create space for users to engage with the natural ecologies of the forest and the lake as they travel the pathway. Refer to Figure 57 to see how Waingaehe Mesh Architecture is integrated with the larger strategy. Compared to the existing pathway, see Figure 58, the pathway development demonstrates how such a design could connect disparate ecologies.

The larger development plan the Waingaehe Mesh Architecture sits within is not intended to be immediately and completely built, but will be a long process consecutively built over many years. As this plan grows, the architectural proposal is designed to grow alongside it. A strategic plan for developing the pathway and connecting architecture has been formed to mesh the needs of the natural habitats on site with the growth of the suburb, see Figure 59.

In this timeline plan, the site itself begins its formation in 2022 with the planting of native forestry in and around the site concurrent with the establishing site works, that create a folly in the emerging forest. This project grows with the forest until the project is completed with the full maturation of both the native planted trees and the culmination of the architectural development in 2052. This timeline development aligns the projects goals of ecological regeneration with economic development of the community, as both grow together. This has been implemented so that the importance of human created environments are not placed over the creation of environments for more-than-human entities. The project is planned for a whole life development where, at the end of the building's lifespan in 2112, the project will be disestablished into an architectural folly. All non-permanent elements will be removed, retaining the established groundworks and resilient structural members while removing non-permanent claddings and finishing elements. This allows native bush to take over the structure and return the area to a natural state. This strategy allows the landscape to retain its use as a human occupied walkway and allow for natural ecologies permanence within this area of Rotorua.

Figure 57

Waingaehe Mesh Architecture: Hikoi Strategy (Proposed)



Note. The Waingaehe awa pathway connects the developed architectural test to several other architectural designs and to a planted strategy of ecological regeneration.

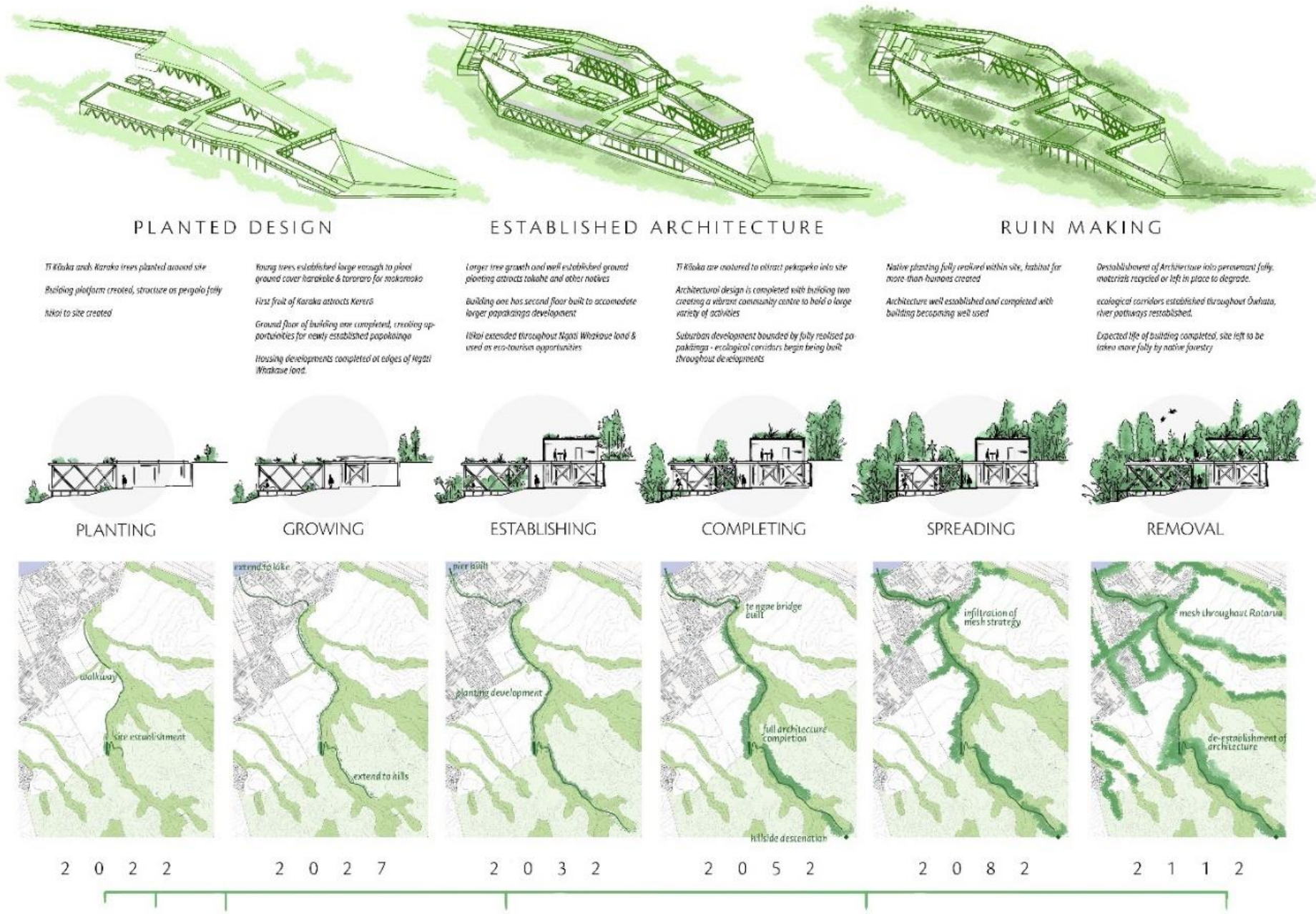
Figure 58

Waingaehe Mesh Architecture: Hikoi Strategy (Existing)

Note. The photo map of the Waingaehe awa hikoi track is shown here for reference against the proposed developments. Gradual changes to the natural ecologies can be seen in the change of land use as the journey moves towards and away from Te Ngae road.

Figure 59

Waingaehe Mesh Architecture: Development Timeline



Note. This timeline diagram describes how the development of the architecture matches the growth of native planting on site, being constructed slowly into a fully realized structure, then transitioning into an architectural folly among the developed native planting.

Mesh Architecture

The Waingaehe Mesh Architecture proposal has been developed as a test of Mesh Architecture. Here the design outcomes are discussed according to the six statements of the design manifesto given in chapter two 'Typologies', refer p.28.

Ecological regeneration

Mesh Architecture needs to actively regenerate the natural environment through architectural design. This architecture does this through the implementation of specific planting strategies which integrate heavily through the development.

A large concern of natural ecologies in Aotearoa are native animal and plant species, which are currently in decline or at risk of extinction. Throughout this project, specific environments are cultivated which encourage endangered animals to have habitats within the architecture. As much of the planting used to create these habitats are native plants, the environments cultivate the regeneration of both animal and plant life. Karaka Trees have been planted through the entrance and rear courtyard of the site which have a symbiotic relationship with Kererū (wood pigeons). These birds are the only native bird who can digest the berries of the Karaka and disperse the seeds (Science Learning Hub – Pokapū Akoranga Pūtaiao, 2019). Tī Kōuka (cabbage trees) have been planted throughout the central planted strips and around the edges of the site. These trees are an excellent habitat for pekapeka (bats) who enjoy creating roosts in the soft bark of these trees (Science Learning Hub – Pokapū Akoranga Pūtaiao, 2020). Harakeke (flax) and tororaro (native shrubs) are both planted in large groups surrounding the larger trees to create spaces for mokomoko (lizards) to inhabit. Mokomoko are in decline in cities, but are very able to live in urban sites provided they have dense ground cover planting (Woolley et al., 2019).

Through these ecological symbioses, the architecture actively engages with regeneration by weaving throughout the habitats. As the planting spreads up and over the building the building spreads into the native habitat to create a dual habitat for humans and the wildlife.

Decolonisation within urban environments

Mesh Architecture needs to work alongside indigenous people groups to achieve designs that can decolonize urban environments. This architecture does this through aligning the use of the site to the values of Te Tatau.

As Te Tatau introduced the project to He Puna ora, the request was for innovative housing designs for a potential papakāinga development. However, as this research investigated the desires of Te Tatau for community economic sustainability, the architecture proposed is for containing community commercial opportunities. To cater for the success of a larger housing development it was determined that to align with the goals of Te Tatau, an alternative arrangement for working opportunities was required. Aligning with the values of self-sustainability, this became the programme for small scale entrepreneurship within the building. The architecture itself does not dictate specific outworking's of this but attempts to cater for the future needs of a wide variety of activities.

Enhance relationships between more-than-humans

Mesh Architecture needs to create spaces which actively participate in strengthening relationships between the humans and the more-than-humans present on a site. This architecture does this through connecting economic sustainability to ecological regeneration.

Through the development of local economies, the building itself forges a relationship to the residents in the area. Mesh Architecture understands that the economic health of people is a vital aspect of wellbeing. By providing areas for biodiversity to develop in urban regions, the architecture links the community to a relationship with more-than-human entities. By linking commercial activity with ecological regeneration, an existing relationship between the community and their natural ecosystems is made manifest through the building.

Relational spatiality through permeability

Mesh Architecture needs to be designed with attention to spatial permeability to achieve designs which can encourage relationality. This architecture does this through experimenting with movements between closed, open, and in-between spaces.

Throughout the layout of this building, spaces move between fully enclosed and fully exposed, with areas mediating between. As users move through the site, they move between semi enclosed spaces so that there are limited places where a hard change from interior to exterior exists. Where these spaces do meet, visual contact is maintained through glazed exteriors. Within the structure, internal partitions are used sparingly, and an approach has been adopted which uses a diagrid structure to create semi permeable walls which create distinctly separate areas but allow free visual and audible contact throughout. By doing this the architecture is experienced with far more

incidental encounter as it is moved through, encouraging interaction and relationship within the various user groups of the building.

Regeneration of more-than-human entities

Mesh Architecture needs to interact with landscapes in a way which actively regenerates the health of natural systems. This architecture does this by making the health of the Waingaehe awa water a primary driver for design.

A major concern of this project is the water quality of the awa, as this directly feeds into the health of Lake Rotorua. Based on mapping findings, this is revealed to be degraded largely due to runoff caused by urban spaces and farming agriculture. In the proposed architectural design, the runoff of water on site is used for services on site and filtered naturally through on-site planting. Rainwater collected from roofing is collected on site for maintaining planted gardens, and for use in toilets to reduce the use of wasted clean water. The water collected through landscape is filtered through native planting and then into the river, flowing alongside the hikoi pathway towards Lake Rotorua. In this way the building influences not only the health of the immediate surrounding planting, but also the span of the river and the health of the lake, impacting all the connected ecologies.

Attention to the mauri ora within materials

Mesh Architecture needs to adopt a stance of material vitality. This architecture does this by critically examining the construction material of timber as an ecological and a cultural entity.

As a result of incorporating material vitality, timber became the dominant material, which establishes mauri ora within the design. In Aotearoa the dominant forestry species are exotic pine trees (Ministry for Primary Industries, 2020), which being non-native are a part of a human impact on Aotearoa's native environment. However, Pine forestry has a range of beneficial ecological factors, with evidence to suggest that pine plantations have less negative impact than publicly perceived (Brockerhofp et al., 2001). Exotic plantations produce high quality water for a large part of the forestry cycle, and is highlighted as a remedial tool for degraded waterways (Baillie & Neary, 2015). Pine forests have also become a habitat for many native and endangered species in Aotearoa, including Kōkako, kākā, and kiwi (Pawson et al., 2010). Kiwi are specifically targeted with conservation efforts within pine forestry with specific management guidelines for protecting the flightless birds during harvesting (Pawson et al., 2010). Critically endangered beetles have also

been found in high quantities in pine plantations (Brockerhoff et al., 2005). There is even evidence to suggest that certain bird species could be reintroduced to pine plantations in areas which they have become regionally extinct (Pawson et al., 2010). These are in addition to the benefits all forestry has, which is the removal of carbon from the atmosphere as the trees take carbon from the atmosphere into themselves during their growth cycle.

Ecological benefits are only one aspect of material vitality. As a part of a “two-fold immanence” (Yates, 2016, p. 265) approach to design, mauri ora has been incorporated through the design process by incorporating native timbers into the design. Meurk and Swaffield (2000) argue that by allowing exotic species to be the dominant feature of commercialised timber, indigenous forestry will remain sectioned into reserves, not allowing users of a site to form genuine relationship towards it. Rather than celebrating a culture of only exotic pine forestry, this project weaves together the planted ecological regeneration of native forestry on the site, with the industry of commercialised development, by using native timbers throughout the design of the building. Through the mixing of these together, the architecture incorporates ecological regeneration along with indigenous connectivity through material vitality.

