

From FARM to FORK:

An architectural response to food insecurity & bridging the natural world,
food producers, & consumers for a community resilient food landscape.



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2025

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 used artificial intelligence tools or generative artificial intelligence tools (unless it is clearly stated, and referenced, along with the purpose of use), 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.

ABSTRACT

With the decline of our environment's health and the failings of Aotearoa's food system, this project identifies the dangers of food insecurity and the fragmentation between food producers, consumers, and the natural environment.

Urban sprawl into food-productive landscapes threatens domestic food security, diminishing versatile soils, and creating tension between new residents and existing farmers.

This research is an architectural solution that mediates these tensions by designing a built food haven in Pukekohe, Aotearoa.

The architecture connects food producers, consumers, and the environment within a food hub that provides community infrastructure, knowledge exchange, accessibility to local food production, food sovereignty, and collaborative initiatives between the three stakeholders.

Bridging these relationships in place fosters awareness of food system and living system processes that food production and people's health depend on.

ACKNOWLEDGEMENTS

I would like to thank my main supervisor Sibyl Bloomfield, and co-supervisor Maibritt Pedersen Zari for their guidance and valuable advice throughout this thesis and previous teachings that have influenced my practice.

Thank you to an amazing and supportive cohort that I have journeyed with for the past five years.
I wish you all the best.

To Alex, Mum and Dad, thank you for all your love and care that have carried me through my studies.

PEPEHA

Tēnā koutou, tēnā koutou katoa.
Nō Koria a Kingitanga Kotahi ōku tīpuna,
engari I whānau mai au Tāmaki Makaurau.
Ko Te Uru o Tāmaki Makaurau te kainga,
I tipu ake ahau tata ki Waitakere te maunga a ko Whau te awa.
Ko Bonnie Sujung Gray toku ingoa.
Ko tēhei taku mihi ki ngā tangata whenua o te rohe nei.
Nō reira, tēnā koutou katoa.

Greetings to you all.
My ancestors come from Korea and the United Kingdom,
but I was born in Auckland.
West Auckland is my home.
I grew up near the Waitakere Ranges and Whau the river.
My name is Bonnie Sujung Gray.
I acknowledge the indigenous people of this area.
Thus, I acknowledge you all.

Figure 1
Huia Bay



Note. photograph of Huia Bay on Durst Automatica 1950's film camera, by Author. 2024.

POSITIONALITY STATEMENT

Growing up in West Auckland with access to the Waitakere Ranges, beaches, and forests allowed me to develop a connection to place and appreciation for the unique natural environment Aotearoa has.

This connection to place, and growing up gardening, camping, and observing Aotearoa's biodiversity have shaped my experiences with the natural world. These connections influenced my relationship and design practice to engage with natural landscapes with care.

My practice reflects a hope for people to be able to experience similar connections, develop appreciation for the natural environment, to work with and nurture it, especially in a time of climate change, biodiversity loss, and exploitation of natural resources.

The position of this research is to understand architecture as a regenerative tool in response to problems such as biodiversity loss, and food insecurity. To provide outcomes that improve quality of life for both people and ecosystems.

Figure 2
Camping at Whatipū



Note. photograph of author as a child at Whatipū, West Auckland. 2008.

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CHAPTER

1.0

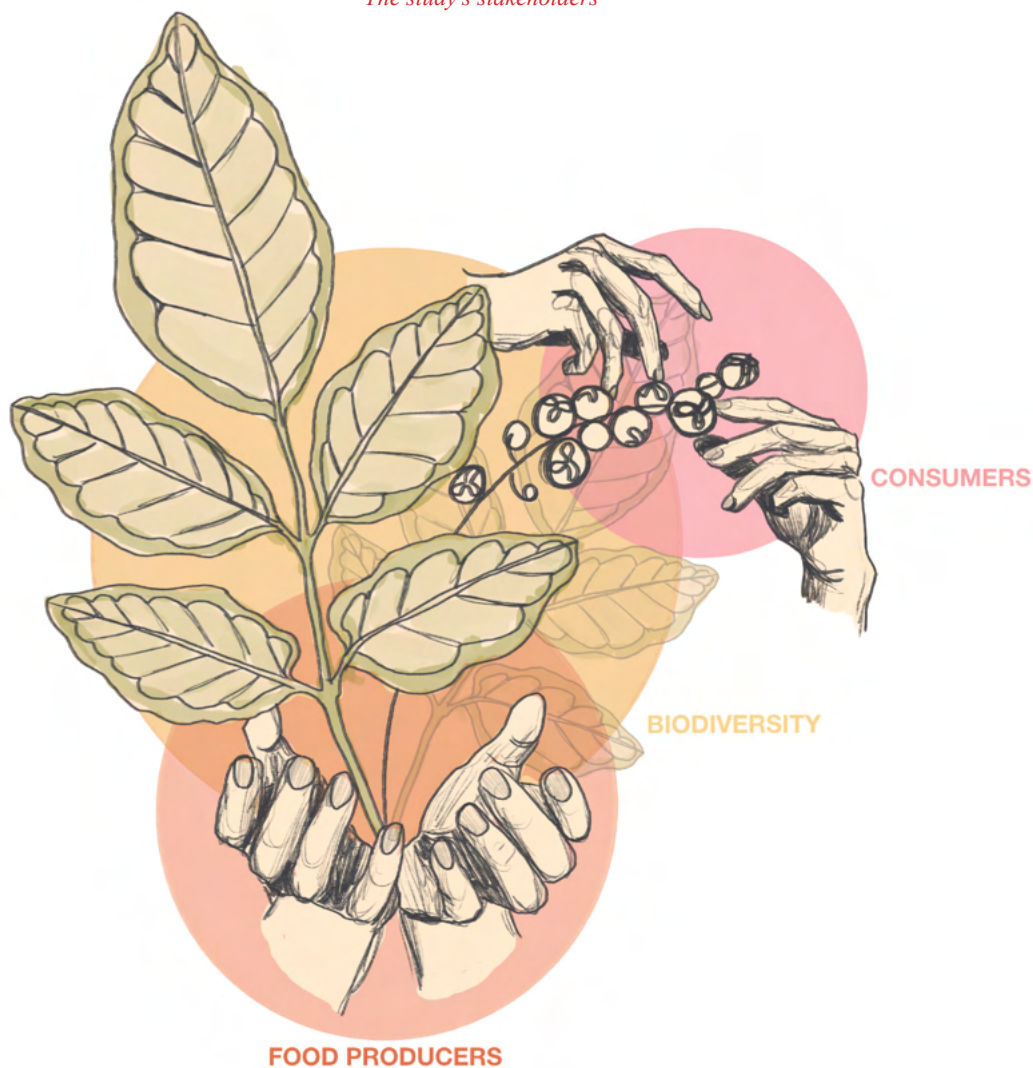
INTRODUCTION

1.1 INTRODUCTION

This thesis investigates the role of architecture as a response to the failings of Aotearoa's food system, food insecurity, and the loss of food-productive land to urban development. The study adopts holistic frameworks to be applied within architectural practice; these frameworks prioritise enhancing the well-being of people, and the environment within the context of design, food practices, and relationships between food producers, consumers, and biodiversity.

The study is place-based to ground the research to site-specific contexts that informs the tensions, and relationships that the study aims to mediate. The architectural research is iterated through design stages: initial design, concept design, and developed design. These stages refine, and position architecture as a tool for ecological and social remediation that bridges food producers, consumers, and biodiversity within a competing suburban and rural landscape to foster community and ecosystem resiliency, food security, and food sovereignty.

Figure 3
The study's stakeholders



Note: Diagram of key stakeholders: food producers, biodiversity, & consumers.

1.2 PROBLEM STATEMENT

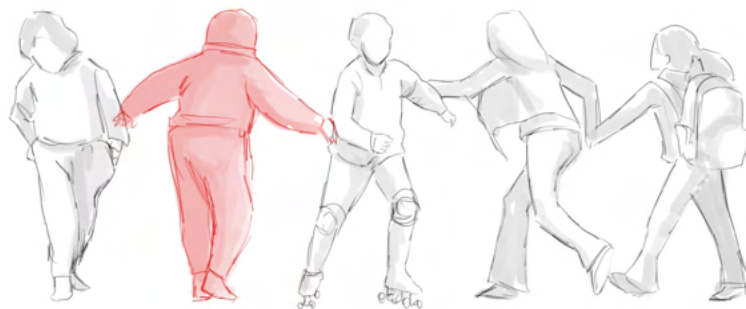
The food system is failing in Aotearoa (PHAC, 2024). The system is failing to provide food security, access to healthy, affordable, and cultural foods for consumers (PHAC,2024).

This section breaks down the problem that drives this research project: how the food system is failing, and why this problem is relevant within the built environment. This develops aims and objectives for the study to adapt architecture into food systems to support and enhance the relationships between food producers, consumers, and biodiversity.

Food security is defined as having guaranteed access to safe foods that are nutritional, culturally acceptable, and have been acquired ethically (Carter et al, 2010). Food insecurity is the consequence of limited resources, when food becomes uncertain in availability and accessibility, and can't provide safe, nutritional, culturally, and ethically acceptable foods (MOH, 2019).

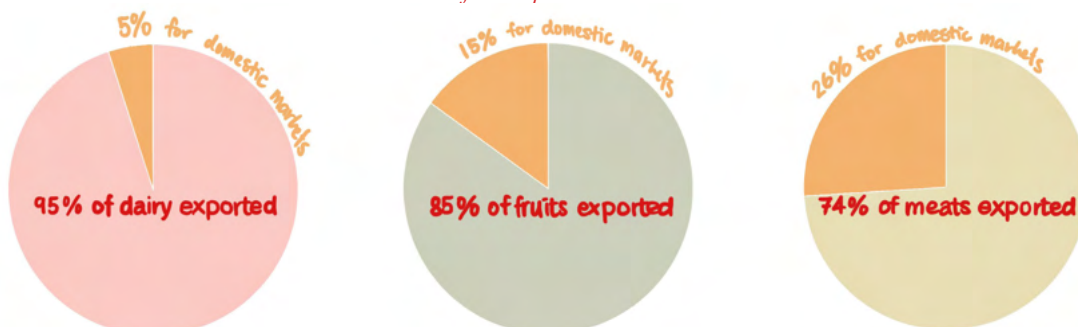
How Aotearoa's food system is failing to provide food security is due to the prioritisation of financial gains over feeding people: food is treated as a product of commerce rather than a basic human right (PHAC 2024). This is shown in the statistic that one in five children in Aotearoa experience moderate-to-severe food insecurity (MOH, 2019), yet the agriculture and horticulture sectors that produce the country's foods make billions of dollars in revenue through exporting 95% of dairy products, 74% of meats, and 85% of fruits (Soliman & Greenhalgh, 2020). The Horticulture Sector alone returned \$7.3 billion in 2023 (MPI, 2023) emphasising that the food system in Aotearoa seeks profits from global markets before ensuring domestic food security.

Figure 4
One in five children in Aotearoa are food insecure



Note: Author's diagram from statistics provided by the Ministry of Health (2019).

Figure 5
Aotearoa's food exportation statistics



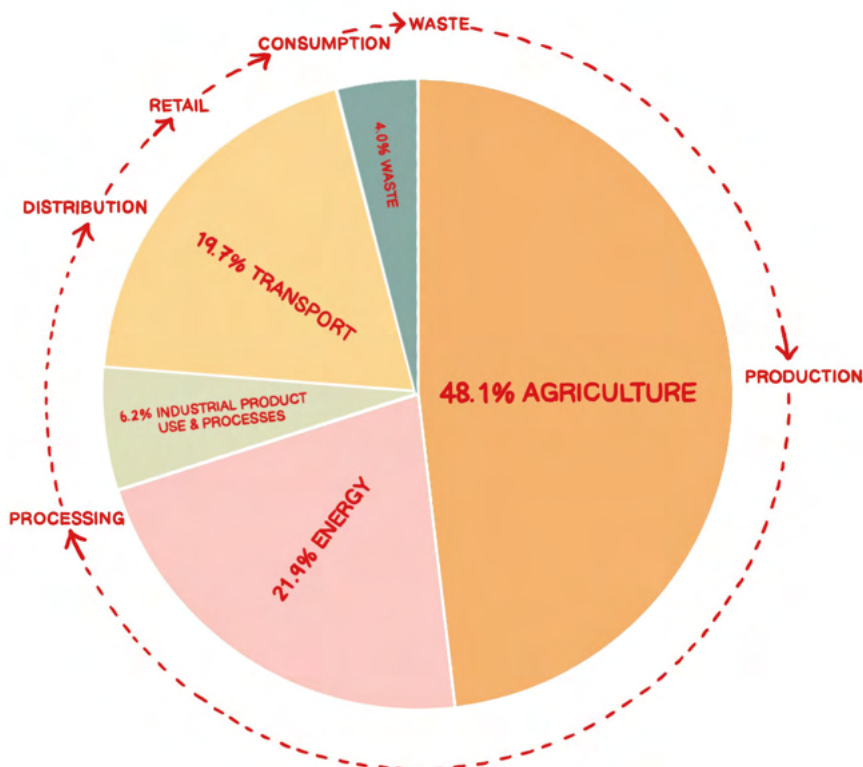
Note: Author's diagram from statistics provided by Soliman and Greenhalgh (2020).

Aiding this reality, that food is a commodity in Aotearoa, the leading indications of food insecurity are the high costs of foods and low incomes earned by households (MOH, 2019) (Carter et al, 2010). The retail space of Aotearoa’s food system is dominated by a duopsony and duopoly that consistently makes high profits due to underpaying food growers and price gouging consumers, by driving high prices that exceed household incomes; it strains the well-being and livelihoods of food growers and consumers (Malcolm, 2021). Food insecurity causes many health complications and a poorer quality of life. Children in food-insecure households experience ongoing affects on their growth, education, relationships, and future (MOH, 2019).

Food is not a product, it is a necessity for survival but more importantly it is fulfilment, it is health, quality of life, expression of culture, a way to bring people together, and share connections with others and the environment (Chu-Ling, 2022).

Aotearoa’s food system contributes to the degradation of the natural environment by exploiting its resources and harming its ability to support future environments and generations (PHAC, 2024) (Hutchings et al, 2012). The food system contributes more than 50% of Aotearoa’s total greenhouse gas emissions (PHAC, 2024); these outputs are from the food system’s western model of mass production, processing, distribution, consumption and waste (TUOM, n.d.) This industrialised and monocultural system contributes to the severity of climate-change impacts and the environment’s decline, through practices that lead to biodiversity loss, soil degradation, and land fragmentation (Vinnell, 2021). Practices that harm the environment include inappropriate land-use, excessive usage of synthetic fertilisers, herbicides and pesticides, introduction of invasive species, energy demands, excessive irrigation, nitrogen leaching, and agricultural waste polluting water sources (Vinnell, 2021).