Examining this project has demonstrated that employing a practice of Mesh Architecture is effective in developing architecture that regenerates wellbeing for more-than-human entities. In this design, the health of the river has been improved; native ecosystems are encouraged to thrive in a space that would typically disallow them; global carbon emissions are reduced; mauri ora is uplifted in the construction and use of the project; small scale resilient economies are encouraged in local communities; relationships between isolated human communities are encouraged to develop; and humans are encouraged to engage in meaningful co-dependant relationship with more-than-humans in their immediate environments. The resulting architecture begins to decolonise the urban space in Rotorua, encouraging Ngāti Whakaue, Te Tatau, and the tangata whenua to have more agency within the deeply ingrained colonial culture in Aotearoa.

Reflections

Examining the shifts of climate trends towards a state of degenerating living conditions has led me to the conclusion that dramatic changes need to be made in the way our society operates. Specifically examining architecture's role in this relationship reveals opportunities where the design of our cities can dramatically impact the way in which cultures operate in urban settings. A source of change to Eurocentric culture has been identified in our indigenous cultures which have a long history of living in relationship to our natural environments. Morton's concept of relational ecologies through the mesh connect traditional Māori beliefs and European cultural thought under a banner of regenerating natural environments.

I have developed Mesh Architecture from this stance, and have tested the strategy through a conceptual architectural design on the edges of eastern suburbs of Rotorua. The strategy of Mesh Architecture led me in the design research to adopt an extended site investigation process. Informational spatial maps were used to investigate the immediate urban scale, showing wellbeing concerns for the more-than-human communities on site, mesh mapping was used to explore global contexts, demonstrating larger influences acting within the project, and hikoi maps were used to map at a human scale to uncover connections and disconnections in the immediate environment. The findings of these mapping techniques affected how I designed programme, and architectural language into the proposed architectural design.

Mesh Architecture was worked through the findings of these mappings to develop a proposal for a commercial hub in Rotorua. The design welcomes human, and more-than-human entities to participate in urban co-habitation. Throughout this process, I found that Mesh Architecture encourages architectural design to become more ecologically regenerative through strengthening relationships between all more-than-human entities present in a site. The resulting architecture is a decolonising agent that allows for non-European tradition towards natural environments to flourish within colonised cities. In these ways Mesh Architecture generates wellbeing for more-than-human entities in Aotearoa.

This study has been successful in its goals; however, I have found two opportunities for future exploration, driven from the limitations of this study.

Throughout the research period I have made every effort to engage authentically with Māori culture, however this was limited by the scope of this design research. Identified here is an opportunity for deeper discussion for how Mātauranga Māori (Māori knowledge) could further influence the practices of Eurocentric architecture. Further design research could explore ways indigenous practitioners could be direct collaborators in design processes to inform more radical architectural design processes.

This design project established by Ngāti Whakaue offered design freedom as there was no existing site infrastructure to incorporate into the design. However, I identified during the course of the study that it is existing urban spaces that need to be regenerated. If Mesh Architecture were to be tested within an established urban environment, it could act more directly as a challenge to urban colonialism. This could lead to more compromises in design as existing factors limit design options, but could have greater impact on existing communities and result in more radical change.

The world has not always looked the way it does now. Our world, our cities, look vastly different from the past, and will look vastly different in years to come. As designers, we have an opportunity to encourage the trajectory of this development towards sustainable practices that regenerate ecological relationships. As architects, we must find a new way of designing if we are to create a future of interconnected relationship with our more-than-human participants. In developing the strategy of Mesh Architecture, I do not propose an isolated solution but are exploring how my practice of architecture in Aotearoa could begin moving in a different direction, to cultivate regeneration in our cities.

This design strategy is offered as a pathway for exploring how the wellbeing of more-than-humans might be regenerated, how indigenous stories and worldviews might be woven back into urban spaces, and how architecture might develop to become a regenerative agent within the Anthropocene. In this way I hope to develop greater relationships towards our more-than-human entities in Aotearoa through Mesh Architecture.

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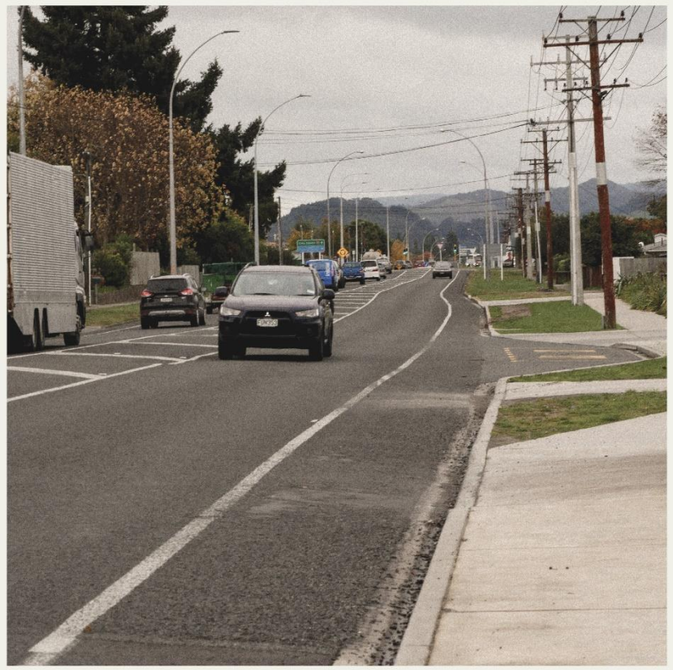
Appendix. Architectural Design Examination Documents

The following document is the visual component of the architectural design works which were formally examined on the 13th of December via online conference. The document contains both pictorial and textual components which are extensions of the work discussed within the thesis. The pictorial components represent the final architectural design proposal which extends and refines the work shown within the document. The textual components represent a heavily condensed version of the thesis text and are included to allow the document to act as a summary of the whole work.

The document is intended to be read as a single continuous horizontal sheet and has been split into sections to allow for formatting constraints. The original work can be found online at https://miro.com/app/board/uXjVOdQu9Ig=/ where it can be read as originally intended.



mesh architecture

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As a species, humans are facing alarming global changes; increasing carbon emissions, rising global temperatures, and the loss of animal species, in recent history are at a scale comparable to a global extinction. These changes to the environment are compromising the sustainability of life on earth. This reality is referred to as the Anthropocene, a shift of climate globally instigated primarily by human action.

To combat these crises, radical changes to the way societies operate need to occur. Every individual is responsible for their own role in creating regenerative practices that affect positive ecological change in their own area of influence. This thesis examines the role that architectural practice has in these crises, and how architectural design might create ecological regeneration through alternative design strategies.

This research takes the view that the Anthropocene is a product of the disconnected relationship of people within modern Eurocentric culture towards their immediate natural environments. A culture of disconnection inhabits everyday lives and separates humans from the natural through the prevalence of urbanised space, which largely remove natural systems from resident's immediate environments. While architectural designers contribute towards this system by providing designs that disconnect individuals, they also have a great opportunity to radically affect human relationship to more-than-human entities through the design of urban spaces.

This thesis develops a new methodology of architectural design, referred to as Mesh Architecture, that provides a framework for designing in a way to enhance these relationships. Mesh Architecture is developed as a strategy of practice for architectural design, which is tested through a design proposal for a commercial centre located in Rotorua. Through the design research the question is asked, how can Mesh Architecture improve the wellbeing of more-than-human entities in New Zealand?

anthropocene

The Anthropocene refers to the current geological era where human development has made such significant change to the environment that it is recognisable on a global scale.

ture and its vital contributions to e, which together embody biodiver- d ecosystem functions and services, are deteriorating worldwide"

Global Assessment Report
IPBES

there has been a global reduction in biological diversity in animal and plant species, leading towards less resilience towards pests, pathogens and climate change .
Increases in global temperatures have accelerated, which is a direct contributor to the increase of extreme weather events and rising sea levels.
Global consumption and pollution have also increased significantly, marine pollution particularly has grown ten times over since 1980 .

colonialism

Sharing a common history throughout many areas of the developed world are stories of colonial empires invading pre-European civilisations, imposing their culture in place of the existing indigenous culture. This is also New Zealand's story, which shares parallels with colonisation in North America

"The Anthropocene grows out of on an entrenched Enlightenment-- derived logic that cleaves humans from nonhuman realities and... assumes they are limited to an instrumental relationship in which... humans have the upper hand."

Being Together in Place
Soren C. Larsen and Jay T. Johnson

Māori, In a similar way to Potawatomi, have a deep spiritual connection to place, understanding that mauri ora flows throughout all the natural world. Relational whakapapa is not limited to human relatives but includes the natural environment. Removing Māori from their land meant not just a removal from an environment, but from their ancestors, disrupting Māori at an intimate, spiritual, level.

While both these cultures are surviving to a degree now, they are both subservient to the more dominant culture of European settlement.

relational ecologies

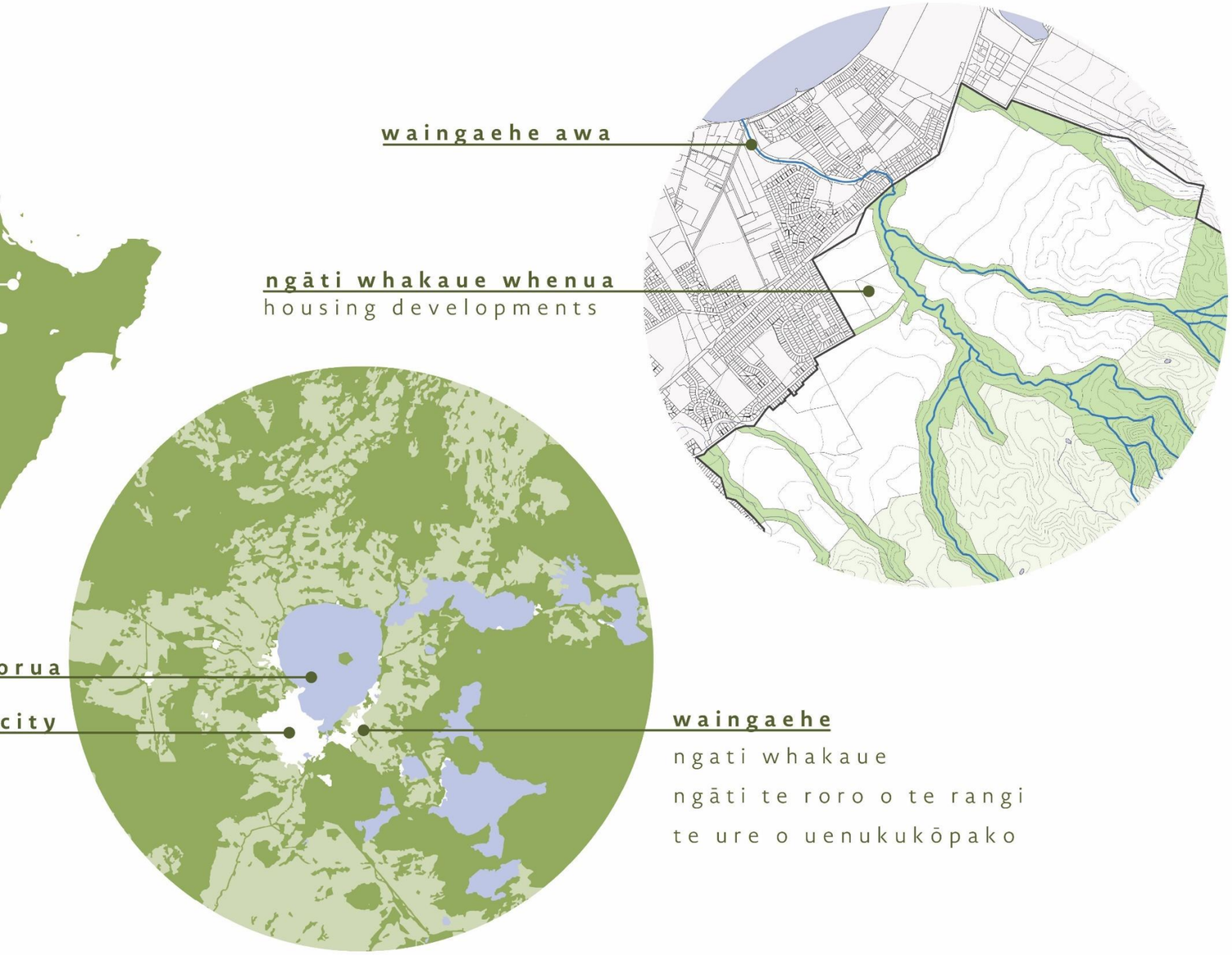
The Ecological Thought, explores a relational worldview through the metaphor of mesh which connects all entities and concepts together as one organism in a complicated web of inter-relationships that affect and rely heavily on one another.