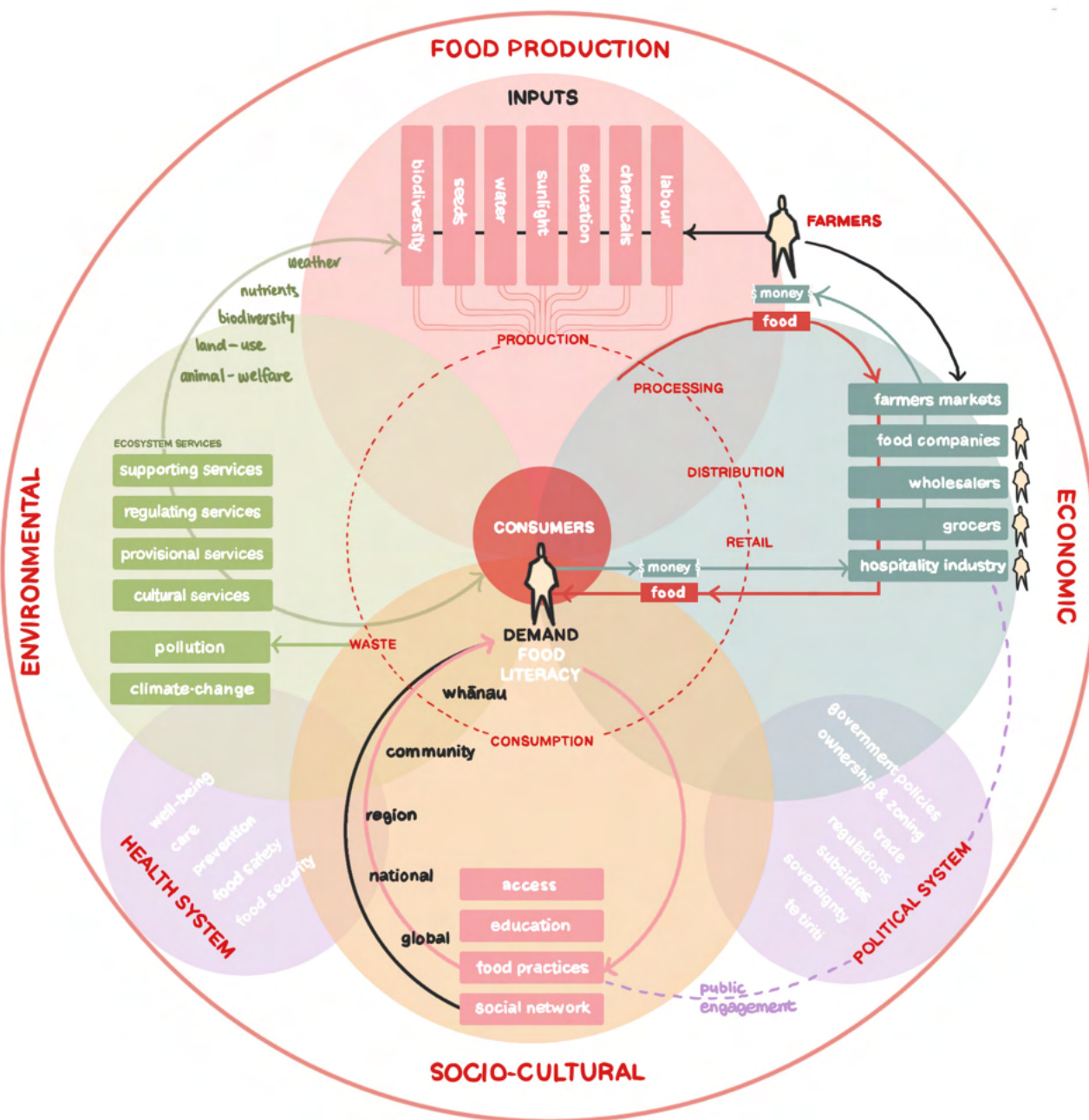
Figure 6
Aotearoa’s greenhouse gas emissions



Note: Author’s diagram from statistics provided by NIWA (n.d.). The food system’s contribution to Aotearoa’s total emissions.

Food production relies on the health and biodiversity of the natural world; the natural world is the original food producer, yet the food system is extracting from the environment and reaping the consequences of human-induced climate change, such as the events of Cyclone Gabrielle (NIWA, 2024). Cyclone Gabrielle damaged up to 47% of apple trees and crops in Hawkes Bay, and 90% of Northland’s kumara crops were lost (MPI, 2023). Both places experiencing challenges supporting consumer demands, future cultivations, and food producer’s livelihoods. Creating a dependency on international food chains to support gaps, this shows Aotearoa’s food system needing to shift to local, resilient, and adaptable food production (MPI, 2023) that provides domestic food security and holistic support in times of crisis.

Figure 7
The relationships & services of the Food System



Note: Author’s adaptation of the food system informed by Nourish (n.d.).

Figure 8
The Food System's supply chain

from farm to fork: PRODUCTION ---- PROCESSING ---- DISTRIBUTION ---- RETAIL ---- CONSUMPTION ---- WASTE



Note: Diagram illustrating the food supply chain, how it travels from farm to fork.

The food system is interwoven with socio-cultural and ecological conditions that it is under-serving, which has distanced relationships and awareness between farmers, consumers, and biodiversity, as they're not working in symbiosis. Knowing the conditions and consequences of Aotearoa's food system, there is now the question: how is architecture relevant within the food system?

Architecture's relevance within the food system is often overlooked but at surface level it provides supporting infrastructure for the food supply chain: production, processing, distribution, and retail, with designs for cropland planning, greenhouses, warehouses, and supermarkets. But architecture's relationship with the food system goes beyond that, as the built environment threatens food-productive and rural landscapes with urban expansion and land fragmentation (MTE, 2021) (Soliman & Greenhalgh, 2020).

Urban sprawling has been an issue in Aotearoa since the 1950's and is still relevant today as remaining farms and market gardens are threatened by rezoning for urban development (MTE, 2021). Land conversions of highly productive lands into urban areas have increased by 54% from 2002 to 2019, while 31% of urban areas were originally available for cultivation (MTE, 2021). The continued loss of versatile soils further restricts the food system's ability to grow foods and ensure domestic food security (Soliman & Greenhalgh, 2020).

Research on architecture's role in food systems are urban-centric, proposing strategies of urban agriculture integrated with buildings, optimising horizontal and vertical surfaces with new technologies such as hydroponics that don't require soil cultivation, and to shorten supply chains for consumers (D'Ostuni et al, 2022) (Specht et al, 2013). The proposal for urban agriculture reduces city's' reliance on long-distance food sources and supports localised food resiliency and security (Akintuyi, 2024). Integrating food production vertically alleviates conventional agricultural practices that require expansive croplands and pastures, which urban sprawling is reducing already (Akintuyi, 2024).

Gaps in the literature involve the role of architecture within existing food-productive landscapes. What effect does shifting into urban agriculture have on rural farms, market gardens, and food-producing communities' livelihoods. What can architecture provide to enhance existing food landscapes, support existing food productive communities, and engage consumers with these landscapes, to provide awareness, knowledge-sharing, and alternative approaches for food security that don't marginalise rural communities and rely on a failing food system?

Whatever the architectural strategy in the food system may evolve into, it must address the ecological, and socio-cultural contexts that are being undermined. Reconnecting and empowering food producers and consumers with food and environmental literacy, to understand the interconnected processes that produces food.

1.3 RESEARCH QUESTION

How can architecture mediate suburban residential and agricultural programmes to reconcile food producers, consumers, and biodiversity within food-productive landscapes threatened by urban sprawling to facilitate food security, and community resiliency?

Figure 10
Reconciling food producers, biodiversity, and consumers



1.4 AIMS & OBJECTIVES

Propose an architectural catalyst for food systems change: architecture as a tool to provide services for the natural environment and communities to be food secure and resilient.

- Investigate alternative food system practices that can be adopted by architecture to engage with food producers, consumers, and the natural environment.
- Investigate regenerative design strategies and services that support community food and environmental literacy.
- Selection of site to respond to site-specific ecosystems and community relationships to propose programming that encourages regenerative food awareness and community interactions.

Investigate architecture as a remediation tool between urban development, food productive landscapes, and the natural world.

- Understand current conditions and relationships between urban, rural, and ecological landscapes in Aotearoa.
- Investigate how food-production design strategies manifest across these landscapes.
- Restoration strategies for ecological landscapes. Regenerative food producing practices.
- Investigate how improving the relationship between these landscapes also improves the relationships between consumers, food producers, and biodiversity.

Position architecture as a place for community connection, bridging the three stakeholders.

- Understand holistic cultural frameworks that bridge humans, and non-humans in a living system.
- Understand the community and cultural experiences of food production, preparation, preservation, and celebration.
- Investigate different programs that support socio-cultural and ecological needs, practices, and experiences within a food-productive environment.

1.5 SCOPE

The food system is highly complex and influenced by many interconnected factors, making the subject too broad to address in its entirety. Therefore, the study's scope focuses on the aspects of the food system that architecture can remediate at a community scale. The scope is localised to a specific site to make the research place-based and responsive to local conditions and relationships between key stakeholders: food producers, consumers and ecology. The architecture explores the capacity to facilitate these relationships on a single site to foster outcomes of food security, food sovereignty, community, and environmental resilience in highly food-productive landscapes competing with urban development.

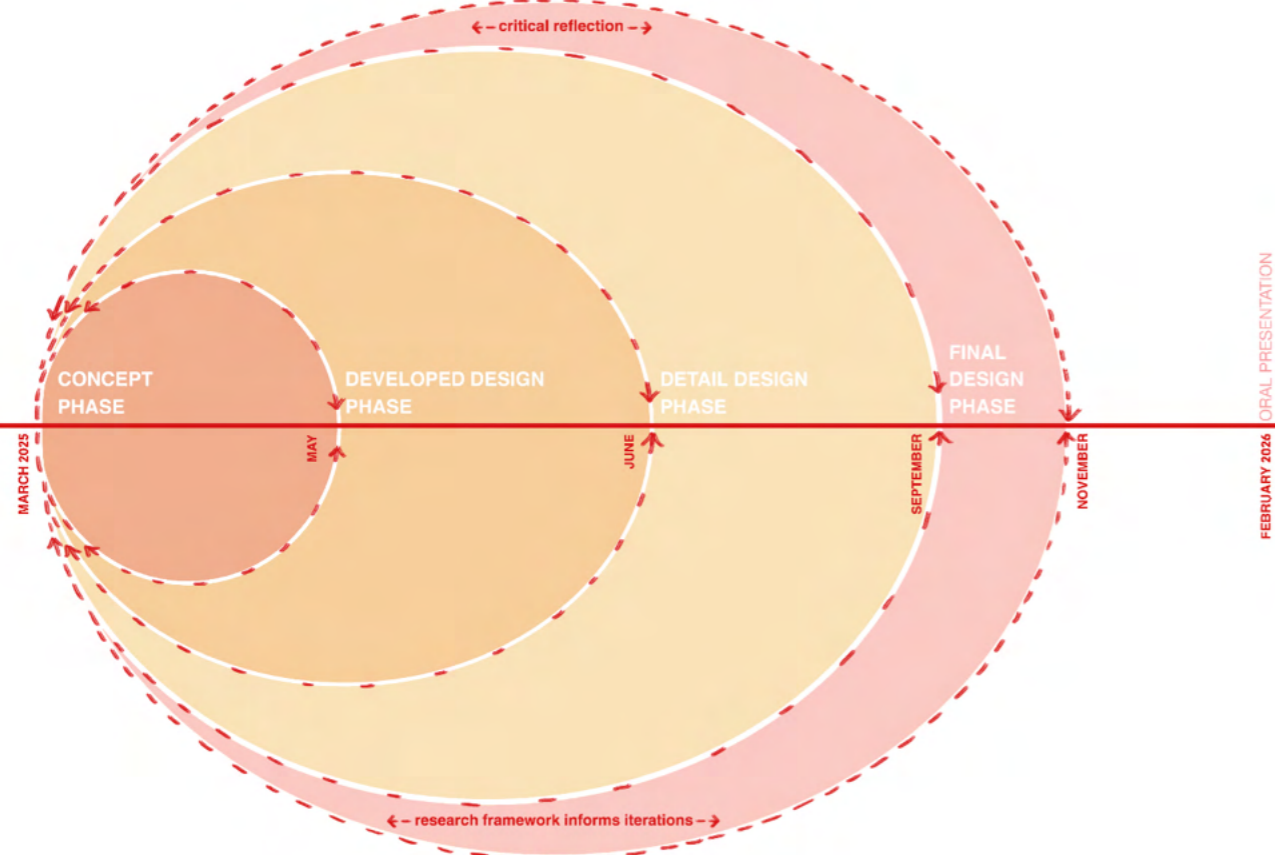
1.6 METHODOLOGY

The overall methodology of this thesis is qualitative (Tenny et al, 2022) architectural design-led research (Groat & Wang, 2013). Research is initially conducted through content analysis (Nacke, 2025) by reviewing literature on food systems, food insecurity and regenerative approaches, to inform the theoretical framework, and design exploration.

Collective precedent analysis (Nacke, 2025) is a design tool that reviews existing architectural applications within the food system. The literature reviews, theoretical framework, precedent analysis, and field research informs design strategies that are tested through design mediums of sketching, drawing, mapping, collaging, diagramming, and modelling through the iterative design phases of initial design, concept design, developed design, and final design.

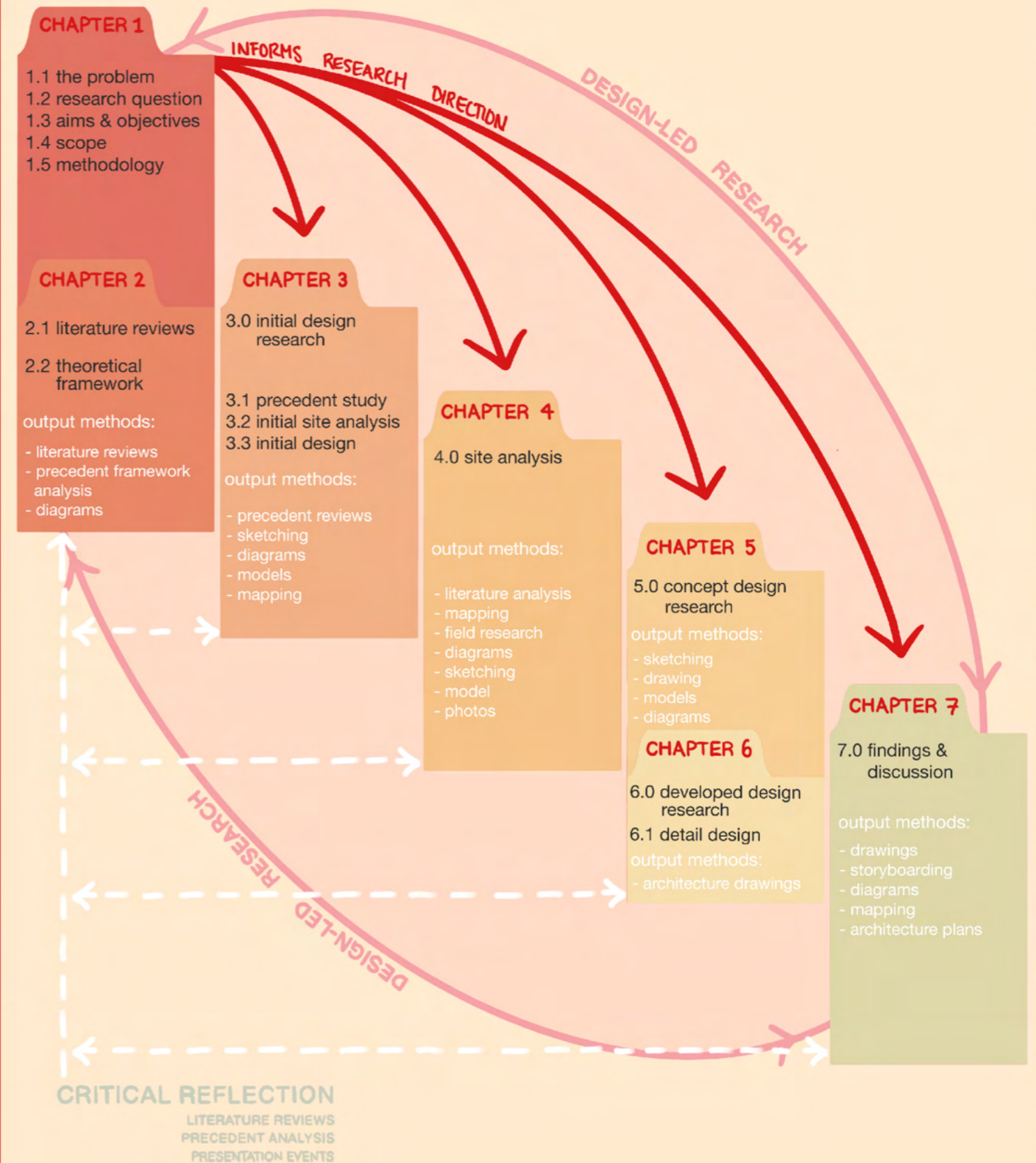
Reflective practice (Nacke, 2025) is constant in the iterative process as a circular loop of literature and precedents informing design, and design informing the research while engaging with presentation critique events. Grounded theory (Tenny et al, 2022) is applied throughout the research, as it identifies relationships and patterns that contextualise the key stakeholders' relationships with food, food-productive landscapes, and the natural world into architectural typologies.

Figure 11
Methodology timeline



Note: Diagram of this study's timeline across the design methodology stages.

Figure 12
Methodology diagram



Note: Diagram illustrating the study's methods.

CHAPTER

2.0

THEORETICAL FRAMEWORK

2.1 LITERATURE REVIEWS: FRAMEWORKS

This chapter reviews literature on alternative food systems thinking, holistic frameworks and design strategies that specifically advocate for regenerative ecological, socio-cultural, and food security outcomes. The literature reviewed guides the study's objective to investigate alternative food system practices and strategies to develop a theoretical framework that informs and grounds the design process.

2.1.1 MAURI ORA COMPASS

An influential framework that has been used to guide my practice and studies at Huri Te Ao – The School of Future Environments is the Mauri Ora Compass. The Mauri Ora Compass and the teaching behind this framework emphasises the need for radical change in architectural practice, to oppose the intensifying ecological crises, and socio-cultural injustices that conventional western practices enable (Yates et al, 2022). For this project the ethos of the Mauri Ora Compass is the foundation that influences the findings of other literature to be adopted into this research's regenerative theoretical framework.

The Compass is rooted in Te Ao Māori and mātauranga Māori, it advocates cultural narratives and upholds the roles of Tangata Whenua and Tangata Tiriti in honouring Te Tiriti o Waitangi in Aotearoa; it suggests architectural practitioners to practise collaboratively with an ethic of care for social, cultural and ecological well-being, and beyond human-centric practices by denying traditional individualistic and colonial models (Yates et al, 2022). The Mauri Ora Compass is a navigator for ecological connections, enhancing socio-ecological relationships, and living systems' well-being by integrating circular systems, bio-regenerative, nature-positive actions at local and global scaled design strategies (Yates et al, 2022).

The Compass does include design strategies that can improve the well-being and reconnection between biodiversity, food producers, and consumers as seen in Figure 14. To support these design strategies in a food systems context, the next literature reviewed is on alternative models for food systems.



BIODIVERSITY



FOOD PRODUCERS

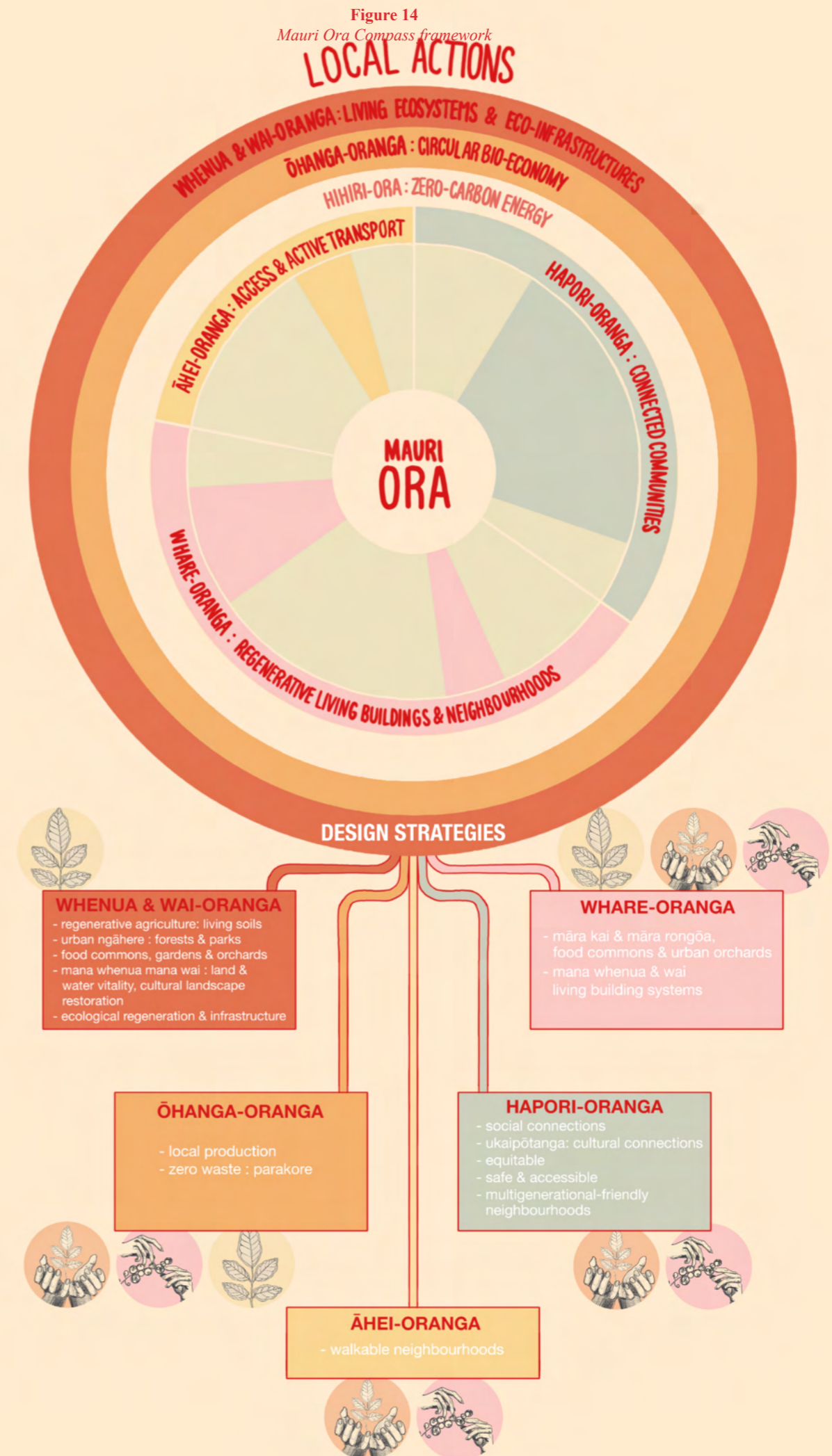


CONSUMERS

Note: Icons of the three stakeholders to be referred to in other diagrams.

Figure 13
The three stakeholders of this study

Figure 14
Mauri Ora Compass framework



Note: Author's adaptation of the Mauri Ora Compass framework informed by Yates et al (2022).

2.1.2 FOOD SOVEREIGNTY & AGROECOLOGY

A theory that challenges conventional food systems is Food Sovereignty. It is a food systems practice and rights framework that outlines people having the “right to healthy and culturally appropriate food produced through ecologically sound and sustainable methods” (Wittman, 2023) and the “right to define their own food and agriculture systems” (Wittman, 2023). This framework prioritises and advocates for people’s right to food from healthy environments that strengthen biodiversity and climate resiliency to empower food producers and consumers with dignity and self-determination in their own practices and accessibility (Wittman, 2023).

Supporting Food Sovereignty’s advocacy for socio-cultural and particularly environmental justice within food systems, the framework adopts agroecology theory (Wittman, 2023). Agroecology applies ecological principles to agricultural systems that are rooted in the study of ecosystem services, biodiversity, relationships between vegetation, animals, people, and climate (Somashekar et al, 2024). Agroecology and Food Sovereignty both advocate for local and indigenous communities’ self-determination of their agrifood practices to encourage self-sustainability, food security, and resiliency, reducing dependency on global food systems and industrial technologies that are harming ecosystems and future food environments (Somashekar et al, 2024).

Food Sovereignty promotes the importance of self-determination and localisation within food-productive landscapes, but the literature is a generalised western framework that isn’t place specific. To be applied in Aotearoa it would need to be modified by mātauranga Māori and Te Ao Māori to uphold indigenous sovereignty in Aotearoa.

Figure 15
Food Sovereignty framework’s principles

FOOD SOVEREIGNTY PRINCIPLES

1. FOCUSES ON FOOD FOR PEOPLE

- right to sufficient, healthy & culturally appropriate food
- food is not a commodity



2. VALUES FOOD PROVIDERS

- supports sustainable livelihoods
- respects the work of all food producers



3. LOCALISES FOOD SYSTEM

- reduces distance between food providers & consumers
- puts providers & consumers at the centre of decision making on food issues



4. PUTS CONTROL LOCALLY

- ensures the rights of local communities to inhabit
- rejects land grabbing & privatisation of natural resources



5. BUILDS KNOWLEDGE & SKILLS

- respects traditional & indigenous knowledge
- participatory & decolonial research methods
- appropriate technology & data sovereignty



6. WORKS WITH NATURE

- diverse, low-external input agroecological systems provide important ecosystem functions, supporting resilience & adaptation to climate change



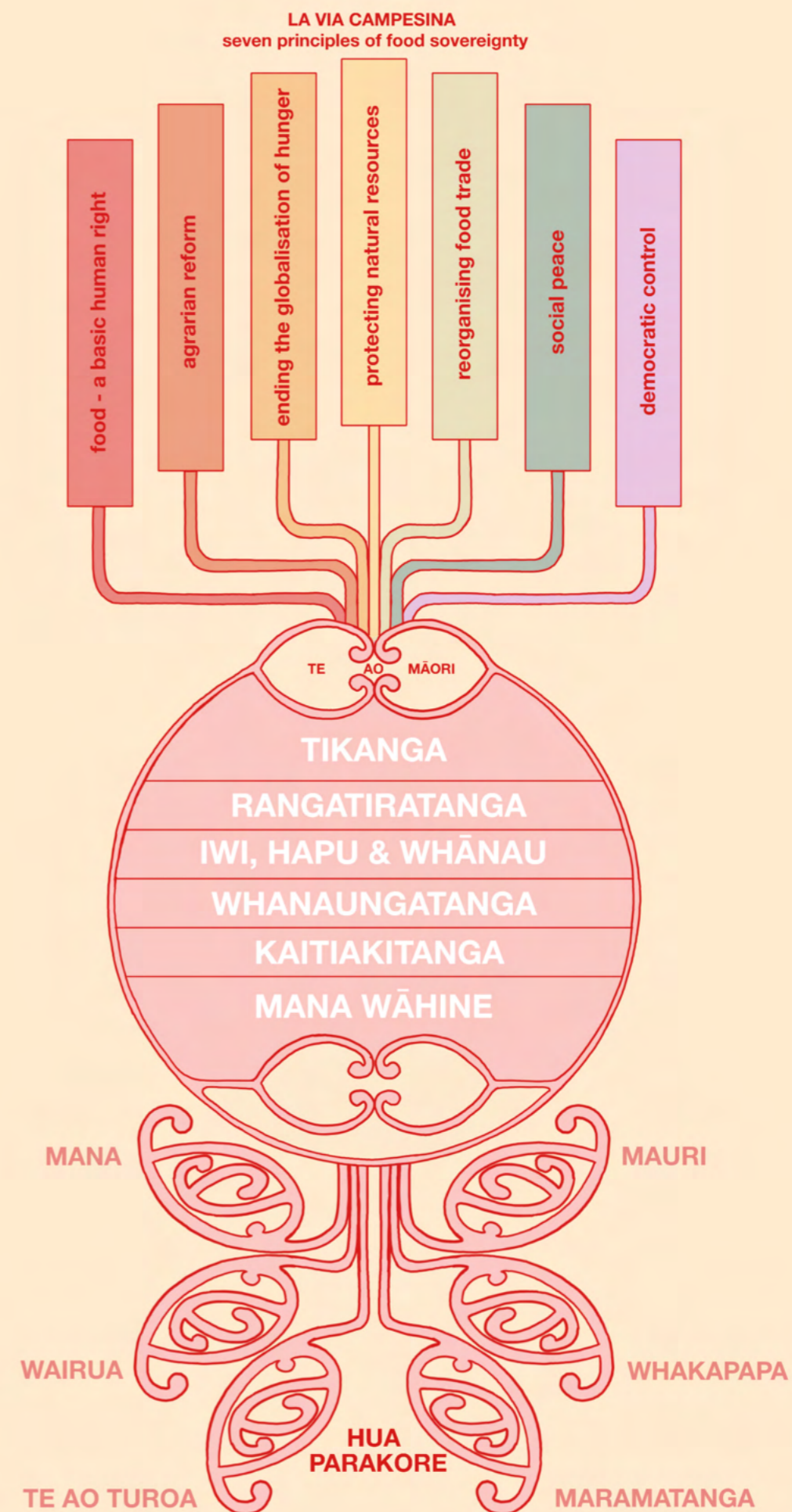
2.1.3 HUA PARAKORE

Under a Māori worldview, Food Sovereignty and Agroecology are realised through Hua Parakore: a Māori food sovereignty framework. Hua Parakore is a Māori sovereignty initiative and organics validation system, that was developed from a community-driven kaupapa that reflects and prioritises Māori knowledge, philosophy, and experiences within food production, as a form of resistance to colonial models, and the triple threat of conventional peak oil, climate change, and food insecurity (Hutchings et al, 2012). The principles and ethics of Hua Parakore provide insight into indigenous ecological knowledge and agrifood practices, that are applicable in Aotearoa and architectural practice.

Hua Parakore is made up of six key principles:

1. Whakapapa in a food sovereignty context is the lineage of plants and the origin of seeds: knowing where the seed comes from and the quality of fruit it will grow provides integrity for a pure organic product, and dependability that it will grow again (Hutchings et al, 2012). Whakapapa of produce act as cultural, ecological, and chronological markers that can tell food producers the histories, stories, and interactions of place (Hutchings et al, 2012).
2. Wairua focuses on the health of the land, food, and people - the health of each entity directly affects the others (Hutchings et al, 2012).
3. Mana manifests as self-determination and autonomy in food-productive environments. Producing food with the practice of manaakitanga, reciprocity that supports community relationships, well-being, and unity, rather than being driven by profit as the current food system does (Hutchings, 2015).
4. Maramatanga is enlightenment and insight into food production, understanding the importance of ecological practice that allows food producers to enhance their practice to grow healthy and organic produce (Hutchings, 2015). It involves identifying natural cycles and practising as kaitiaki (guardians embodying kaitiakitanga) through practices such as the Māori lunar calendar, and karakia (Māori prayers & ceremonies), that treasure the knowledge that has been passed down (Hutchings,2015).
5. Te Ao Turoa is the natural order of the world (Hutchings et al, 2012). To food producers Te Ao Turoa is the home of pure food, it encourages the behaviour of protecting and regenerating indigenous species so that the natural world is healthy, which reflects the health of produced foods.
6. Mauri ensures that all essences of an ecosystem are thriving, so it can support healthy food-productive landscapes that produce food high in quality and nutrition to sustain consumers (Hutchings et al, 2012). Mauri considers biodiversity, soil structures, soil fertility, and water management to protect and enhance the integrity of these systems within a food productive space (Hutchings et al, 2012).

Figure 16
Hua Parakore Framework's guiding principles



Note: Author's adaptation of the Food Sovereignty framework informed by Hutchings et al. (2012) and Hutchings (2015).

2.1.4 KAI ORA APPROACH

Another Māori food framework is the Kai Ora approach. Developed from mātauranga Māori and the experiences of Māori food producers, the approach adopts a living systems framework of ki uta ki tai, (to the mountains, to the sea) that encapsulates the relationships within an ecosystem of spiritual, physical, and human elements (Hutchings et al, 2020). Within this living system food producers are seen as mediator between spiritual realms and natural resources, who engage and nurture through reciprocal practices that regenerate the natural environment, in exchange for healthy environments and communities (Hutchings et al, 2020). Food under this approach is not seen as a commodity, unlike the current food system, it is instead viewed as a conduit of the living system; it links people's well-being to the health of the mountains, lands and water (Hutchings et al, 2020). It teaches people that their lifeforce is tied to the health of ecosystems, and their day-to-day practices can enhance or diminish ecosystems (Hutchings et al, 2020). The Kai Ora approach reframes that living systems are central to food production rather than profit, and that ecological practice is essential to the success of food production through its ability to nourish and connect people to the natural environment and their communities (Hutchings et al, 2020).