"It is a vast, sprawling mesh of interconnection without a definite center or edge. It is radical intimacy, coexistence with other beings, sentient and otherwise... ..."

The Ecological Thought
Timothy Morton

This mesh establishes a relational ecology that understands humans as co-dependant with natural entities. A mesh ecology asserts that there is no dominance or separation, but that human and non-human entities have equality with each other.

The members of this mesh include humans alongside animals and plant life, but extend to contain non-living entities such as maunga and awa, and stretch to include the entities of social structures, societies, political groups, and economies. All these separate entities work together to influence and affect one another in the mesh.



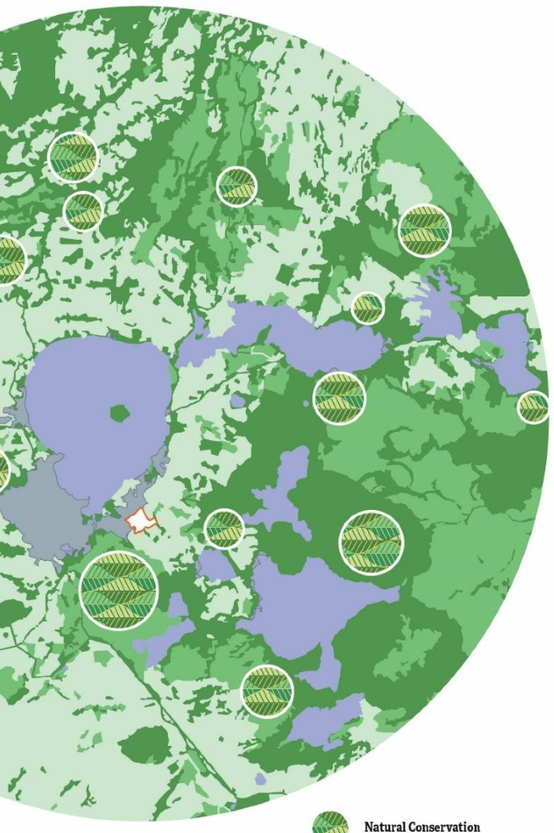
papakāinga

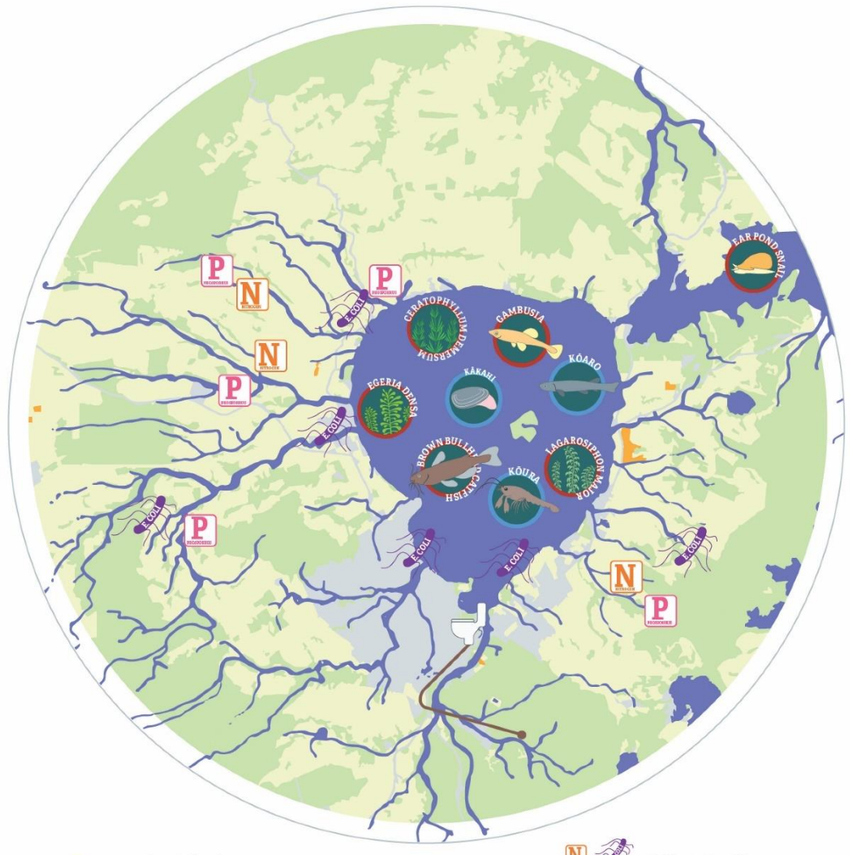
This project is a proposal for a papakāinga in the eastern suburbs of Rotorua, a city built along the southern edge of Lake Rotorua in the upper North Island of Aotearoa. This papakāinga is a section of a larger development plan of Ngāti Whakaue who own the land this site is within. They, alongside Te Tatau o Te Arawa (Te Tatau), are the client of this development.

Te Tatau have given an opportunity for He Puna Ora to assist in the implementation of these goals within the development of a papakāinga in Ngāti Whakaue land. The proposal for a papakāinga forms a small part of a larger urban development instigated by Ngāti Whakaue on their Māori owned land seated on the eastern suburbs of Rotorua. This development is an ongoing process of developing existing forestry, farmland, and quarries, into residential housing.

The location of this papakāinga is used to test Mesh Architecture through a series of site mappings which investigate the mesh ecology of the site in Rotorua to discover and describe relationships between more-than-human entities.

Mappings within Mesh Architecture focus immediately on the relationships in a site. While typical architectural site maps will naturally tend towards describing certain kinds of relationships, Mesh Architecture encourages maps to look beyond traditional western approaches to understand how indigenous cultures might understand land. By adopting these perspectives the following tests of Mesh Architecture approach site mappings to discover wide-spanning more-than-human relationships in a site.





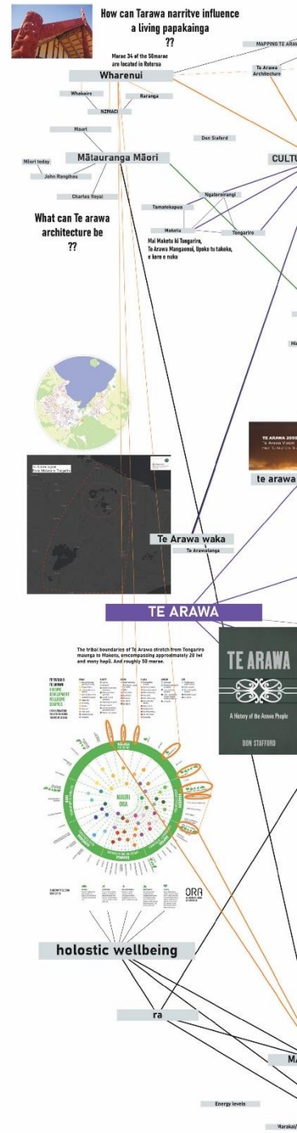
informational mapping

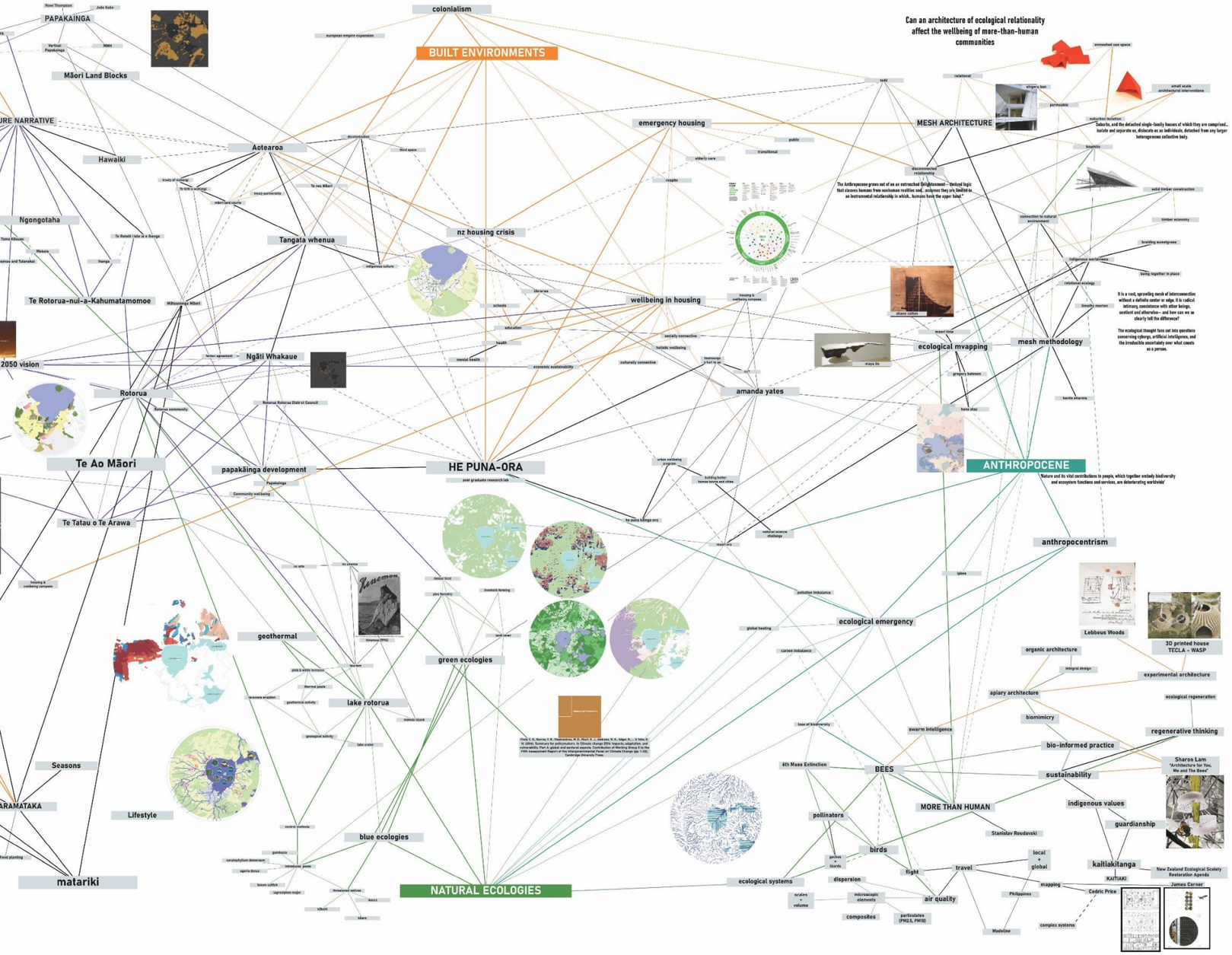
An Informational approach is where the boundaries of an organism do not define the edge of study but focus on the connections that organism has to others. An informational mapping approach then is where connections and interrelationships form the focus of the study, rather than focusing on the single site itself.

Mesh Architecture was tested through informational spatial mapping which set out to discover the varied ecological factors existing in Rotorua. This research consisted of research into the ecologies of Te Arawa combined with outputting visual maps which described the ecological factors and entities discovered. These maps were an effective way of exploring relationships. By translating research data into maps, data was easily visualised and discussed.

Through this process many key insights about Rotorua were gained. Maps of waterways combined with research of the ecological health of the awa and lakes in the region described how the many awa surrounding Lake Rotorua contribute towards its health. These were compared with another series of maps investigating the general use of the land surrounding the city.

This comparison demonstrated the relationships between human urbanism and health of water in Rotorua, showing how the spread of urban spaces contributed towards the declining health of Lake Rotorua. Through farming and agriculture, the spread of urbanism removed much of the natural space around inlets,, the inlet streams have been contaminated with bacteria, and through human use of the lake, pests have invaded and disrupted native ecologies.





m e s h m a p p i n g

Mappings within Mesh Architecture adopts the stance of Informational mapping by focusing immediately on the relationships in a site. While typical architectural site maps will naturally tend towards describing certain kinds of relationships, Mesh Architecture encourages maps to look beyond traditional western approaches to understand how indigenous cultures might understand land. By adopting these perspectives the following tests of Mesh Architecture approach site mappings to discover wide-spanning more-than-human relationships in a site.

This resulted in the mesh map which shows the vast array of relationships and entities at work in the site. creating a map of research, linking each entity, ecology, and concept to each other to describe the web of interconnected more-than-human relationships.

210605 Hikoi map
Lee Road - Gee Road

210605 Hikoi map
Owhata Road - Te Ngae Road - Wharenui Road

lake rotorua

waingaehe aw
photomap diag

koi mapping

existing

te ngae road

existing ōwhata suburbs

ngāti whakaue housing development

h i k o i . m a p p i n g

Mesh Architecture was performed through hikoi mapping. The term refers to a process of creating maps from photographed hikoi journeys through a site to document an experience at human scale.

Following the path of accessible routes from the site of the proposed papakāinga to Lake Rotorua, several hikoi exercises were completed. During each route a series of photos was taken every twenty steps to depict the human scale experience through the environment. Each street was traversed once in each direction, and the photos collated as posters to show journeys isolated from any geographical mapping representation.

These paths followed the path of human access between the papakāinga location and Lake Rotorua to show the clear delineation between each side of Te Ngae Road, describing the relationship this roadway has to the entities surrounding it. Observed in this map, Te Ngae Road is the centre of suburban sprawl, seen in the quick disparity of architecture experienced when moving towards and away from the road.

The discoveries found by these hikoi maps allowed for a greater engagement with more-than-human entities as they appear to the human level experience. New discoveries were found that revealed disconnected relationships between entities in place. From an aerial perspective, the awa and roadways seem to interact and move over and below each other, while when seen from a human perspective, roads disrupt and disengage the awa. In this way these hikoi maps complement the larger scale mapping tests by offering smaller scale interactions directly with ecologies.

ōwhata suburbs

mesh.architecture manifesto

This thesis has developed Mesh Architecture as a design strategy to impact the effects of ecological crises through architectural design. This is presented here as a manifesto, a series of six statements aligning the criteria of Mesh Architecture with the finidngs of the research.

1. Mesh Architecture must be ecologically regenerative to positively impact the environment. To combat the loss of global biodiversity, architecture must actively work to increase biodiversity in the local environment.

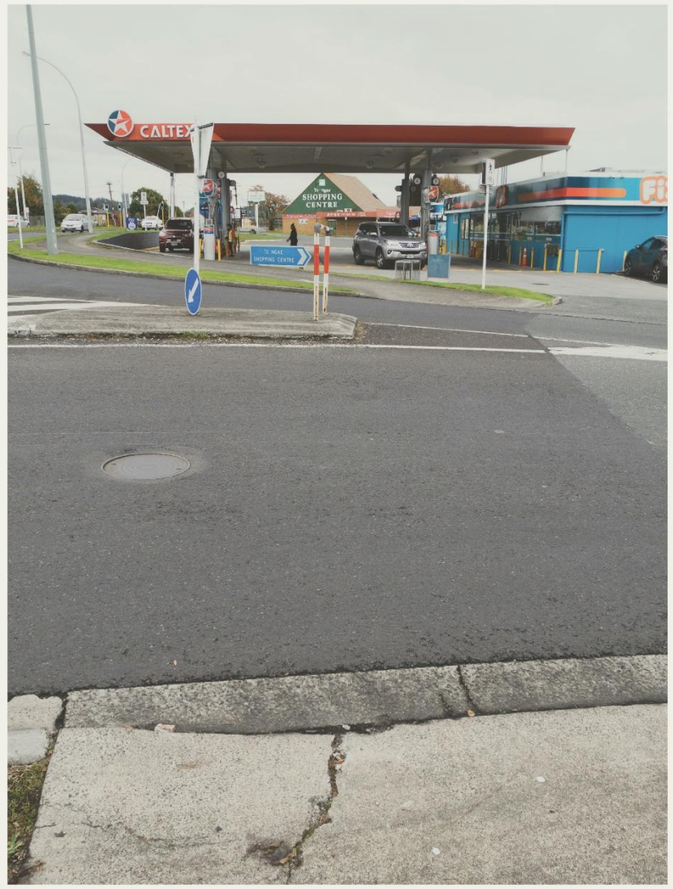
2. Mesh Architecture must participate with indigenous peoples to decolonise urban environments. Wellbeing cannot be exclusive to a dominant western culture but must be specifically embrace indigenous communities.

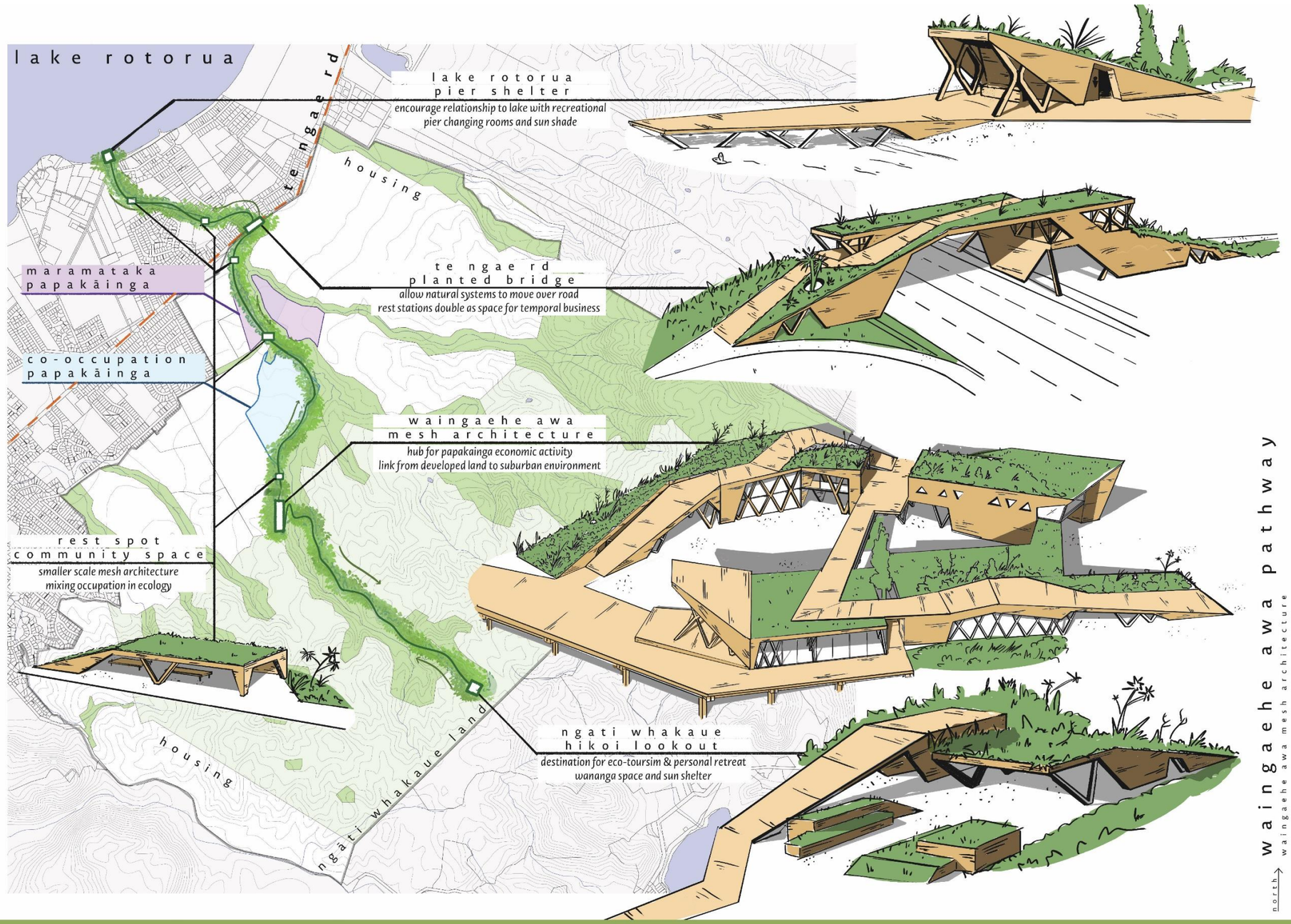
3. Mesh Architecture must create environments that enhance relationships between human participants, and relationships towards more-than-human participants. The architecture must be designed within a relational ecology of all more-than-human entities which rely on the wellbeing of each other.

4. Mesh Architecture asserts relationship through spatial permeability. The design must allow for permeable occupation of environments outside of a binary understanding of interior and exterior; encouraging incidental encounter through spaces of connection and communication.

5. Mesh Architecture works actively through landscape to regenerate more-than-human entities, within urbanised space. The mesh influences a landscape design that weaves natural and built environments through each other and promotes the sustainable existence of both in the same space.

6. Mesh Architecture is designed with attention to the mauri ora within materials, acknowledging their vitality. Materials are more than commodities but have a voice that can connect person to place.





ecological regeneration

Alongside the process of developing Mesh Architecture and testing this strategy through mapping methodologies, Mesh Architecture was simultaneously tested through a process of architectural design. Both research and design were developed in tandem, each responding to the other.
Through the design drivers of permeability, urban ecological landscapes, and material vitality, the architectural design was strengthened and refined to better address the goals of the research. This culminated as a resolved architectural design. Through this exercise, Mesh Architecture is evaluated in its goals to improve the wellbeing of more-than-human entities.

The architectural proposal itself sits within a design for a much larger urban design proposal which spans the length of the Waingaehe awa. Each student within He Puna Ora has provided an architectural proposal for the same papakāinga project, and collectively, a papakāinga centred development along the side of Waingaehe awa was proposed, which runs through the development. This plan shows how the three separate design proposals from Badimayalew, Collis, and Yates-Francis are linked with each other through a path from Lake Rotorua to the edge of Ngāti Whakaue land, connecting the papakāinga to a pathway spanning the length of Waingaehe awa.
The papakāinga proposal does not sit on its own but is part of a larger strategy to regenerate the awa through the planted river pathway which travels from the edge of Ngāti Whakaue land to the edge of Lake Rotorua.

1 **lake pier**
pier engagement with lake to encourage recreation
changing rooms and public bathrooms
entrance into waingaehe awa walkway & beginning of planting strategy

waingaehe awa regenera
degenerated area of the waingaehe regenerated throug
hikoi boardwalk along path to encourage public use of

lake rotorua

3 **te ngae bridge**
bridge over te ngae road linking planted walkway through transit corridor
planting allows wildlife to pass over the road safely
walkway allows safe hikoi to lake to encourage casual use

2b **shelter point**
rest spot along river pathway
planted roof park spaces
intermittently placed

te ngae road

existing ōwh

7 **co-occupation papakāinga**
papakāinga proposal by matangireia yates-francis
designs for co-occupation living towards native forestry

ngāti whakaue housing

waingaehe awa hikoi pathway photomap diagram

waingaehe awa pathway
existing native panting integrated with hikoi
additional planting extends range of ecologies

waingaehe awa pla

ation planting
gh native planting
the track

shelter point
study hall & library
connect walking track to existing suburbs
2a

existing ōwhata suburbs

maramataka papakāinga
papakāinga proposal by yennegh badimayalew
designs for living in relation to maramataka
6

ata suburbs

waingaehe awa mesh architecture
commercial development mesh architecture connecting papakāinga to natural landscape
working opportunities for small and temporary economies
connecting more-than-human ecologies through
4

development

lookout point
ngāti whakaue lookout
hikoi destination
informal wānanga secluded space
5

nted reserve

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e v e l o p m e n t

er development plan is not intended mediately built, but will be a process tive over many years. As this plan he architectural proposal is designed alongside it.