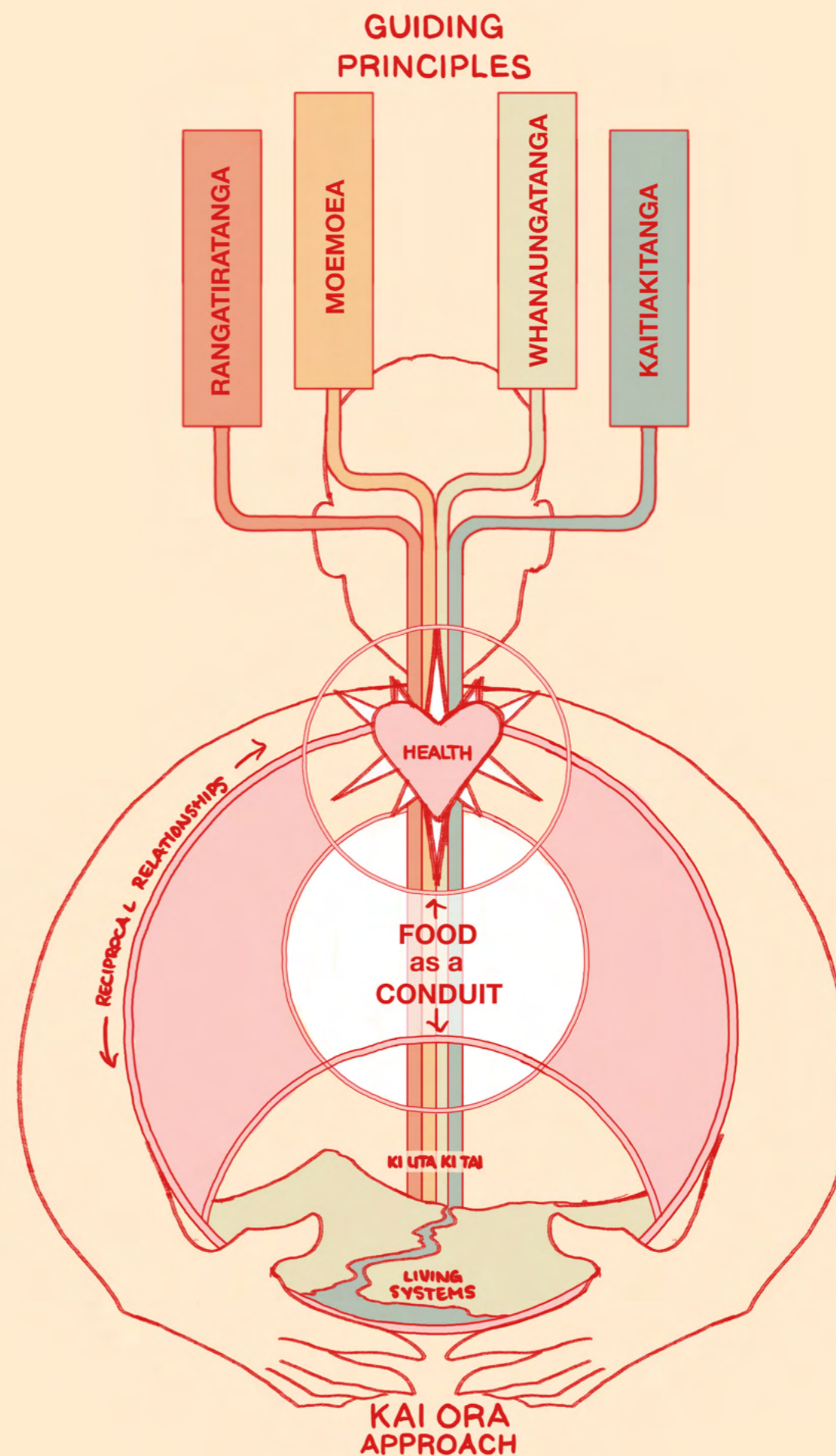
2.1.5 KAITIAKITANGA

Mentioned in both Hua Parakore (Hutchings, 2015) and the Kai Ora approach (Hutchings et al, 2012) as a guiding principle for ecological practice, is Kaitiakitanga as seen in Figure 16 and Figure 17. Kaitiakitanga, generally referred to as guardianship of the natural environment in a reciprocal manner, is a Māori environmental and sustainable practice that weaves Māori identity, ancestry and cosmology in connection with the natural world (Kawharu, 2020). Establishing identity and ancestral ties in features of the natural world such as mountains and rivers fosters a deep sense of belonging and recognition that people's identity and lifeforce is inherently tied to the environment which generates an obligation to care for place (Shearer, 1986) (Hutchings et al, 2020).

Under an agrifood practice, Kaitiakitanga involves physical, emotional, and spiritual dimensions that go beyond sustainability, it makes food producers consider the effects of their practices on broader living systems and their communities (Hutchings et al, 2020). Food producers can embody Kaitiakitanga to become kaitiaki, to reframe the food system, regenerate living systems that improve cultivation conditions and sustain communities with healthy food and connections with the natural world (Hutchings et al, 2020).

One of the aims of this project is to design an architectural response that is ecologically regenerative, to support healthy natural environments. Throughout the literature reviews there is a recurring theme that food production is dependent on the health of an ecosystem. Ecological health is tied to food, tied to people, and tied to the practices of architecture and the agrifood sector. To deepen the ecological concepts of this project's developing theoretical framework, the next two literature reviews are on Ecosystem Services and Nature-Based Solutions. These models provide design strategies that mimic natural systems that can be adapted into architectural practice to meet the ecological regeneration objectives.

Figure 17
Embodying the principle of Kaitiakitanga through agrifood practices



2.1.6 ECOSYSTEM SERVICES

The Ecosystem Services framework originated from an anthropocentric position with ecological economists attempting to monetise ecosystems, to measure, and understand the importance of natural systems based on beneficial outcomes for humans (Blahna et al, 2017).

The original purpose and conception of Ecosystem Services conflicts with the aims and objectives of this project, however the framework does identify and communicate the fundamental importance of ecosystem's, determining and supporting human and non-human life (Kiddle et al, 2021). Yet human actions diminish ecosystem's ability to provide those services (Island Press, 2003). For this research project it understood ecosystems are complex, an interconnected network of plants, animals, and microorganic communities (Island Press, 2003) that humans work with, not dictate. Therefore, the adaptations of this framework decentres the individual and identifies the services that enhance collective well-being, food provision, the natural environment, and socio-cultural relationships that can be mimicked in the architectural response and interpreted through Nature-Based Solutions to reframe the original anthropocentric lens of ecosystem services with indigenous ecological knowledge, socio-cultural equity and providing food security as illustrated in Figure 18.

The services that ecosystems provide: (Island Press, 2003)

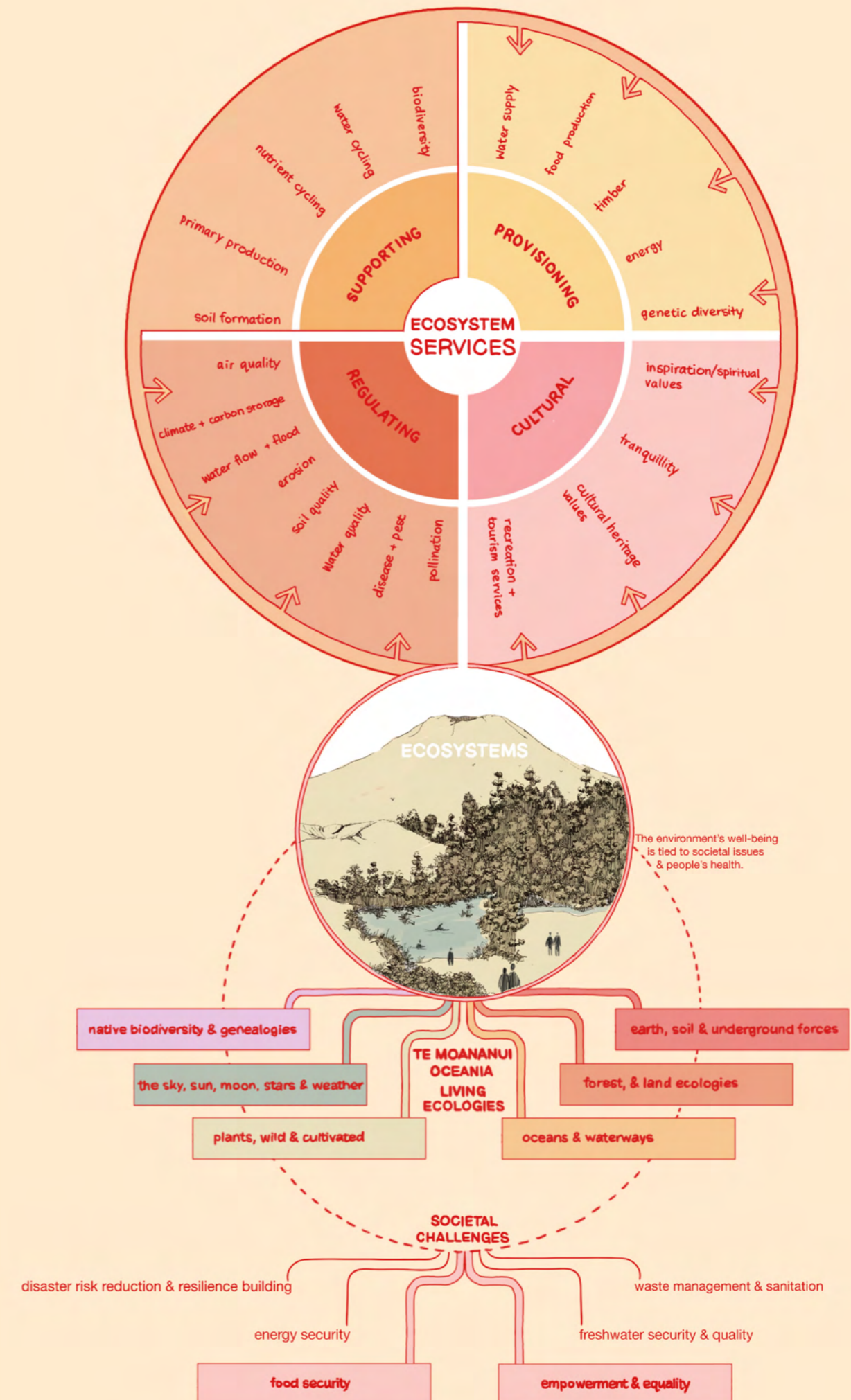
- **Provisioning Services:** natural resources obtained from ecosystems such as food, water, fibre etc.
- **Regulating Services:** climatic processes such as air quality, erosion control, water purification etc.
- **Cultural Services:** non-material benefits for people such as spiritual enrichment, cognitive development, education, recreational, sense of place and community building.
- **Supporting Services:** the natural processes necessary for ecosystems to provide the other services such as photosynthesis, oxygen, soil formation etc.

2.1.7 NATURE-BASED SOLUTIONS

Nature-Based Solutions (NBS) are regenerative actions that work with the natural world to enhance ecosystem services, ecological resilience, and the well-being of all living beings (Pedersen Zari et al, 2024). NUWAO (Nature-based Urban design for Well-being and Adaptation in Oceania) has provided an NBS design guide for Te Moananui Oceania (the Pacific region) that provides a toolkit of design strategies that can be used for architecture, urban planning, community engagement (Pedersen Zari, 2024) and address the study's problem of food insecurity. From NUWAO'S guide (Pedersen Zari et al, 2024) NBS are categorized into six realms of living systems and six socio-cultural problems as seen in Figure 18.

Seen in Figure 18, Ecosystem Services is interpreted through NBS to reframe the original anthropocentric lens of Ecosystem Services with indigenous ecological knowledge, socio-cultural equity, and providing food security.

Figure 18
Ecosystem Services & Nature-Based Solutions Diagram



Note: Author's adaptation of Ecosystem Services framework and Nature-based solutions informed by Helmer et al. (2020) and Pedersen Zari et al (2024).

2.2 THEORETICAL FRAMEWORK

The project's theoretical framework draws on the principles and strategies of Mauri Ora Compass, Food Sovereignty, Agroecology, Hua Parakore, Kai Ora, Kaitiakitanga, Ecosystem Services and Nature-Based Solutions.

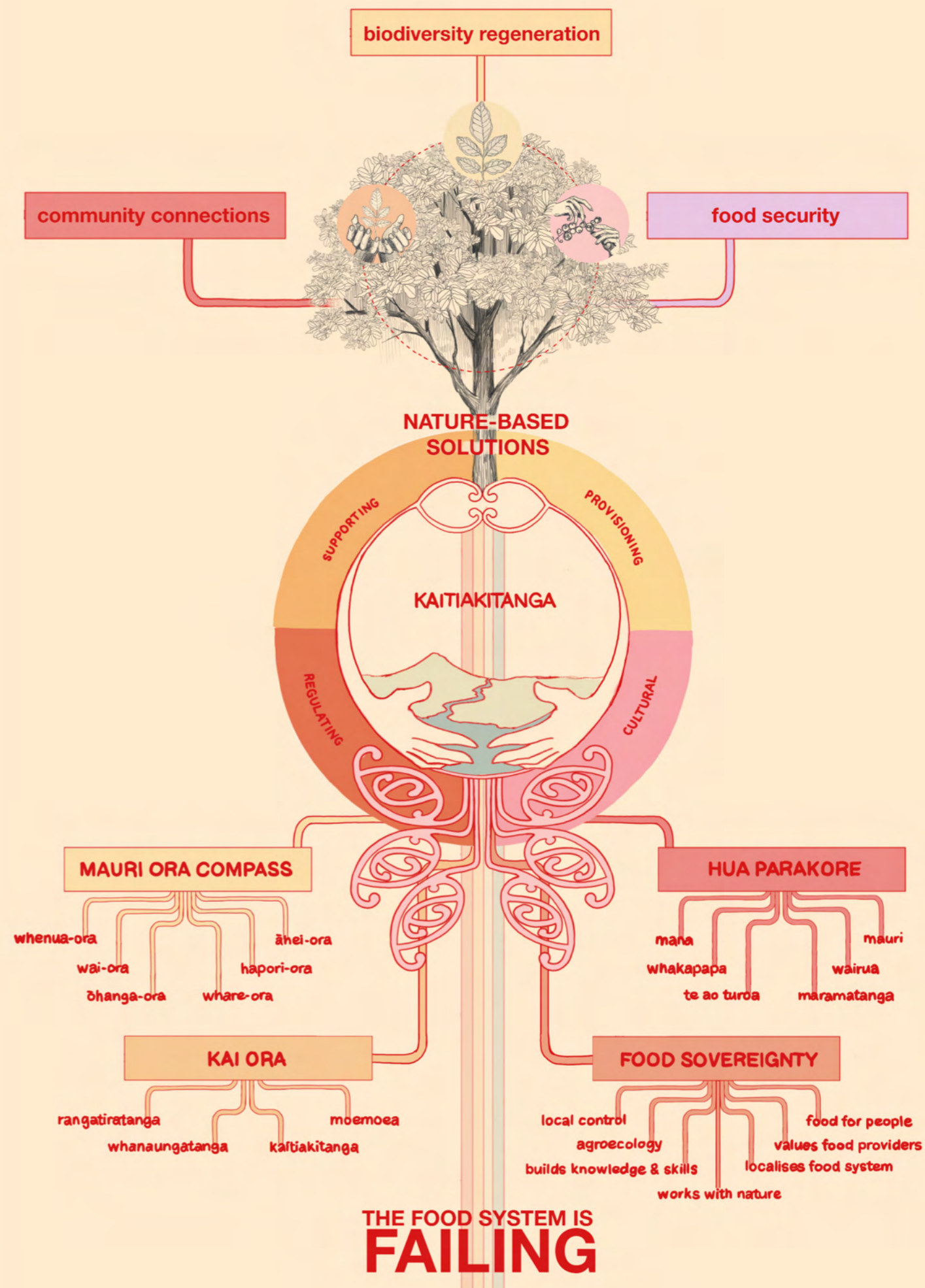
Food Sovereignty (Wittman, 2023), Agroecology (Somashekar et al, 2024), and Ecosystem Services (Blahna et al, 2017) come from generalised western models which diverge from the indigenous theories of Hua Parakore, the Mauri Ora Compass, Kai Ora, and Kaitiakitanga. Western models tend to be economical and human-centric, for instance, the Ecosystems Services framework originated from wanting to monetise ecosystems (Blahna et al, 2017). The Māori frameworks are a form of resistance, that aim to decolonise western models, particularly food systems where Māori and marginalised communities are overrepresented in food insecurity statistics (PHAC, 2024). However, because the frameworks of Food Sovereignty, Agroecology, and Ecosystem Services are generalised, they can be reinterpreted by Māori principles and practice into a theoretical framework to best respond to the problem and uphold indigenous practice, sovereignty, collective well-being, and ecological relationships.