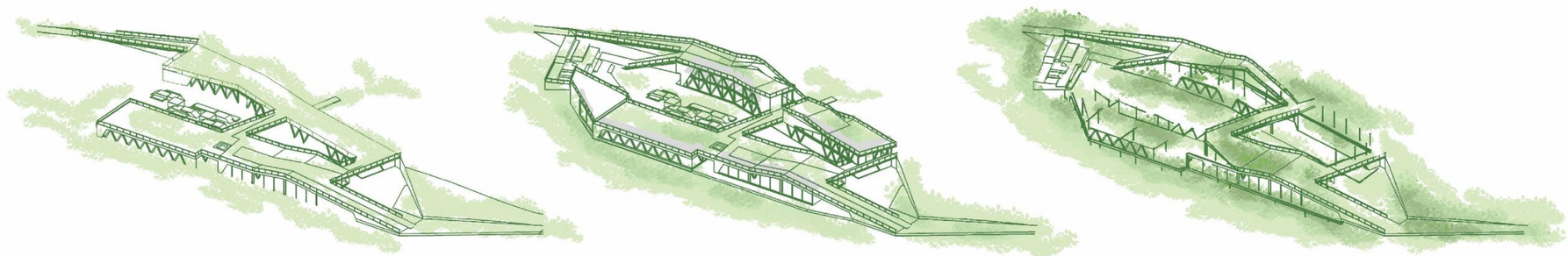
meline plan, the site itself begins its n in 2022 with the planting of native in and around the site concurrent establishing site works, that create a the emerging forest. This project vith the forest until the project is ed with the full maturation of both e planted trees and the culmination chitectural development in 2052.

eline development aligns the projects f ecological regeneration with c development of the community, as row together. This has been nted so that the importance of reated environments are not placed

e creation of environments for an-human entities.

ject is planned for a whole life ment where, at the end of the s lifespan in 2112, the project will be lished into an architectural folly. All manent elements will be removed, the established groundworks and structural members while removing manent claddings and finishing s.

tegy allows the landscape to retain s a human occupied walkway and or natural ecologies permanence is area of Rotorua.



PLANTED DESIGN

Ti Kōuka ands Karaka trees planted around site

Building platform created, structure as pergola folly

hikoi to site created

ESTABLISHED ARCHITECTURE

Young trees established large enough to plant ground cover harakeke & tororaro for mokomoko

First fruit of Karaka attracts Kererū

Ground floor of building one completed, creating opportuinities for newly established papakāinga

Housing developments completed at edges of Ngāti Whakaue land.

Larger tree growth and well established ground planting attracts takahē and other natives

Building one has second floor built to accomodate larger papakāinga development

Hikoi extended throughout Ngāti Whakaue land & used as eco-tourism opportunities

DISASSEMBLY

Ti Kōuka are matured to attract pekapeka into site

Architectural design is completed with building two creating a vibrant community centre to hold a large variety of activities

Suburban development bounded by fully realised papakāinga - ecological corridors begin being built throughout developments

Native planting fully realized within site, habitat for more-than-humans created

Architecture well established and completed with building becoming well used

Destablishment of Architecture into permenant folly. materials recycled or left in place to degrade.

ecological corridors established throughout Ōwhata, river pathways restablished.

Expected life of building completed, site left to be taken more fully by native forestry

Hikoi pathway retained while architecture removed

PLANTING

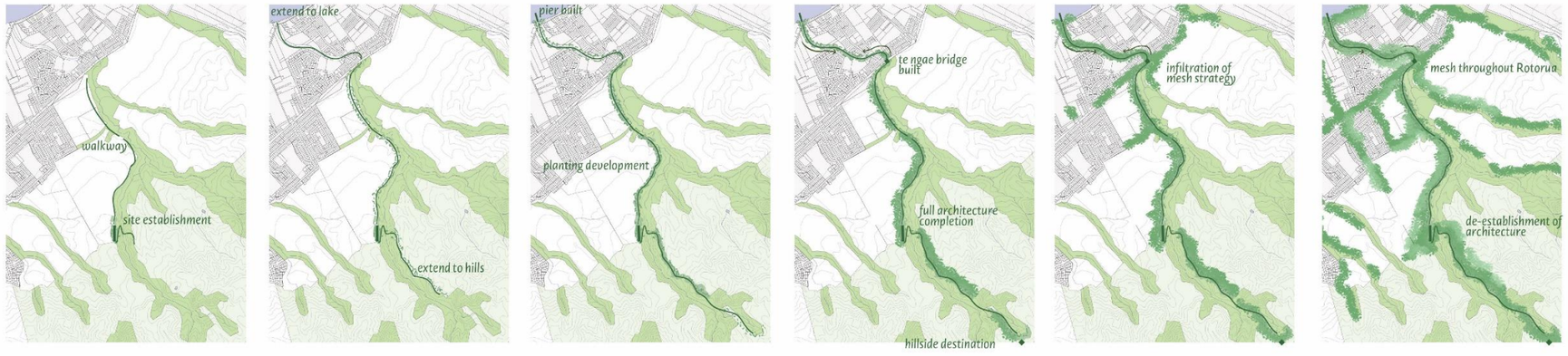
GROWING

ESTABLISHING

COMPLETING

SPREADING

TRACES



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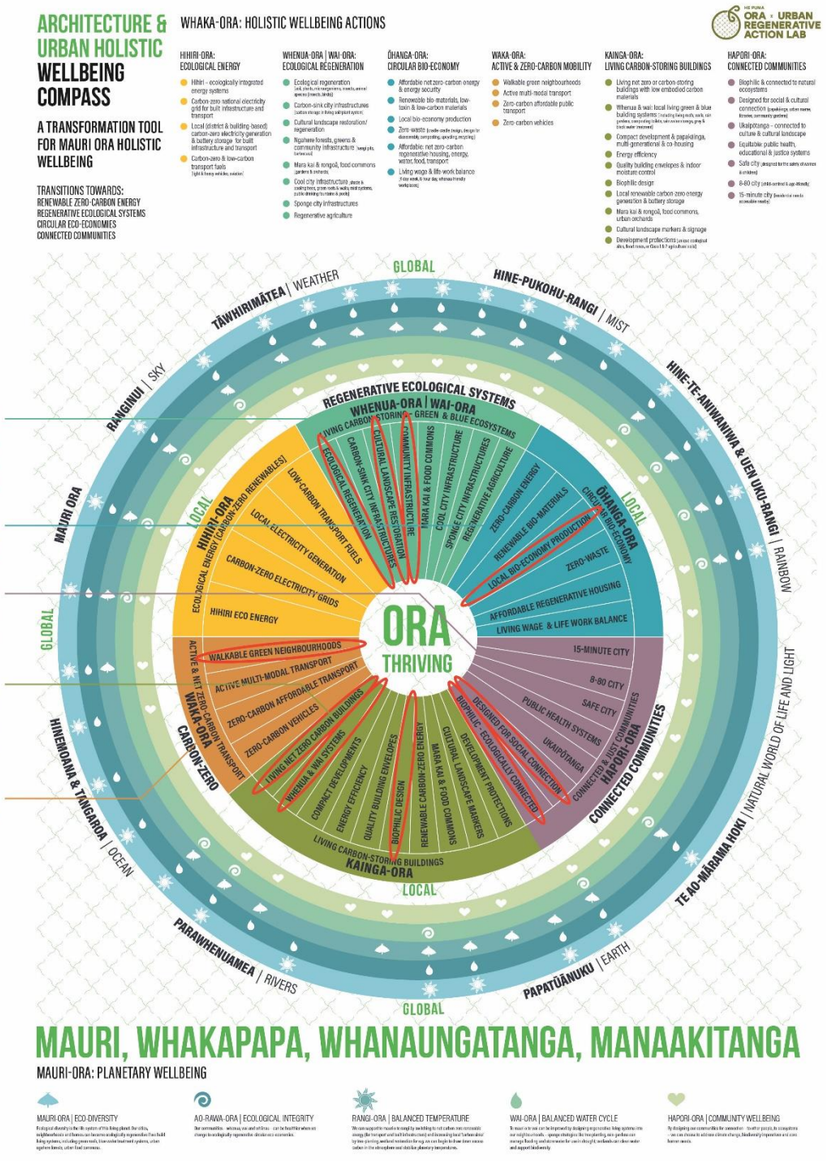


whenua-ora / wai-ora
Ecological regeneration
ultural landscape restoration
community infrastructure

ōhanga-ora
ocal bio-economy production

hapori-ora
esigned for social connection
philic-ecologically connected

kainga-ora
ing net zero carbon buildings
whenua & wai systems
biophilic design

waka-ora
alkable green neighborhoods

decolonisation

Mesh Architecture needs to work alongside indigenous people groups to achieve designs that can decolonize urban environments.

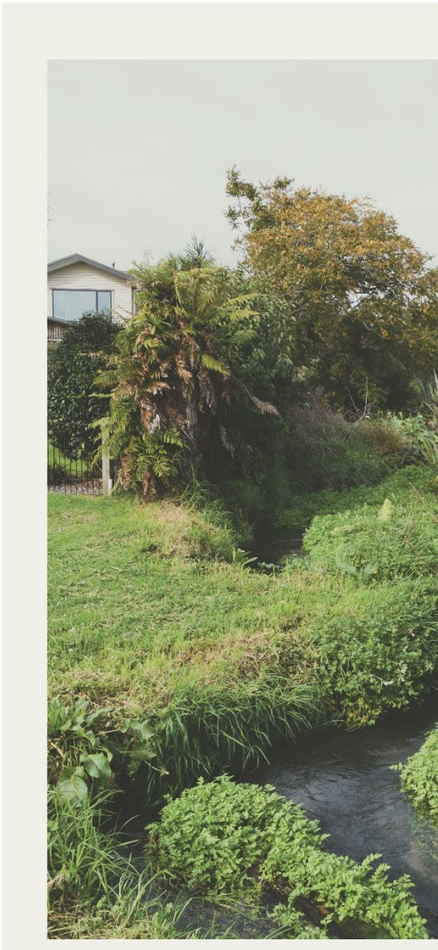
This architecture does this through aligning the use of the site to the values of Te Tatau. Developed within He Puna Ora ias the Wellbeing Compass which has been used here to demonstrate how this project works alongside Te Tatau and He Puna Ora to acheive holistic regeneration.

As Te Tatau introduced the project to He Puna ora, the request was for innovative housing designs for a potential papakāinga development. However, as this research investigated the desires of Te Tatau for community economic sustainability, the architecture proposed is for containing community commercial opportunities.

To cater for the success of a larger housing development an alternative arrangement for working opportunities was required. Aligning with the values of self-sustainability, this became the programme for small scale entrepreneurship within the building. The architecture itself does not dictate specific outworking's of this but attempts to cater for the future needs of a wide variety of activities.

Through the development of local economies, the building itself forges a relationship to the residents in the area. Mesh Architecture understands that the economic health of people is a vital aspect of wellbeing.

By providing areas for biodiversity to develop in urban regions, the architecture links the community to a relationship with more-than-human entities. By linking commercial activity with ecological regeneration, an existing relationship between the community and their natural ecosystems is made manifest through the building.



karaka
Karaka berries are edible if prepared correctly by carefully boiling the poison out from the centre of the fruit. Kererū are among the few birds that can eat these berries, which the trees rely on for propogation.

kererū
Kererū are aotearoa's only native pidgeon. These birds traditionally served as a primary food source for māori pre-colonialism. These birds are vital for the spreading of the seeds of karaka & Tī Kōuka which the kererū feed on

pekapeka
Pekapeka are drawn into residential spaces by providing bat boxes built under the subfloor.. as native planting develops, these trees become more natural roosts than the artifical ones. The hollows of mature tī kōuka are often used for natural roosts

mokomoko
mokomoko thrive in the small hiding spaces created from loose rocks and mulch ground cover. feeding off of these native bushes and grasses they also serve a purpose in distributing seeds for these plants

tī kōuka
Tī Kōuka provide soft bark for roosting of pekapeka and the small berries attract tauhau. The large leaves provide mulch as the tree continually moults. These trees are susceptible to disease and rely on artifical planting for survival

harakeke
Native flax bush species were special for māori providing a source for weaving & medicine. The flowering branches attract Tui and as the flax covers the ground and creates natural mulch, mokomoko are given natural habitats, the nectar also providing them food

Within the main courtyard local planter boxes are the centre of the gathering space. These encourage participation by their accessibility. By promoting a culture of local cultivation of crops, a local scene of home-grown agriculture is developed.

Throughout the design, architecture is connected intrinsically into the landscape to become part of the natural ecologies. native bushlands and trees push through the built environments creating more accesible habitats for at-risk species

Connection to the Ngāti Whakaue housing development is directly adjacent to suburban housing, making a relationship between local communities and a working environment.

interior/exterior halfway space blurs distinction between landscaped, paved & enclosed environments, blending movment through the whole building to create more-than-humans relationships

w a i

Waingaehe Mesh
building cut into th
awa. The building
eastern single-s
double-story stru
adjacent roadwa
housing developr
connected by bri
connect the acces
These roofs are la
central courtyard
feature predomina
designed to encou
throughout the co

The architecture
hikoi track by int
walking paths, t
architecture, over
access through the
to this pathway
environments, co
café. Connected
enclosed private
private areas is d
move through pu
encouraging inci
through multiple s

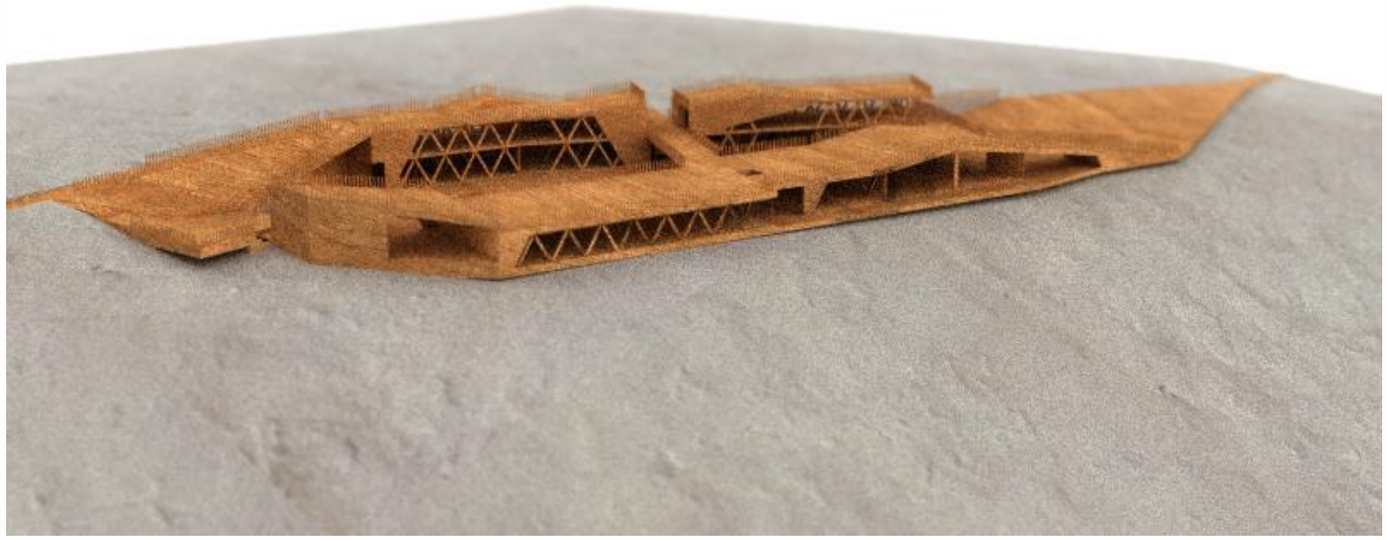
n g a e h e . m e s h . a r c h i t e c t u r e

Architecture is a split double-story
he river-bank adjacent the Waingaehe
features two separate buildings of an
tory structure and a western
cture which was level access to an
y connected to Ngāti Whakaue's
ment. The separate buildings are
dges over a central courtyard which
ssible roof spaces for pedestrian use.
rgely planted, as are areas within the
and surrounding the structure. These
antly native planting which have been
urage conservation of native species
mmercial space.

integrates with the Waingaehe awa
egrating this pathway into rooftop
his pathway moves through the
the walkable roofs, providing public
e structure from each end. Connected
are public spaces such as a park
urtyards, community gardens, and a
to these public spaces are then
working spaces, accessing these
lone through gradients where users
blic spaces to access private ones,
dental encounter as users move
paces to access the interior.

These spaces are further mediated by transitioning through outdoor and indoor spaces. The architecture shifts between enclosed halls intended for human activity and planted natural landscape. Between these are a range of halfway spaces that make up the bulk of the design, creating areas that question the distinction between landscape and interior space. Moving through the site along the central hikoi pathway encourages encounters between users as they transition through natural landscapes to gain access to interior locations.

The layout of this structure acts out Mesh Architecture by allowing a porous movement through landscape and enclosure. Users of the site are encouraged to move from suburban areas into an enclosed environment via a series of landscapes to enter fully human-centric environments. In this way, the design asks users to engage with more-than-human entities as they move throughout.

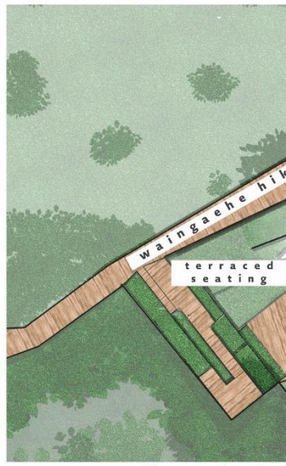


9 . a r c h i t e c t u r e p r o p o s a l

site plan

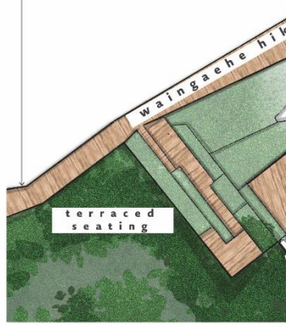
waingaehe mesh architecture

north



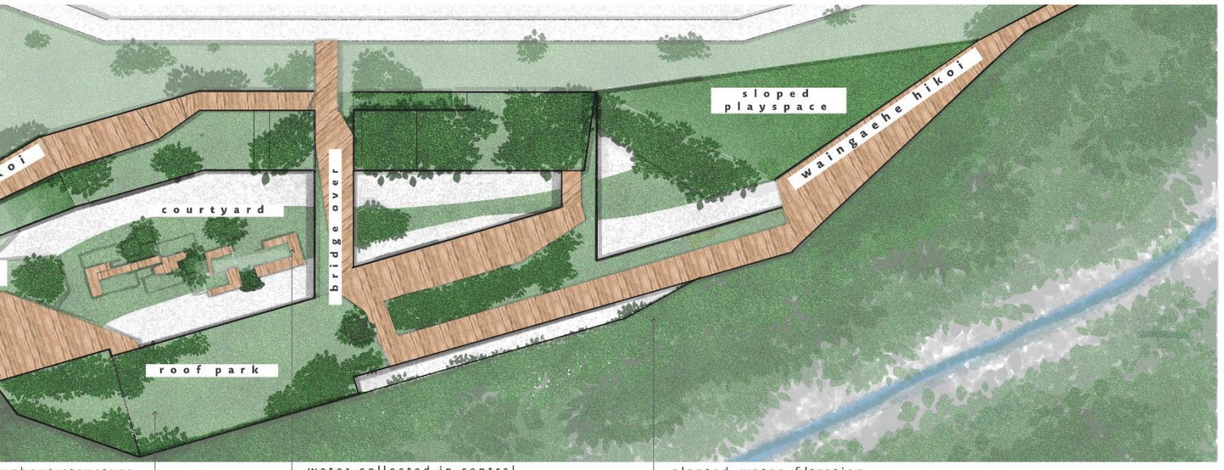
native planting thro
to permeate into urb
as the native plan
through built en
wildlife comes with

movement towards edge of ngāti whakaue land. nature boardwalk hīkoi through preserved native planting along waingaehe awa



10.plan detail

ngāti whakaue housing
access roadway



ughout structure
oan environment.
ting is brought
vironments the
it

water collected in central courtyard and used for building services supply including community food gardens

planted water filtration gardens alongside of built structure to protect river from contaminated runoff

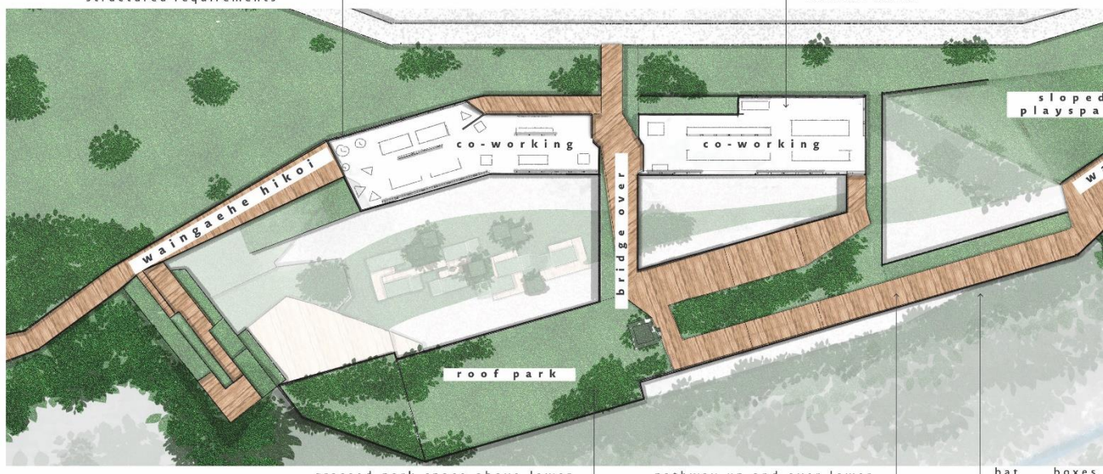
combined plans

waingaehe mesh architecture

north

co-working environments set up for casual meeting groups and study halls with group seating and beanbags for less structured requirements

co-working environments set up as more formal desk arrangements for office required business. furniture designed to promote interaction between users



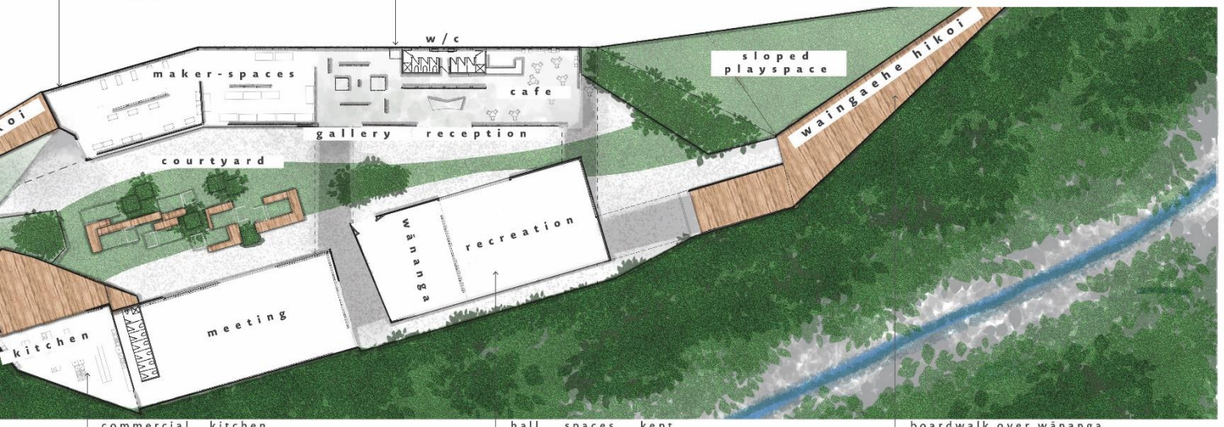
grassed park space above lower building planted as a picnic space mixed with low native bush shrubs. integrated human and animal habitats

pathway up and over lower buildings. connected through to waingaehe awa pathway and to papakāinga development footpaths

bat boxes alongside de architecture attract pekap into urban spa

spaces dedicated for physical manufactuuring, caters for small scale economic production, and learning spaces

cafe gallery & reception for building all within semi-enclosed open air environment. stitch space between fully enclosed internal and external areas



commercial kitchen avaialble as a production space and as as an opportunity for cooking classes

hall spaces kept unprogrammed to allow for more varied and free-form acitivity as required

boardwalk over wānanga halls connecting waingaehe awa walking path through developed architecture