For example, the Food Sovereignty model's principle "focuses on food for people" rightly challenges food as a commodity, but also has human-centric connotations, which under mātauranga Māori could be reinterpreted and better promote unity, collective well-being, not only between people and food but between other communities, and the living system that is connected to foods. Adapting another principle: "works with nature" (Wittman, 2023) can be expanded by Māori principles of whakapapa, maramatanga, and kaitiakitanga to actively and meaningfully engage with the natural environment in a reciprocal relationship, that removes the tendencies of western practices to be extractive or conservative.

De-centring the human is important, as conventional food systems prioritise human consumption and economic gains at the cost of environmental degradation and undermining traditional indigenous agrifood practices. Indigenous frameworks challenge the western models with alternative systems thinking that is deeply connected with the natural world and situates humans within the living system, not above. The Māori frameworks adopted into this study's theoretical framework deeply understand broader relationships and interconnected systems between socio-cultural, ecological and food contexts. They inform how the study can mediate and restore relationships between biodiversity, food producers, and consumers.

These frameworks and principles are broken down into the categorised strategies of achieving food security, community empowerment, and ecological regeneration to mediate the three stakeholders. The categories are principles and strategies informed by the Mauri Ora Compass, Food Sovereignty and Agroecology, Hua Parakore, Kai Ora, Kaitiakitanga, Ecosystem Services, and Nature-Based Solutions as seen in Figure 19.

Figure 19
Theoretical Framework



Note: Author's adaptation of reviewed frameworks making this study's theoretical framework to guide the design research.

CHAPTER

3.0

INITIAL DESIGN

To begin developing an architectural response, now that a theoretical framework has been established, the study reviews existing architectural projects that address food insecurity and food production, to inspire initial design ideas to be adapted under the theoretical framework. There is also exploration of food-related programming from past studio work I have produced is expanded on in this study. The section begins initial site analysis to situate the initial design research that explores forms and programming of the architectural intervention.

3.1 INITIAL PRECEDENT STUDY

Initial case studies that were reviewed gave insight into different architectural applications and scales within urban and rural environments. These precedents are not necessarily aligned with the theoretical framework overall, but are consistent with architecture as a tool responding to food insecurity and food production that provides insight into architectural design's capabilities to integrate within food systems.

(Tallman, 2023) Parc des Expositions Paris – Hall 6 is a project based in Paris, France designed by Valode & Pistre in 2019. This project is part of a larger scheme that aims to achieve 250 acres of revegetation across the city of Paris. It is an urban agriculture initiative that addresses the distance between urban dwellers and food sources. The project transforms the rooftop of Pavilion 6 of the Paris Expo Porte de Versailles building into an urban farm. This project aims to foster environmental and economic resilience through hydroponic and aquaponic technologies that grow food for the local area but also provide plots for locals to engage, learn, grow, and socialise with others in the community rooftop garden. A key aspect of this project is the utilisation of existing buildings, installing agricultural systems on horizontal and vertical surfaces, engaging with the neighbourhood as a small-scale localised food supply but is part of a larger scheme to revegetate the city.

Figure 20
Sketches of Parc des Expositions Paris Hall 6 precedent

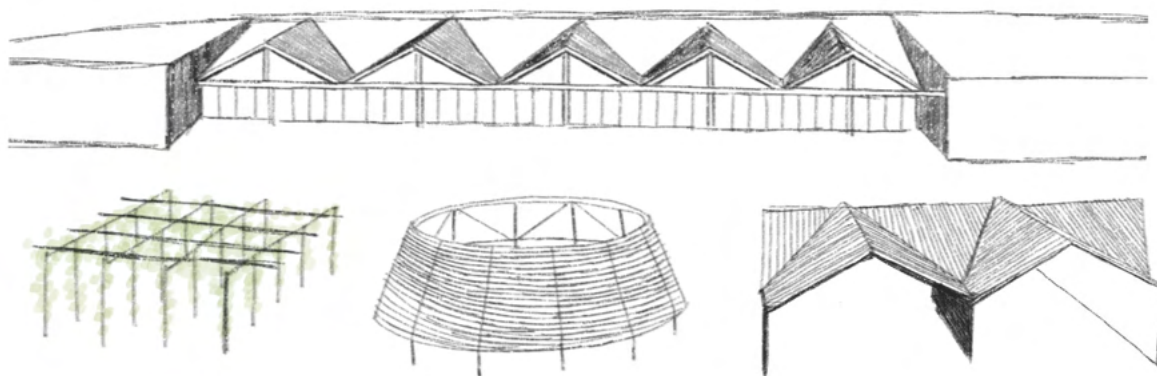
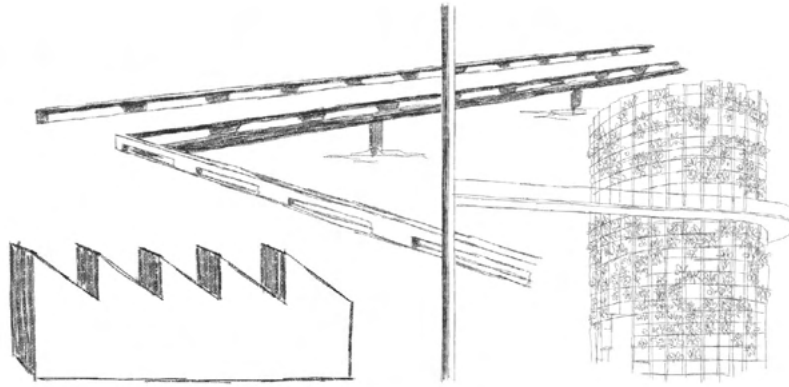


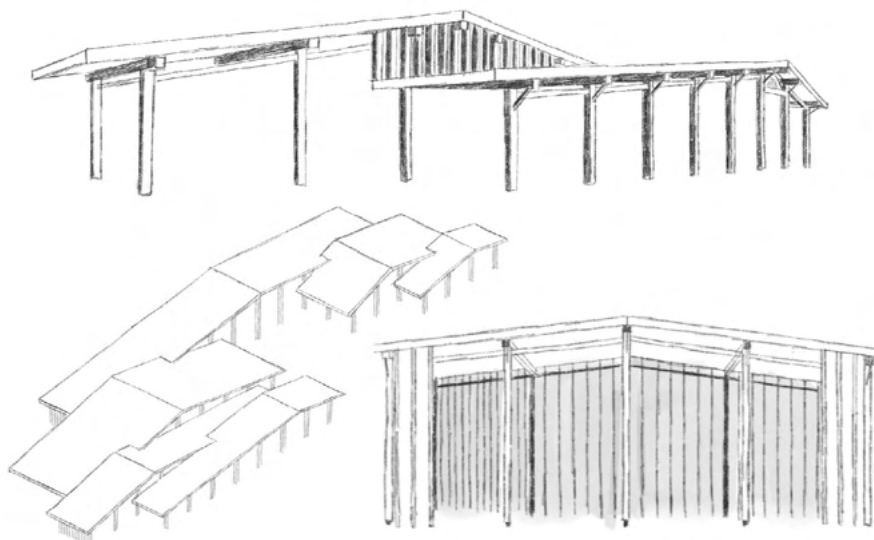
Figure 21
Sketches of Sunqiao urban agriculture precedent



Note: Sketches replicating forms from the precedent, drawn by Author

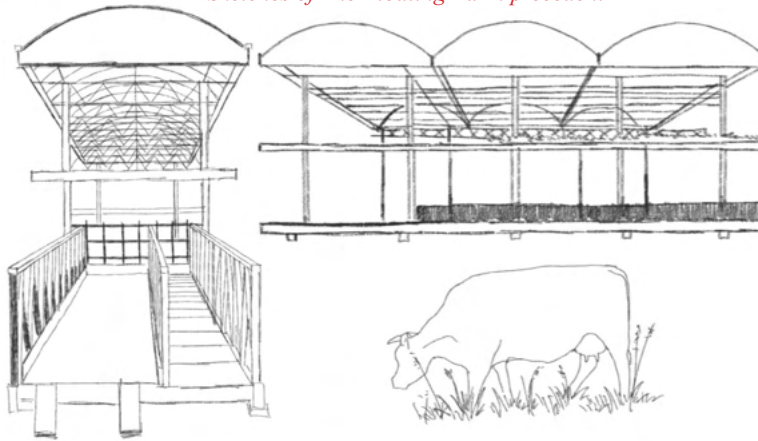
(Walsh, 2017) Sunqiao urban agricultural district is a masterplan in Shanghai, China, proposed by Sasaki. It proposes a public realm within the urban environment that includes interactive large-scale vertical farming, a science museum, laboratories, and hydroponic and aquaponic systems that aim to educate the population and future generations on where food comes from. It is an alternative response to urban sprawling and traditional farmlands. Key aspects from this masterplan are the exposure of traditional agricultural practices and emerging cultivation technologies to the public, for visitors to develop awareness on food literacy, appreciation, and inspiration especially for the children interacting with the structures to understand where food comes from and how it is grown.

(8 Lines, 2017) Tula Farmers Market, designed by 8 Lines is a building built in 2017 in Russia. This project supports and reflects the values of local farms and small businesses, to support food producers, rural communities, and rural cooperation. It has a basic roof structure, so that farmers can interchange use of the interior based on their needs for the market. This precedent supports the intent of supporting food producers and exploring ideas of community gathering spaces through interchangeable activities that the community can determine whether that be farmers markets, live-stock auctions, community meetings or knowledge exchange through workshops.



Note: Sketches replicating forms from the precedent, drawn by Author

Figure 23
Sketches of The Floating Farm precedent

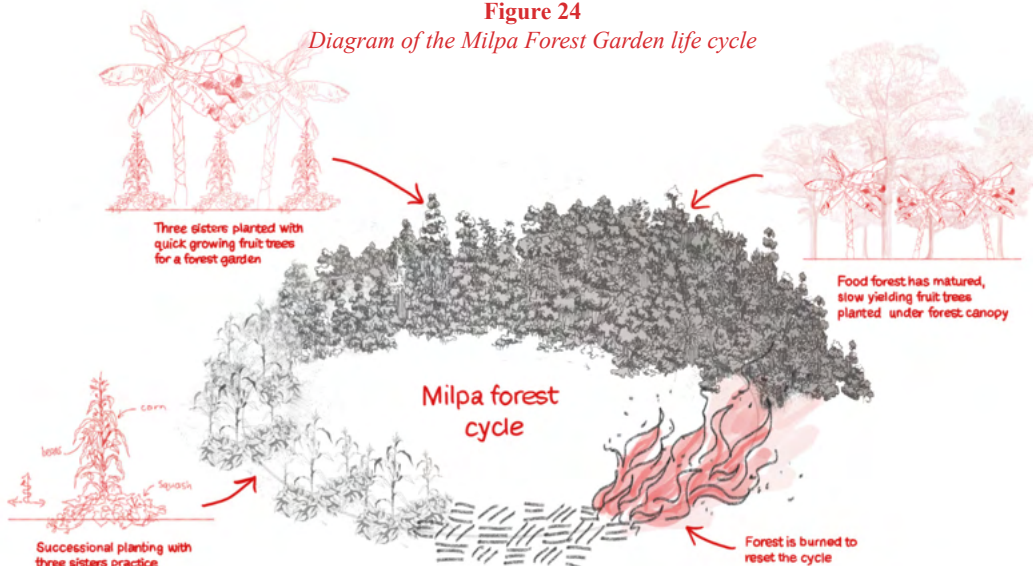


(Goldsmith Company, 2019) The Floating Farm Dairy, designed by Goldsmith Company in 2019, is based in the Netherlands. The building is a stacked structure on 3 pontoons that float in the harbour, which produces, processes, distributes and retails dairy products. The building even provides its own services of rain and wastewater recycling, manure handling, feeding systems, and a cow pasture, bringing food producers, consumers, livestock, and food system processes into one space of urban agriculture. It maximises verticality, shortens the supply chain, and initiates relationships between farmers and consumers directly. This case study embodies the supply chain in one building to directly serve the local community.

Within the Mayan forests of Mexico is an agroecological system rooted in indigenous and traditional agricultural practices, called the Milpa Forest Gardens (Watson, 2019). The design of these gardens is of the Lo-TEK movement which includes vernacular architecture that is informed by indigenous ecological practices (Watson, 2019). Lo-TEK investigates local technologies, and reimagines relationships informed by traditional ecological knowledge, to challenge conventional practices (Watson, 2019). The practice behind this precedent is shared with the theoretical frameworks, especially with indigenous food sovereignty practice and nature-based solutions.

The Milpa Forest Gardens are open field polyculture gardens that rely on forest succession rather than conventional pesticides and fertilisers (Watson, 2019). A cycle of forest succession and fire enhances soil fertility and biodiversity within the gardens; challenging a misconception that fire results in deforestation, it instead fertilises the soil to succeed a new forest (Watson, 2019). This precedent shows the interaction between living systems that the architectural research can adapt, or interact with nature-based strategies, informed by indigenous ecological knowledge, that inspires landscape design and vegetation as structures, to encourage biodiversity to create a built landscape that works with natural cycles.

Figure 24
Diagram of the Milpa Forest Garden life cycle



Note: Diagram showing the Milpa forest living system with polyculture planting and forest succession, adapted from Watson (2019).

The Kai Rotorua Railway Food Hub was a studio project I did in 2022 for my Bachelor of Architecture and Future Environments (Gray, 2022). The design brief was to engage with kai sovereignty through architectural design that had a seed library, café, and kūmara 'museum', which was interpreted to be a celebration of Māori agrifood practices, and the history of kūmara.

The design was a neighbourhood-scale investigation into food landscapes, identifying food swamps, deserts, and havens in Rotorua. These classifications describe the accessibility and the availability of healthy foods (Tonumaipé'a et al, 2021). Food swamps are environments that are dominated by fast and highly processed foods compared to healthy options. Food deserts are densely populated areas where access to healthy foods is limited. Food havens are environments that have ease of access to healthy and fresh foods such as fruits and vegetables (Tonumaipé'a et al, 2021).