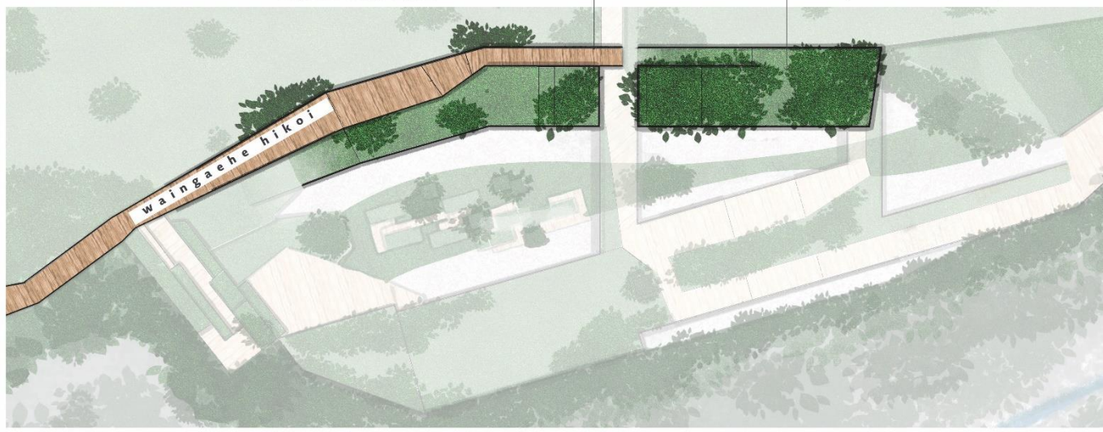
lower floor plan

waingaehe mesh architecture

north

boardwalk passes over building to allow overlook and connect walking track to different environments as it passes through contained whenua and exposed rangi space

intensive native planting over co-working area. attracting native birdlife into urban spaces through providing patches of habitat throughout human used spaces



upper floor plan
waingaehe mesh architecture

built
eveloped
to
eka back
aces

rooftop plan
waingaehe mesh architecture

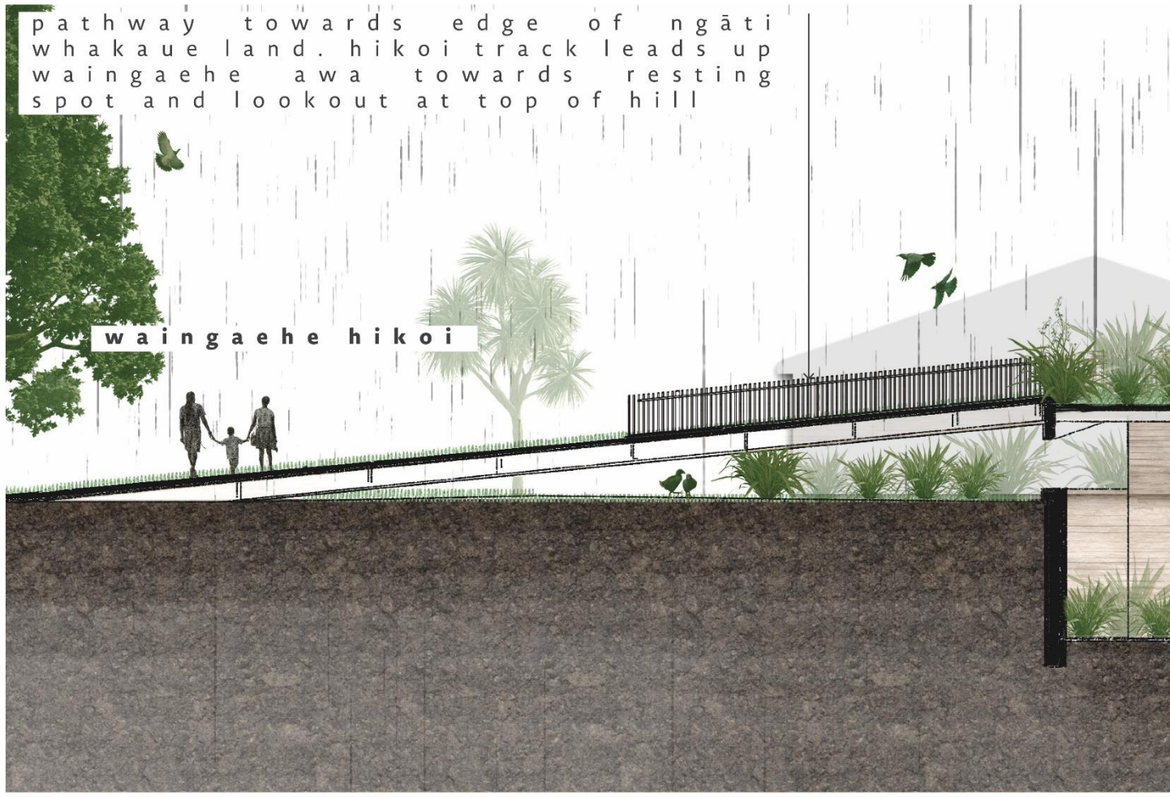
social sustainability

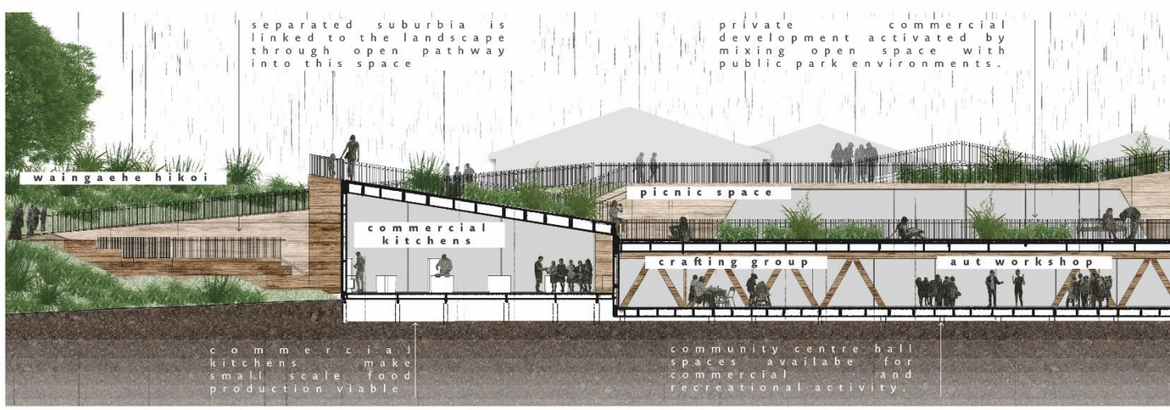
The use of the development is a range of commercial activities, interwoven with a public accessway connecting users of the site with the hikoi track. The architectural proposal sits within a papakāinga, but from investigating the vision of Te Tatau for the future of the region, the programme for this proposal moved away from designing housing itself. Observed in the goals of Te Tatau was the intent for self-sufficiency, self-determination, and commercial sustainability to be encouraged in the wider communities of Māori in Te Arawa.

Here in Ngāti Whakaue's papakāinga this architectural proposal addresses that goal not by providing housing, instead creating a centre for community commercial sustainability. This centre allows for the success of community business by encouraging a range of local small-scale enterprise. This is designed through a range of loosely planned spaces which each work towards the goals of creating an environment which promotes economic opportunity and ecological regeneration.

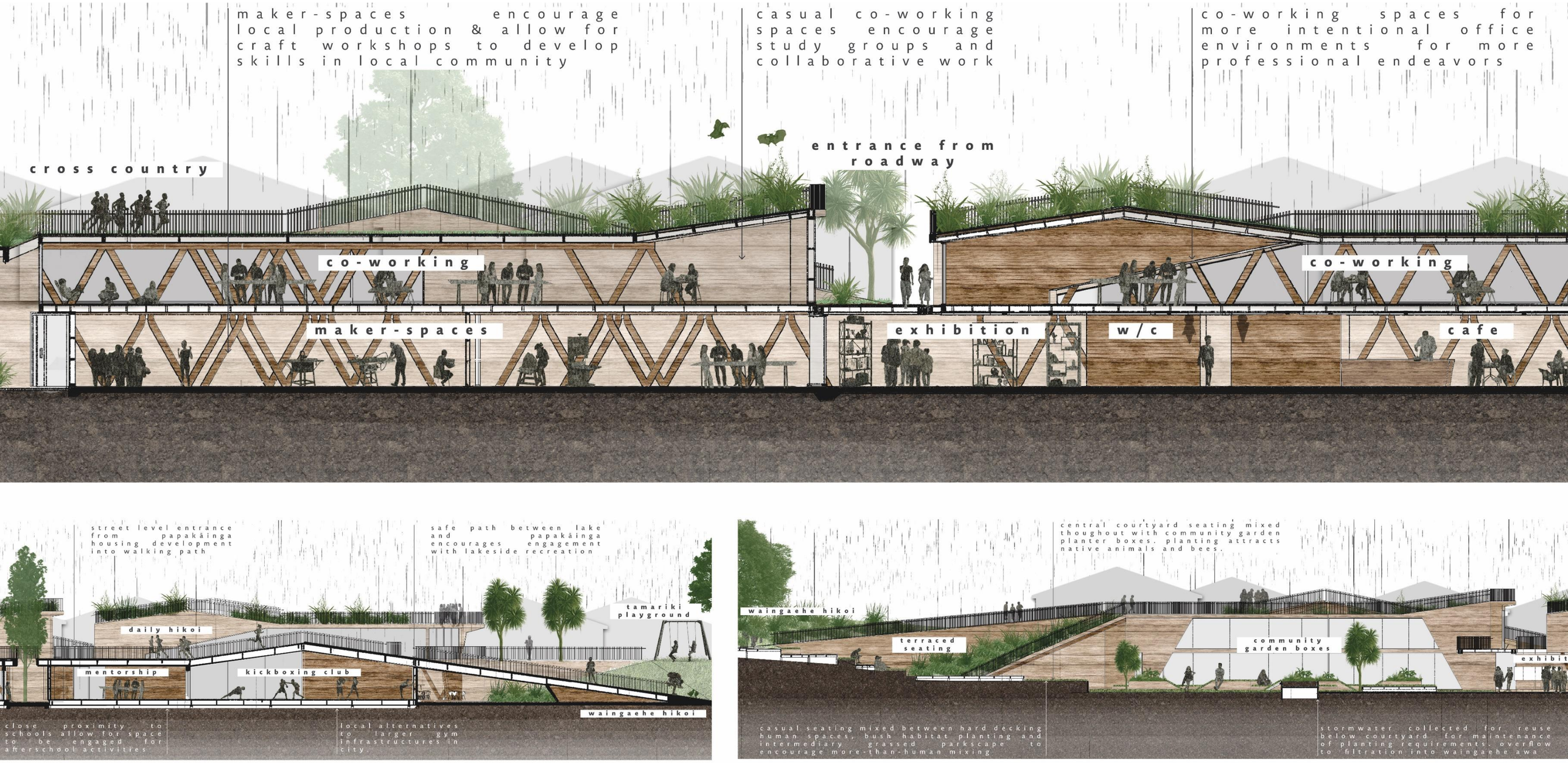
By offering a range of small, flexible spaces, the kinds of opportunities encouraged are small scale or part time business. This scale of business is more appealing to the members of a community who do not have the ability or resource to manage a full-scale business in the central city, but also need more space than their personal home provides.

Through this open but small programme, the building engages directly with the people living close to the site and encourages their economic wellbeing by providing opportunities for local economic growth. The intent of this program is to encourage the economic stability of the people within the papakāinga and surrounding suburbs. By doing this the architecture creates a relationship with the people in its place by encouraging the wellbeing of the patrons and the site through their engagement with each other.