Figure 25
Railway Food Hub's irrigation cart

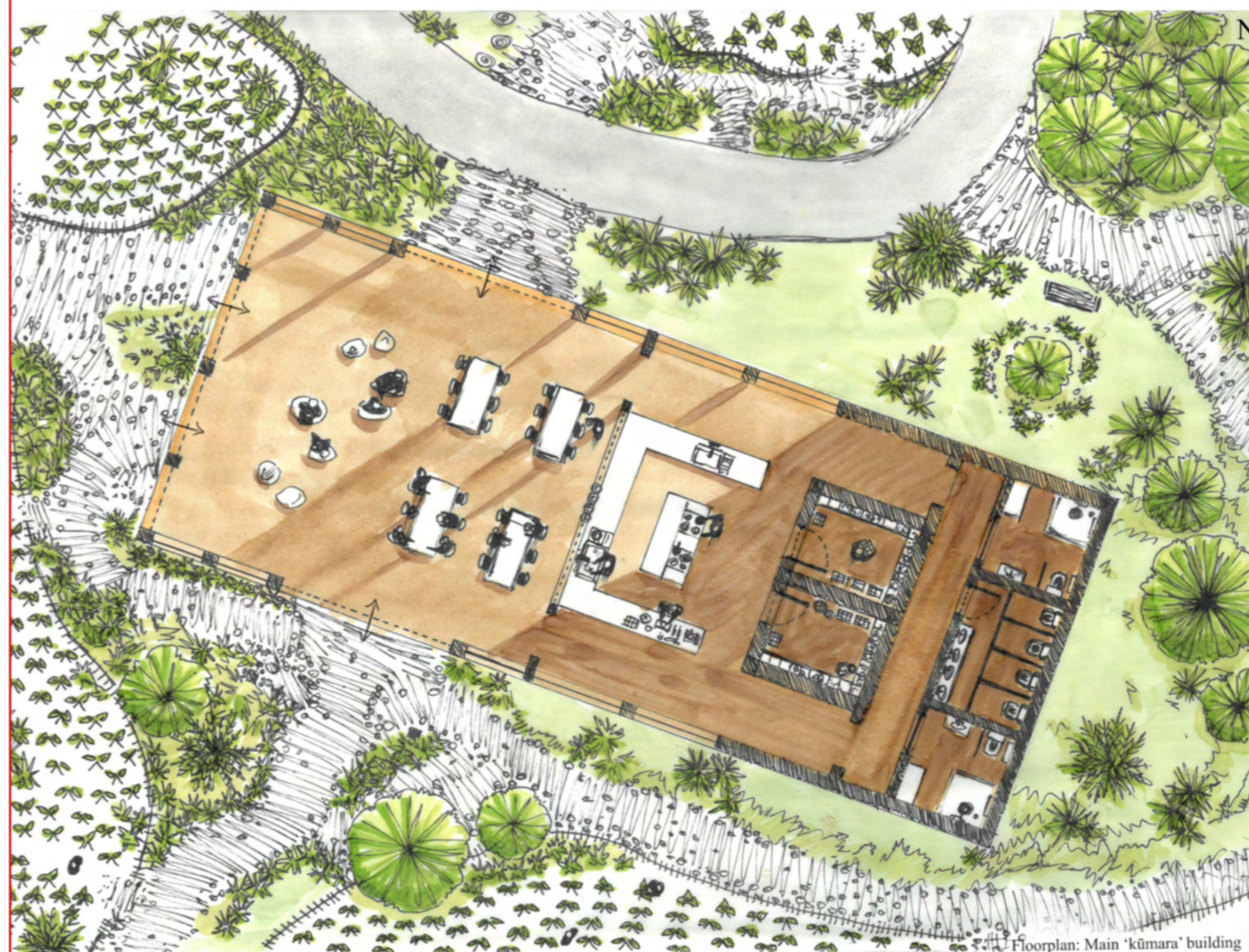
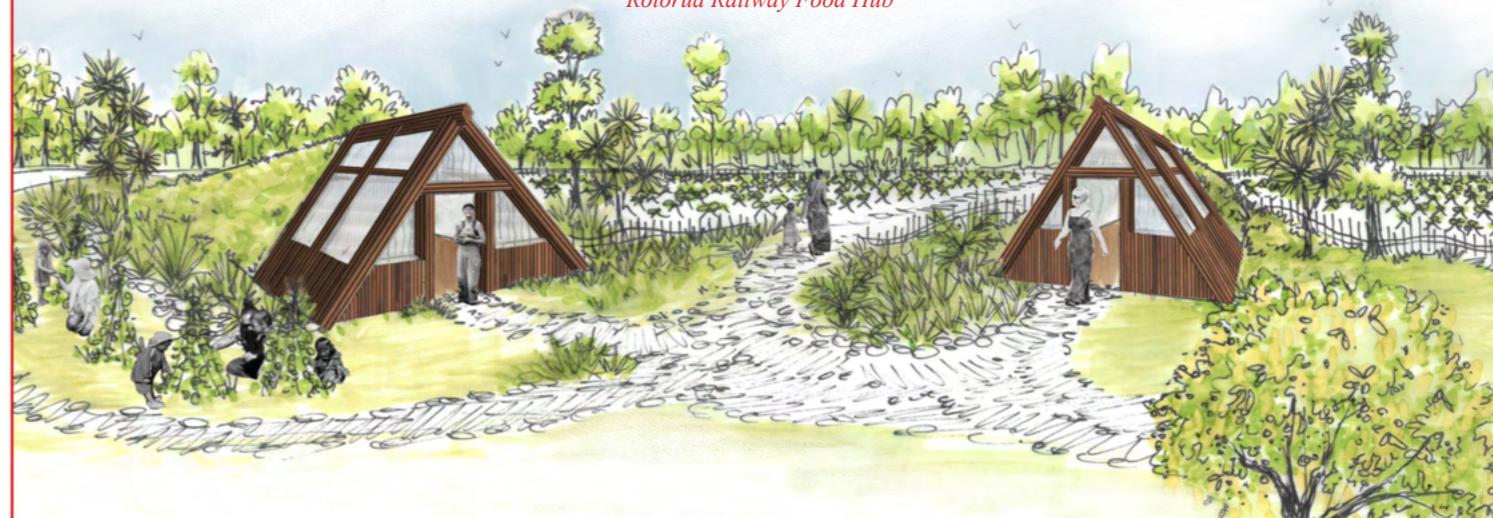


Note: Author's collage shows utilising the railway system on site by using it as irrigation for the gardens (2022)

The project explored how theories of Māori food sovereignty (Hutchings, 2015) and food havens would manifest in architecture through building and landscape design. The structure was inspired by traditional Māori whare embedded into the ground, much like how kūmara is cultivated in mounds. The programming of the designs preserved and celebrated Māori cultivation practices, particularly their cultivation of kūmara. The structures and gardens allowed users to gather for wānanga, practising sowing, nurturing, and harvesting foods, with places to rest, reflect, and engage with the food gardens.

The Railway Food Hub provided insight into identifying the many food landscapes that people inhabit, involved the learning of Hua Parakore and applying its principles into architectural programming, and the application of both building and landscape design to achieve the brief. Moving forward now, this study expands that initial investigation of architecture's ability to transform a space into a food haven but focuses on socio-cultural aspects, mediating relationships between food, food producers and consumers to ensure community resilience and food security.

Figure 26
Rotorua Railway Food Hub



Floorplan: Main 'kūmara' building



Note: Hand-drawn visualisations of the Railway Food Hub, by Author (2022).

Tipu Matomato Te Harakeke is a conceptual design proposal for Kāti Huirapa Rūnaka ki Puketeraki that I helped visualise in 2024. The brief was to regenerate the site's indigenous ecology and cultural landscape as a mahika kai pā, a food gathering area (Dunstall et al, 2024). The concepts explored nature-based solutions integrated with indigenous Māori practice and iwi collaboration to achieve climate change adaptation. The aim for this project was to reconnect mana whenua with the site, to support cultural and ecological well-being (Dunstall et al, 2024).

The design work involved in this report investigated a wider mahika kai network across other Kāti Huirapa Rūnaka ki Puketeraki sites, to identify the environmental and cultural relationships between these hubs, their functions and proximity to maunga, awa, and moana (Dunstall et al, 2024). This analysis provides insight into food networks, showing community driven nested food landscapes that build up a larger food gathering network, that restores Māori's relationship with the natural environment through their ability to engage with traditional food practices.

Figure 27
Tipu Matomato Te Harakeke: main building



Note: Drawing of the main building hosting a haka, with the maunga Hikororoa seen in the distance, drawn by Author (2024).

This project helped inform for me the application of architecture as a facilitator for ecological restoration, and how people engage through the process of ecological regeneration to learn about natural food sources, food-gathering, and living systems. The research displays nature-based solutions informed by Māori knowledge and practice to reconnect people to culturally significant sites, the natural environment, and a network of food landscapes.

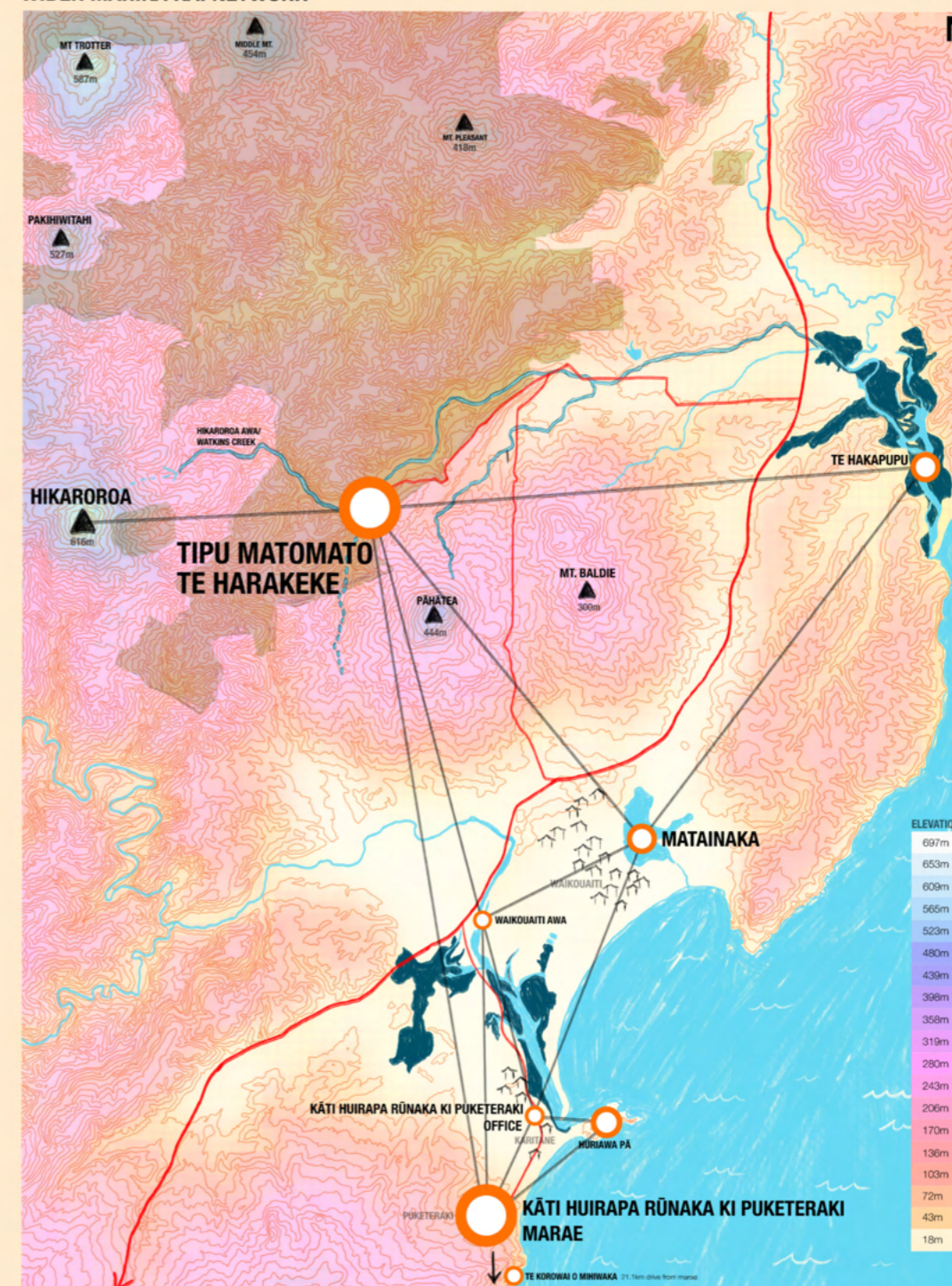
These previous project explorations on food landscapes laid the groundwork of my understanding of how architectural design can be used to enhance food outcomes and accessibility, but also to build connections between people and the environment through food practices, Māori principles, and food landscapes. They further inform this study's intentions of bridging food producers, consumers, and the natural environment for a resilient food landscape within a declining food system.

Figure 28

Tipu Matomato Te Harakeke: Mahika Kai Network & section of the main building.

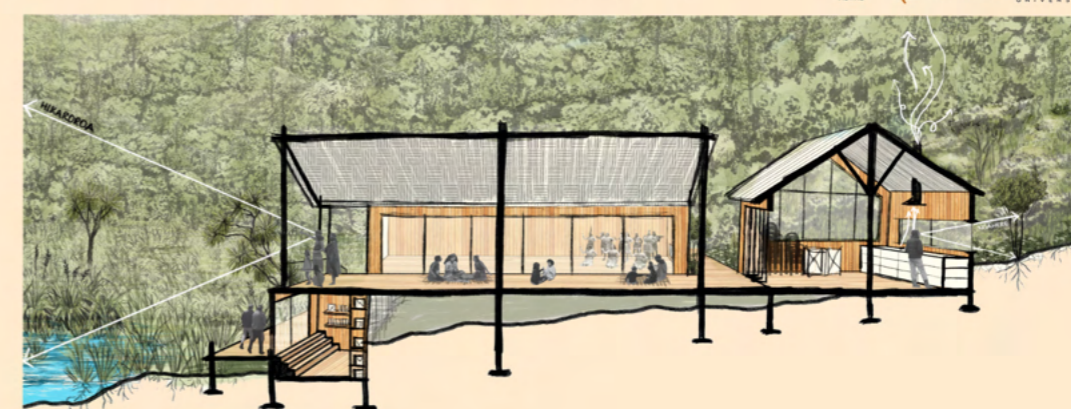
TIPU MATOMATO TE HARAKEKE

WIDER MAHIKA KAI NETWORK



KEY

- hubs
- ▲ maunga
- contours, 20m intervals
- pine forestry
- network connections
- SH1 & roads to Tipu Matomato Te Harakeke
- population density



Note: Map networking other food-gathering sites, and a section visualisation of the main building on site, drawn by Author (2024).

3.2 INITIAL SITE ANALYSIS

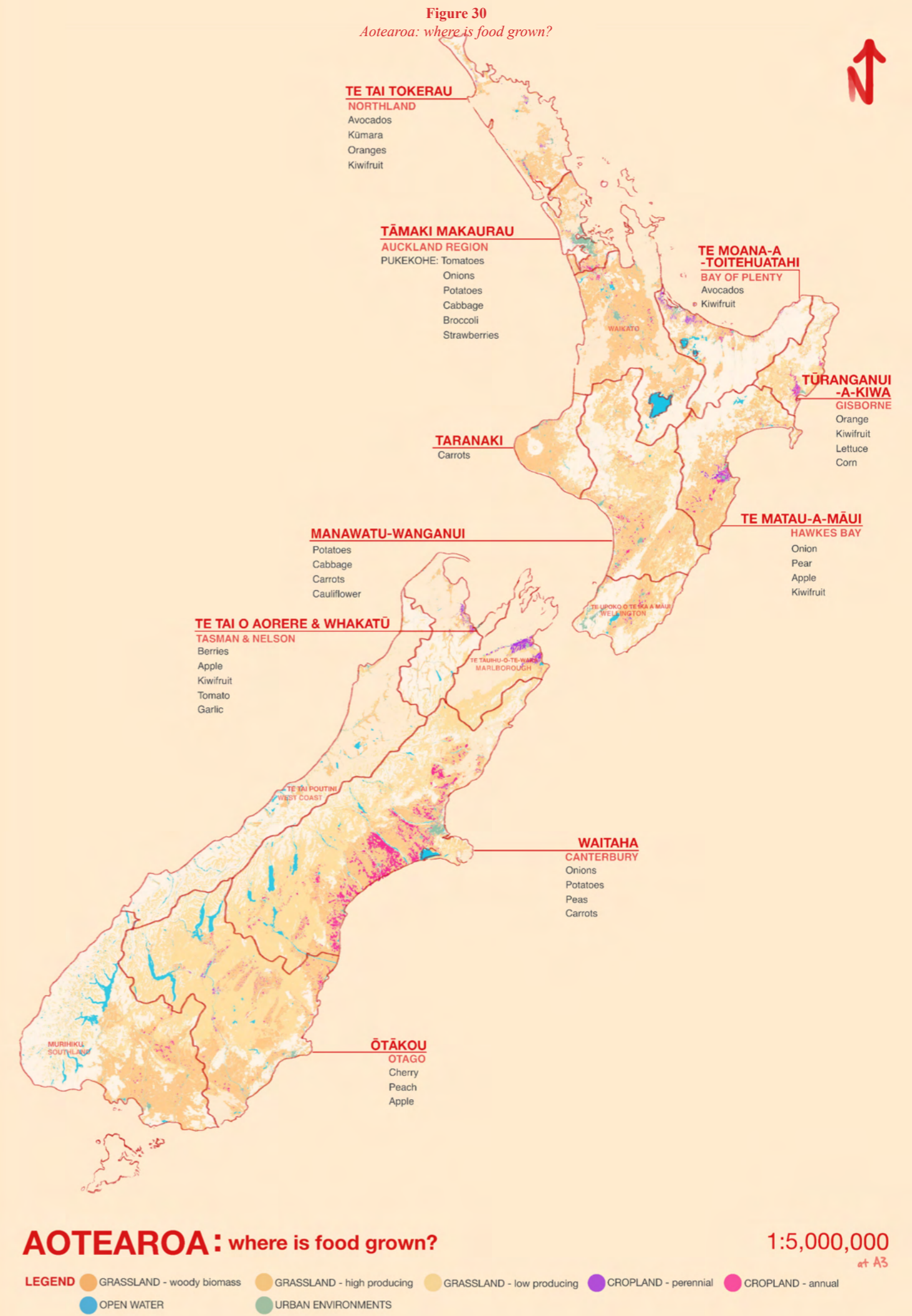
Before beginning initial design exploration, an initial site analysis is conducted, to find a site where expanding built environments are threatening food-productive landscapes. An initial site analysis grounds the design research to be place-based. The analysis begins at a broad scale down to a town, where an individual site is selected in chapter 4.0.

Initial site analysis begins to contextualise where food is grown in Aotearoa. There are 16 regions, 10 of which significantly contribute to the production of foods for international and domestic markets (Horticulture NZ, 2023). Figure 30 visualises which regions significantly grow the country's produce, and compares it with land-use data for overall understanding of the extent of urban and food-productive environments. Food productive landscapes include grasslands that cultivate grains, animal feed, and grazing paddocks for livestock that produce dairy or meat. Croplands are differentiated between perennial cropland and annual cropland; perennial croplands are orchards and vineyards, while annual croplands are seasonal rotations of vegetables



Figure 29
Sheep & cow pastures

Note: Visualisation of livestock that occupies grassland classifications.

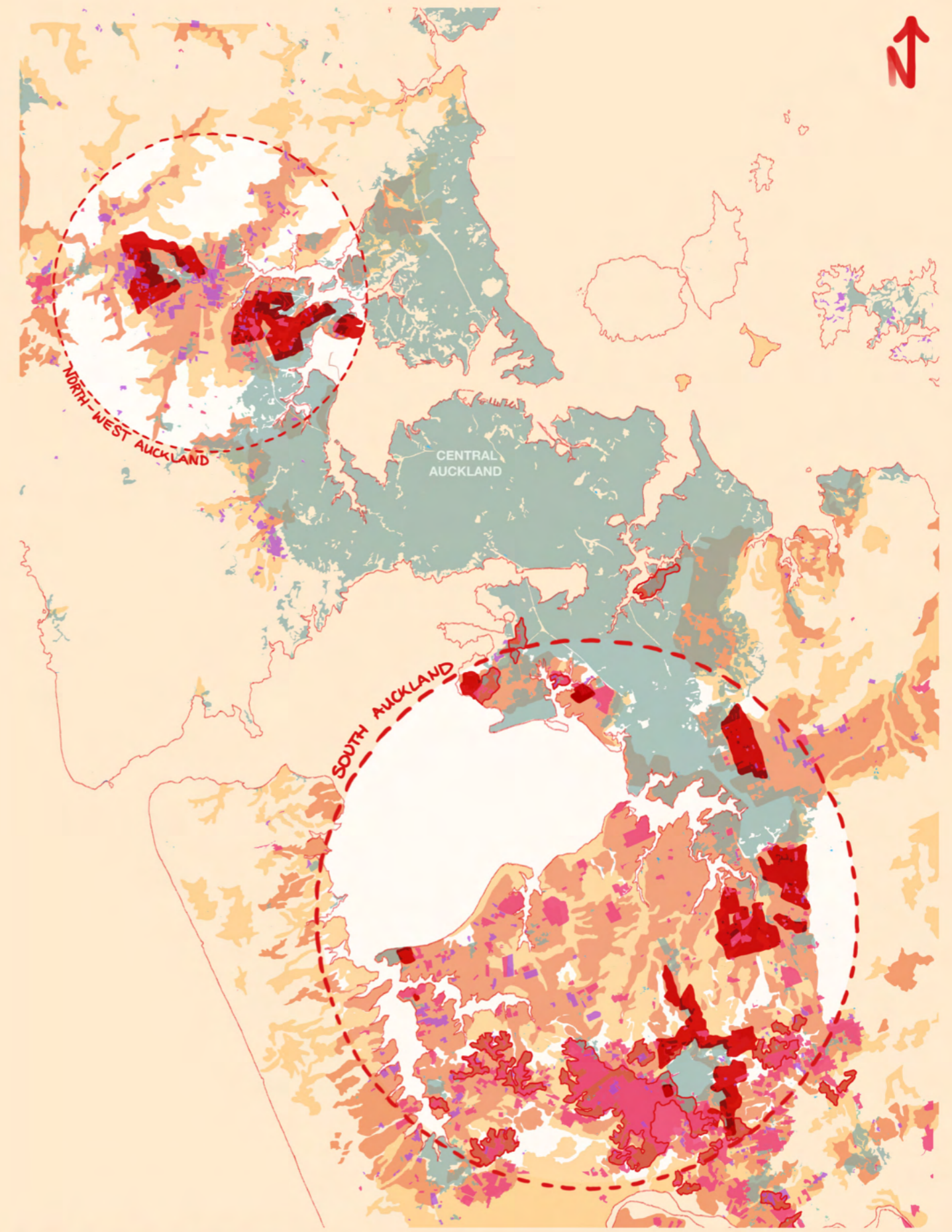


Note: Map of Aotearoa's key food-producing regions. Data adapted from MFE (2020) and Horticulture NZ (2023)

Figure 31
Tāmaki Makaurau: where is the conflict between development & cultivation

Figure 31 scales down to the Tāmaki Makaurau region, as it is the fastest growing city in Aotearoa with intensive population growth and urbanisation making it ideal for this study's investigation (Curran-Cournane et al, 2016). The mapping identifies key food productive areas in the region through soil types, land-usage and future development zoning to identify tensions through urban development encroaching onto versatile soils.

Key areas identified in this analysis are Western and Southern Tāmaki Makaurau , with food-productive landscapes, highly productive soils, rich histories of food growing and intensive housing development. Due to the extent of future development, productive soils, and the area being densely populated with high levels of food insecurity (Chu-Ling, 2022), the study will scale down to South Tāmaki Makaurau.



TĀMAKI MAKĀURAU: cultivation & development conflicts 1:250,000
 at A3

LEGEND

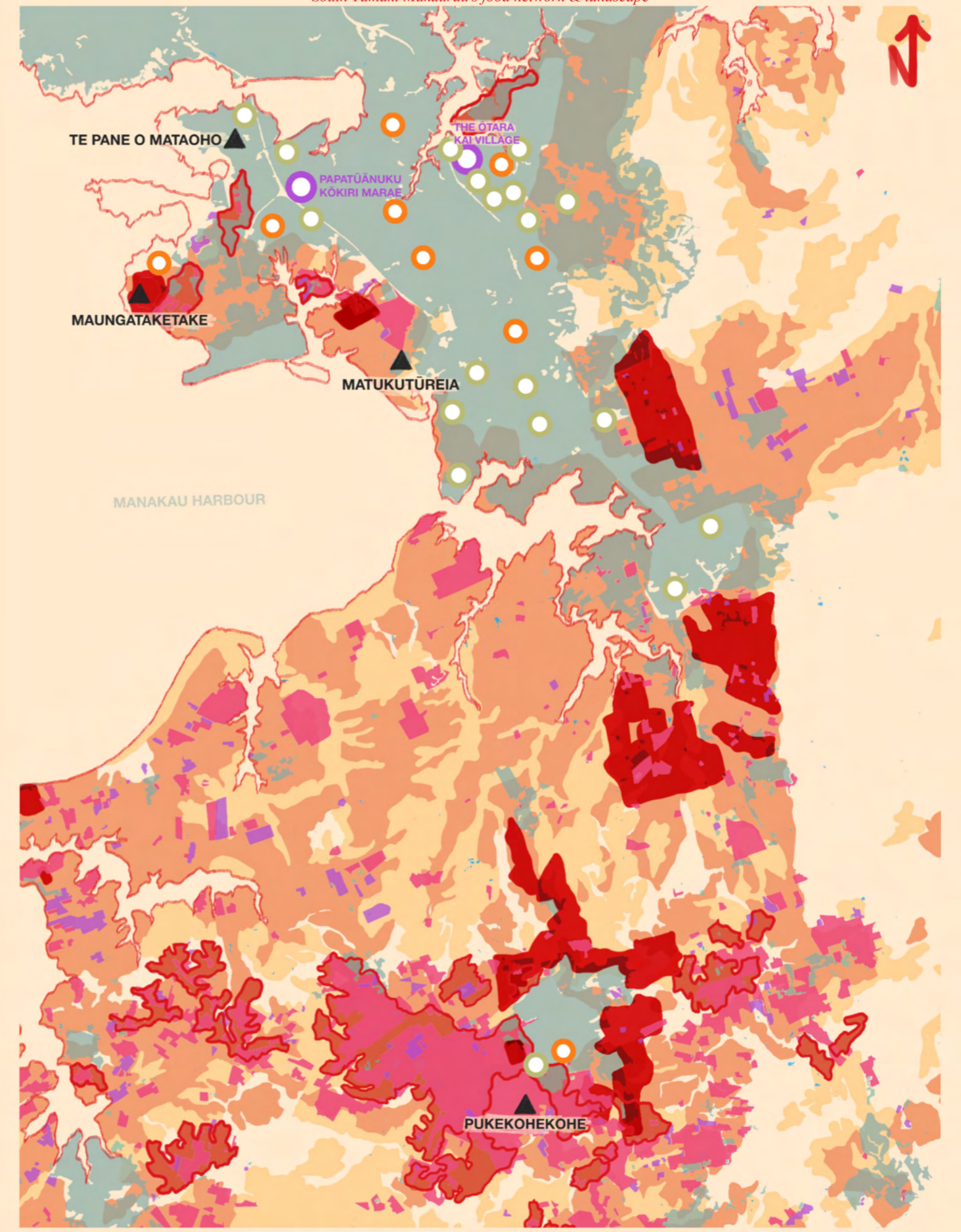
● FUTURE DEVELOPMENT	● URBAN AREAS	● CROPLAND - perennial	● CROPLAND - annual
● HPL-LUC class 1	● HPL-LUC class 2	● HPL-LUC class 3	 CONFLICT ZONES

Note: Mapping data of food-productive and future developing environments are overlapped to see where there is conflict. Data adapted from MFE (2020), Landcare Research (2024), and Auckland Council (2022).

Figure 32
South Tāmaki Makaurau's food network & landscape

In South Tāmaki Makaurau there is a multi-scale network of community-led initiatives to build food resiliency to address local food insecurity. Figure 32 shows grassroots food-sharing through installations of pātaka kai, educational community gardens, and food hubs, that collectively create a food resilient network built from community support and unity in South Tāmaki Makaurau. The mapping examines the food network with productive soil classifications, urban areas, and future development zones, to find overlaps and gaps within the food network.

Figure 32 shows the area of Pukekohe with highly productive class one soils; the highest classification for food production, disconnected from the community-built food network of South Tāmaki Makaurau. In Figure 32 there is a visual barrier of farmlands dividing Pukekohe from the South Tāmaki Makaurau's urban food network, indicating the disconnected relationship between food producers and consumers. This disconnection could be a result of rural food producers directly engaging with industry systems, rather than consumers. The findings of disconnection between food producers and consumers meet the criteria of this study to mediate relationships, therefore the study will scale down to Pukekohe due to its intensive food-productive landscapes and disconnection from wider community-led food networks.



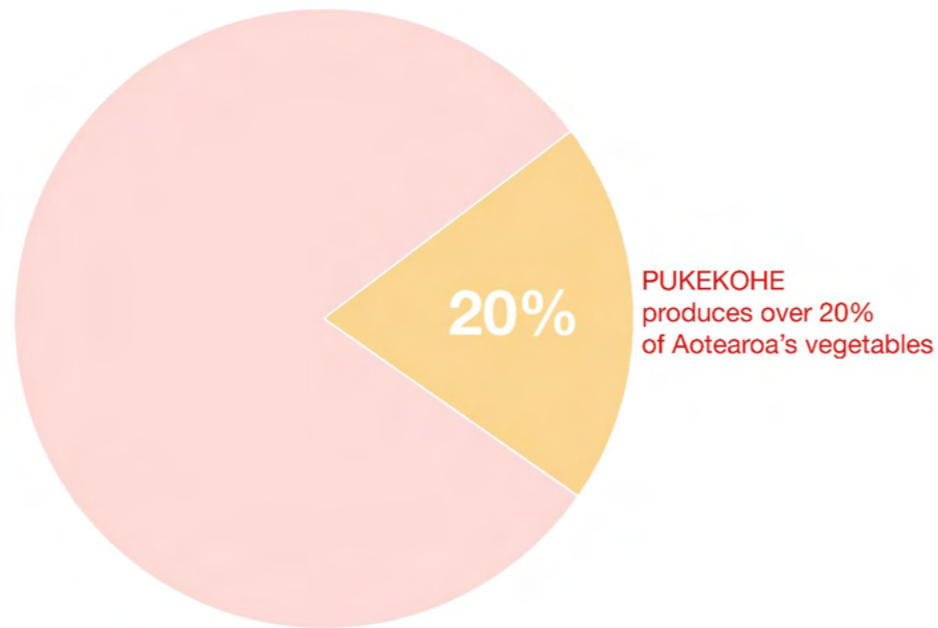
SOUTH TĀMAKI MAKAURAU: food network & landscape 1:115,000
at A3

LEGEND	● FUTURE DEVELOPMENT	■ URBAN AREAS	■ CROPLAND - perennial	■ CROPLAND - annual	▲ MAUNGA - MOUNTAIN	
	■ HPL-LUC class 1	■ HPL-LUC class 2	■ HPL-LUC class 3	○ KAI INITIATIVES	○ COMMUNITY GARDENS	○ PĀTAKA KAI

Note: Mapping data of food-productive and future developing environments are overlapped to see where there is conflict. Data adapted from MFE (2020), Landcare Research (2024), Auckland Council (2022), .

The town of Pukekohe is specifically named in the horticulture sector's document (Horticulture NZ, 2023) as a key grower of the country's food supply as it provides over **20%** of Aotearoa's vegetables (OLAW, 2021). Figure 35 shows a growing suburban environment that is encroaching onto cropland with the intention of converting highly productive soils into residential neighbourhoods. The project will be situated in Pukekohe as it meets the criteria: conflict between a growing built environment competing with food-productive landscapes, and potential conflicts between new residents and existing food producers.

Figure 33
Pukekohe grows 20% of Aotearoa's vegetables.