11.section detail


maker-spaces encourage local production & allow for craft workshops to develop skills in local community
casual co-working spaces encourage study groups and collaborative work
co-working spaces for more intentional office environments for more professional endeavors
cross country
entrance from roadway
co-working
co-working
maker-spaces
exhibition
w/c
cafe
street level entrance from papakāinga housing development into walking path
safe path between lake and papakāinga encourages engagement with lakeside recreation
tamariki playground
daily hikoi
mentorship
kickboxing club
waingaehe hikoi
close proximity to schools allow for space to be engaged for afterschool activitires
local alternatives to larger gym infrastructures in city.
central courtyard seating mixed thoughout with community garden planter boxes. planting attracts native animals and bees.
waingaehe hikoi
terraced seating
community garden boxes
exhibit
casual seating mixed between hard decking human spaces, bush habitat planting and intermediary grassed parkscape to encourage more-than-human mixing
stormwater collected for reuse below courtyard for maintenance of planting requirements. overflow to filtration into waingaehe awa

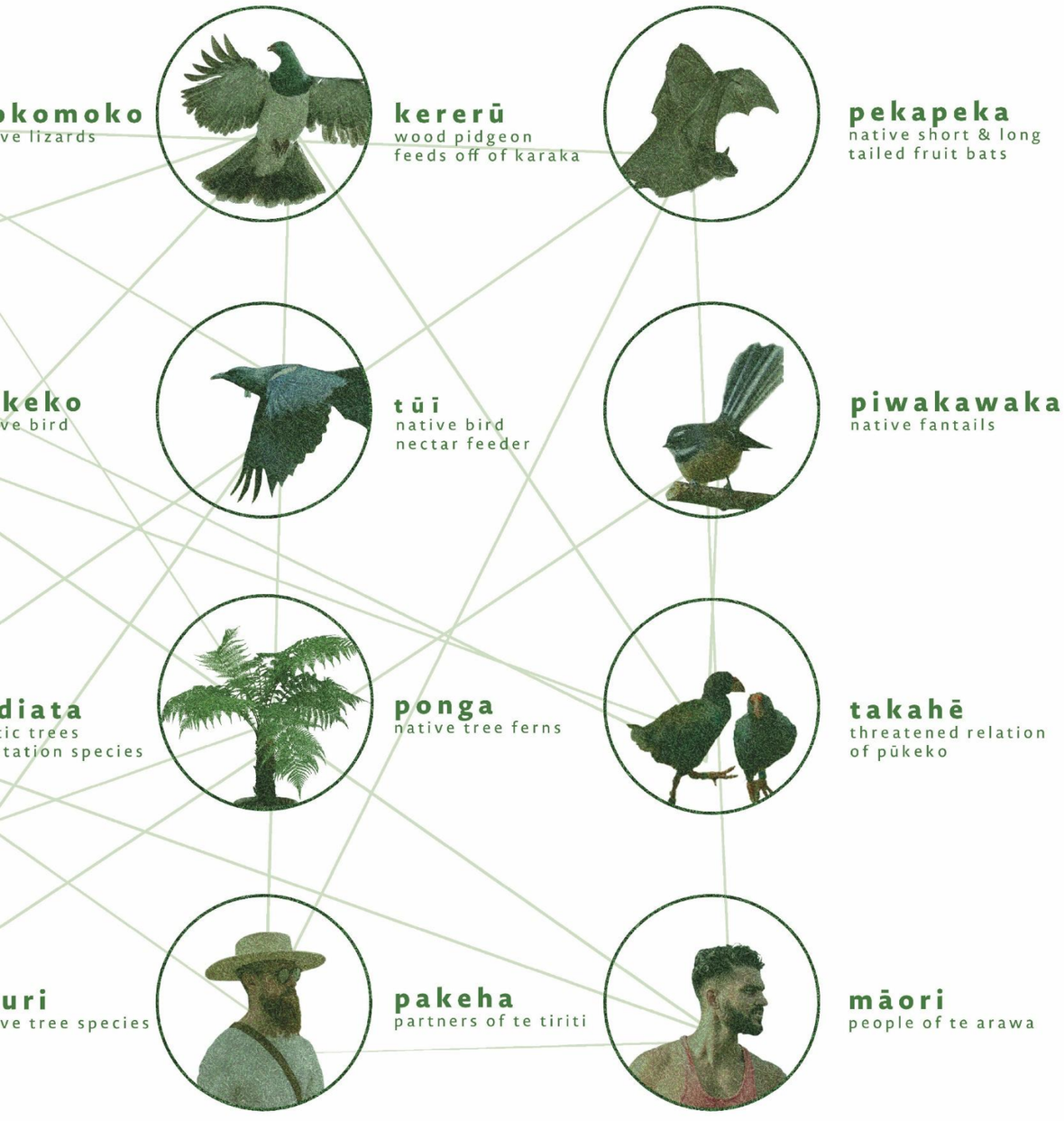
more-than-human relationality

Mesh Architecture needs to actively regenerate the natural environment through architectural design. This architecture does this through the implementation of specific planting strategies which integrate heavily through the development.

A large concern of natural ecologies in Aotearoa are native animal and plant species, which are currently in decline or at risk of extinction. Throughout this project, specific environments are cultivated which encourage endangered animals to have habitats within the architecture.

As much of the planting used to create these habitats are native plants, the environments cultivate the regeneration of both animal and plant life. Karaka Trees have been planted through the entrance and rear courtyard of the site which have a symbiotic relationship with Kererū (wood pigeons). These birds are one of the only native bird which can digest the berries of the Karaka and disperse the seeds. Tī Kōuka (cabbage trees) have been planted throughout the central planted strips and around the edges of the site. These trees are an excellent habitat for pekapeka (bats) who enjoy creating roosts in the soft bark of these trees. Harakeke (flax) and tororaro (native shrubs) are both planted in large groups surrounding the larger trees to create spaces for mokomoko (lizards) to inhabit. Mokomoko are in decline in cities, but are very able to live in urban sites provided they have dense ground cover planting .

Through these ecological symbioses, the architecture actively engages with regeneration by weaving throughout the habitats. As the planting spreads up and over the building the building spreads into the native habitat to create a dual habitat for humans and the wildlife.

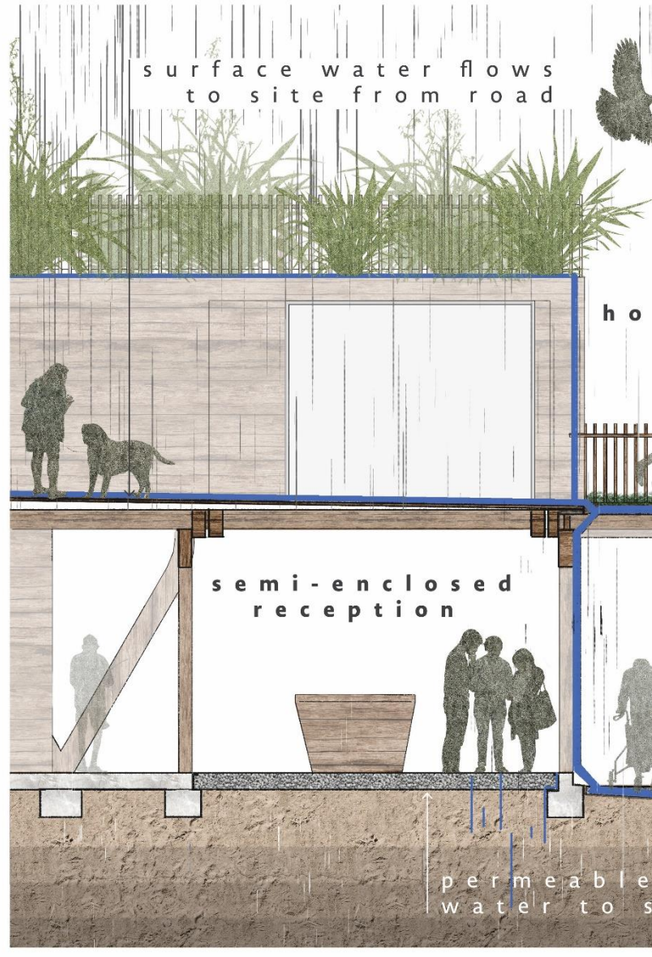


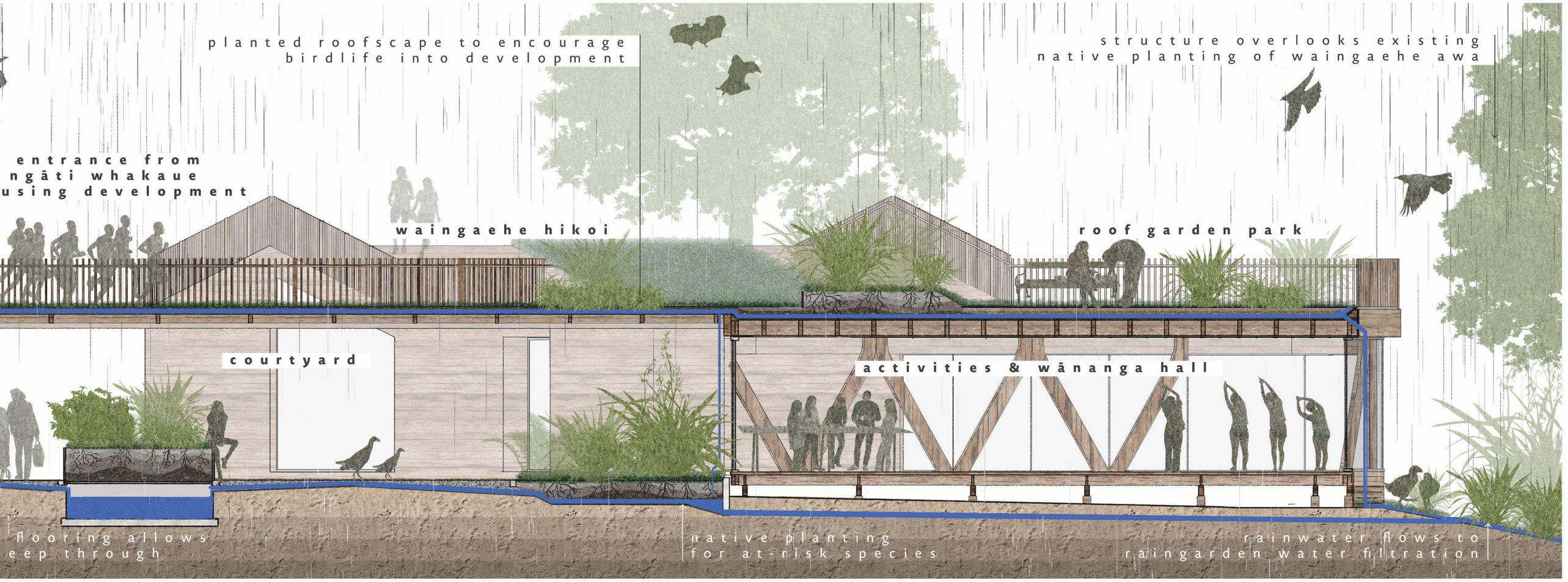
permeable architecture

Examining this project has demonstrated that employing a practice of Mesh Architecture is effective in developing architecture that regenerates wellbeing for more-than-human entities.

In this design, the health of the river has been improved; native ecosystems are encouraged to thrive in a space that would typically disallow them; global carbon emissions are reduced; mauri ora is uplifted in the construction and use of the project; small scale resilient economies are encouraged in local communities; relationships between isolated human communities are encouraged to develop; and humans are encouraged to engage in meaningful co-dependant relationship with more-than-humans in their immediate environments.

The resulting architecture begins to decolonise the urban space in Rotorua, encouraging Ngāti Whakaue, Te Tatau, and the tangata whenua to have more agency within the deeply ingrained colonial culture in Aotearoa.




planted roofscape to encourage
birdlife into development
structure overlooks existing
native planting of waingaehe awa
entrance from
ngāti whakaue
using development
waingaehe hikoi
roof garden park
courtyard
activities & wānanga hall
flooring allows
eep through
native planting
for at-risk species
rainwater flows to
raingarden water filtration

m e s h . a r c h i t e c t u r e

The world has not always looked the way it does now. Our world, our cities, look vastly different from the past, and will look vastly different in years to come.

As designers, we have an opportunity to encourage the trajectory of this development towards sustainable practices that regenerate ecological relationships.

As architects, we must find a new way of designing if we are to create a future of interconnected relationship with our more-than-human participants.

In developing the strategy of Mesh Architecture, I do not propose an isolated solution but are exploring how my practice of architecture in Aotearoa could begin moving in a different direction, to cultivate regeneration in our cities.

This design strategy is offered as a pathway for exploring how the wellbeing of more-than-humans might be regenerated, how indigenous stories and worldviews might be woven back into urban spaces, and how architecture might develop to become a regenerative agent within the Anthropocene.

In this way I hope to develop greater relationships towards our more-than-human entities in Aotearoa through Mesh Architecture.

Text and image by Todd Collis

Acknowledments to research partners He Puna Kāinga-Ora Housing and Urban Wellbeing Lab, Matangireia Yates-Francis, Yennegh Badimayalew, and Madeline Dumagan.