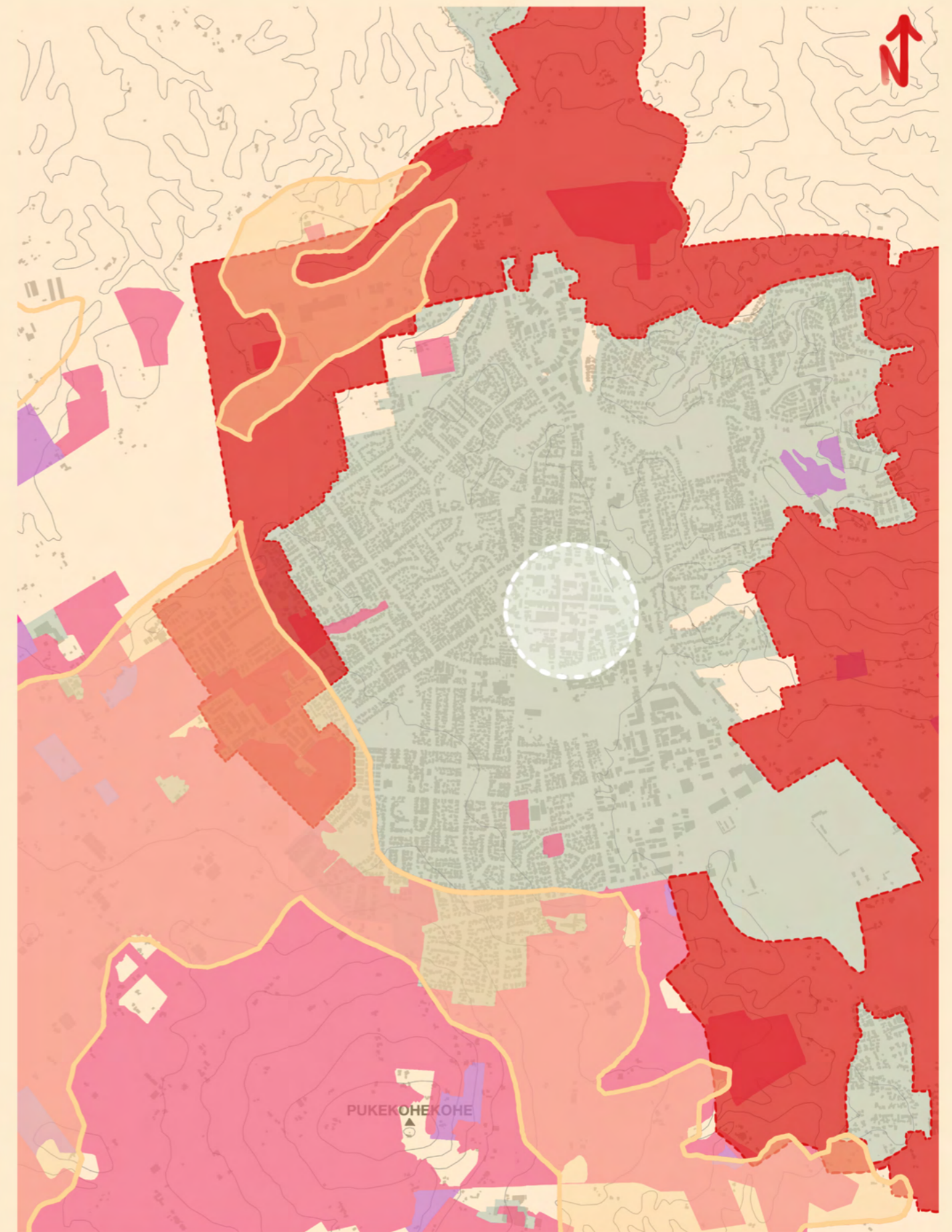
Note: Statistics informed by OLAW (2021)

Figure 34
Pukekohe character



Note: Collage of Pukekohe's characteristics, suburban residential development, colonial buildings in the town centre, and intensive farming.

Figure 35
Pukekohe: cultivation vs the built environment



PUKEKOHE : cultivation vs built environment

1:25,000
at A3

- LEGEND**
- FUTURE DEVELOPMENT
 - URBAN AREAS
 - CROPLAND - perennial
 - CROPLAND - annual
 - HPL - LUC class1
 - TOWN CENTRE

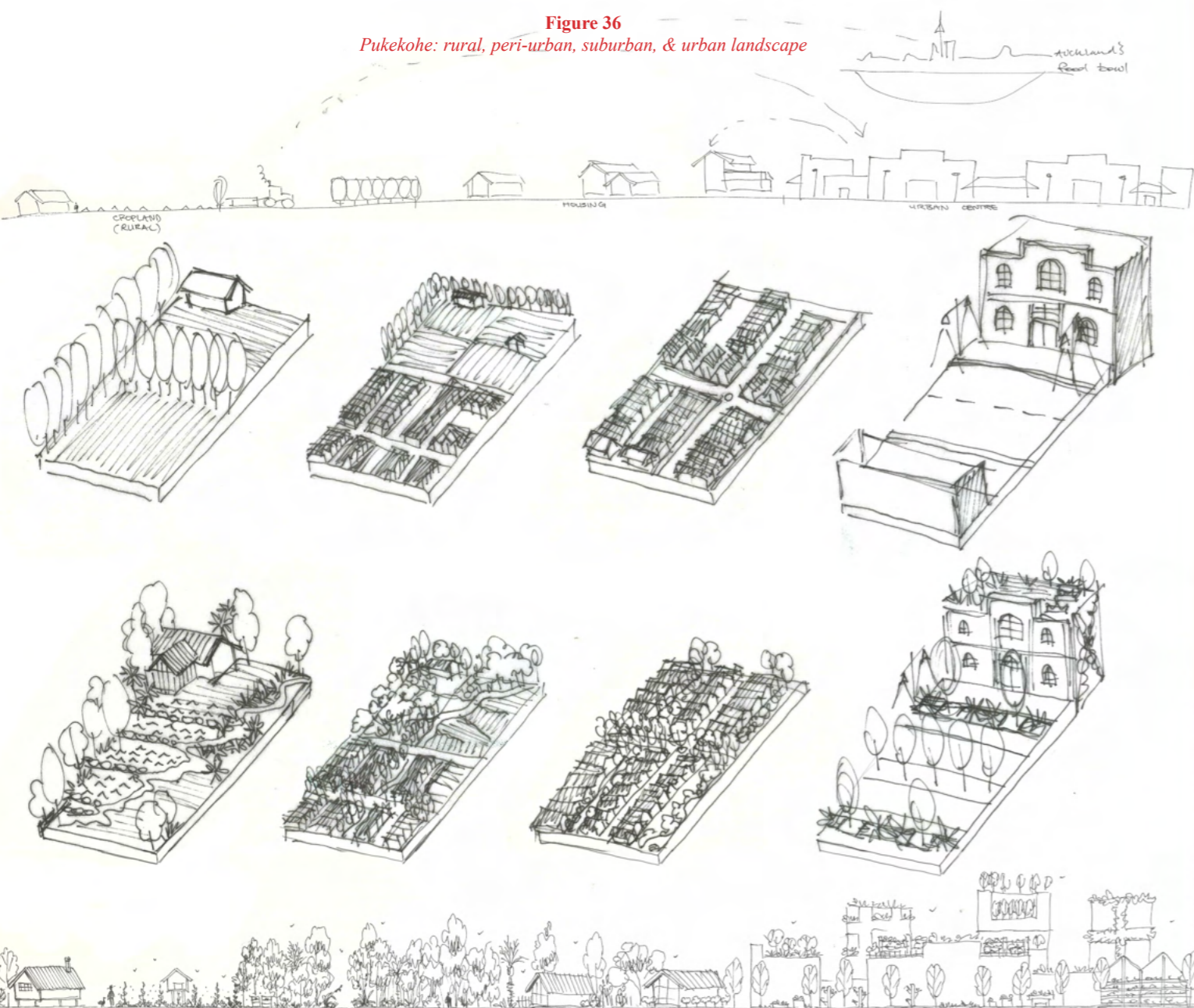
Note: Map networking other food-gathering sites, and a section visualisation of the main building on site, drawn by Author (2024).

3.3 INITIAL DESIGN

Initial design is informed by the theoretical framework, precedent analysis, previous food-centred architecture work I've conducted, and initial site analysis that situates the investigation in place. The initial design process started with a design sprint that tested different programmes of food-production, community engagement, and ecological regeneration that could take place in Pukekohe across the urban, suburban, peri-urban and rural environments through sketching. The initial design sprint, seen in Figure 37, was informed by NUWAO's nature-based solutions (Pedersen Zari et al, 2024) from the theoretical framework, that applied programmes of community gardens, edible home gardens, indoor food gardens, greenhouses, planting for biodiversity, and edible landscapes integrated into urban landscapes.

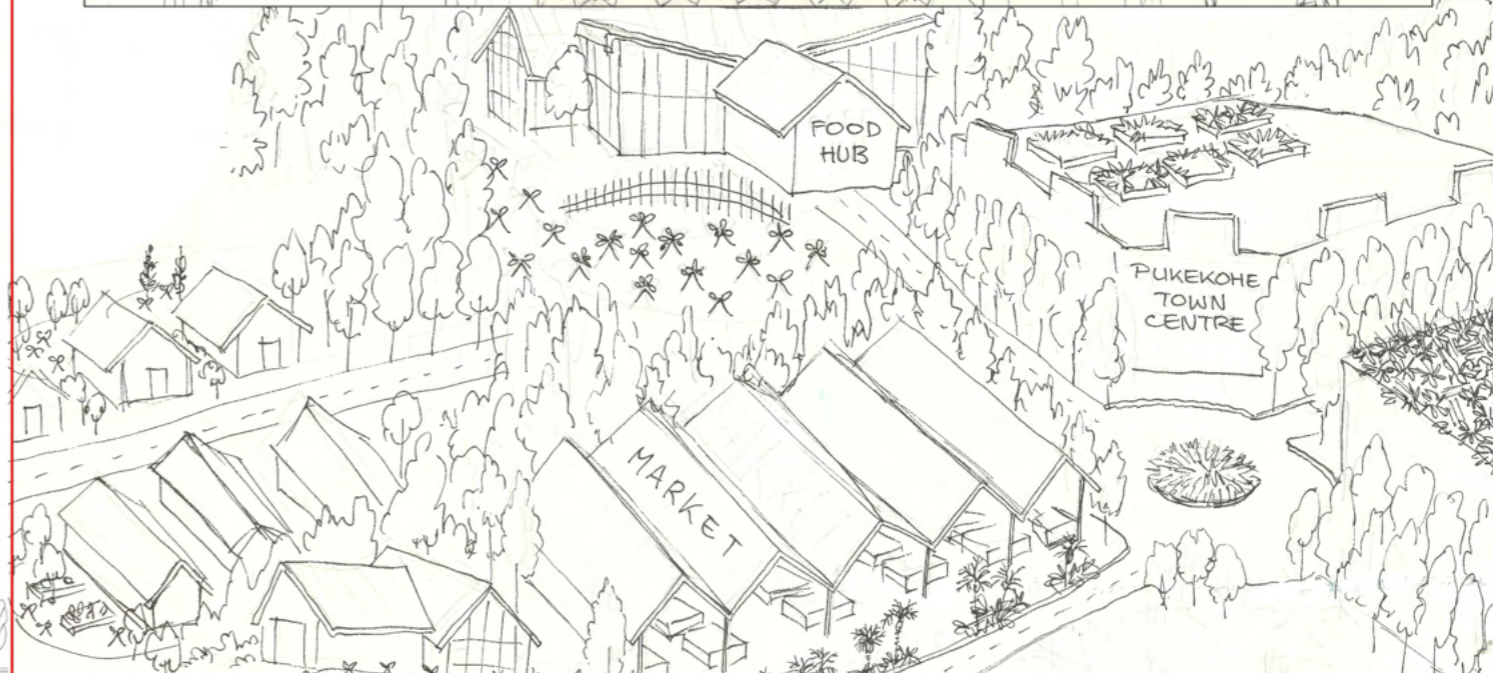
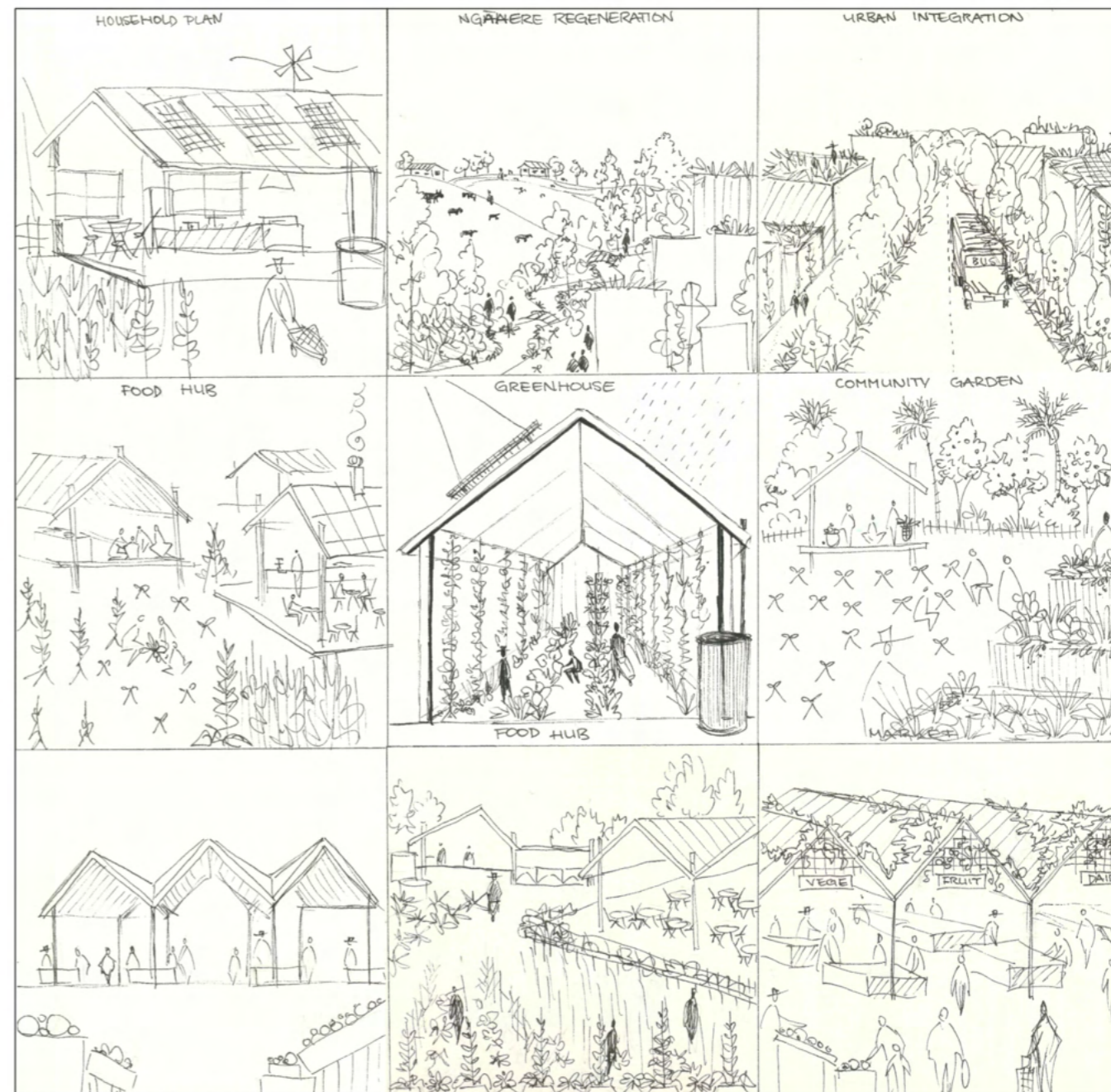
Initial form exploration in Figures 37, 38, 39, and 40, shows iterative sketching of vernacular structures that are recognisable as food productive buildings such as greenhouses and sheds, were conducted through sketching and model making. The forms also expanded on initial work from the Railway Food Hub (Gray, 2022) and Tipu Matomato Te Harakeke, and exploring traditional Māori whare design, and pātaka designs as seen in Figure 38, to understand traditional Māori relationships with food practices in spatial arrangements.

Figure 36
Pukekohe: rural, peri-urban, suburban, & urban landscape



Note: Sketches illustrating the transition between different landscapes in Pukekohe, and transforming those landscapes based on Nature-Based Solutions.

Figure 37
Quick start sketches



Note: Sketches exploring different programming that hosts food producers, consumers and biodiversity

Figure 38
Form sketches

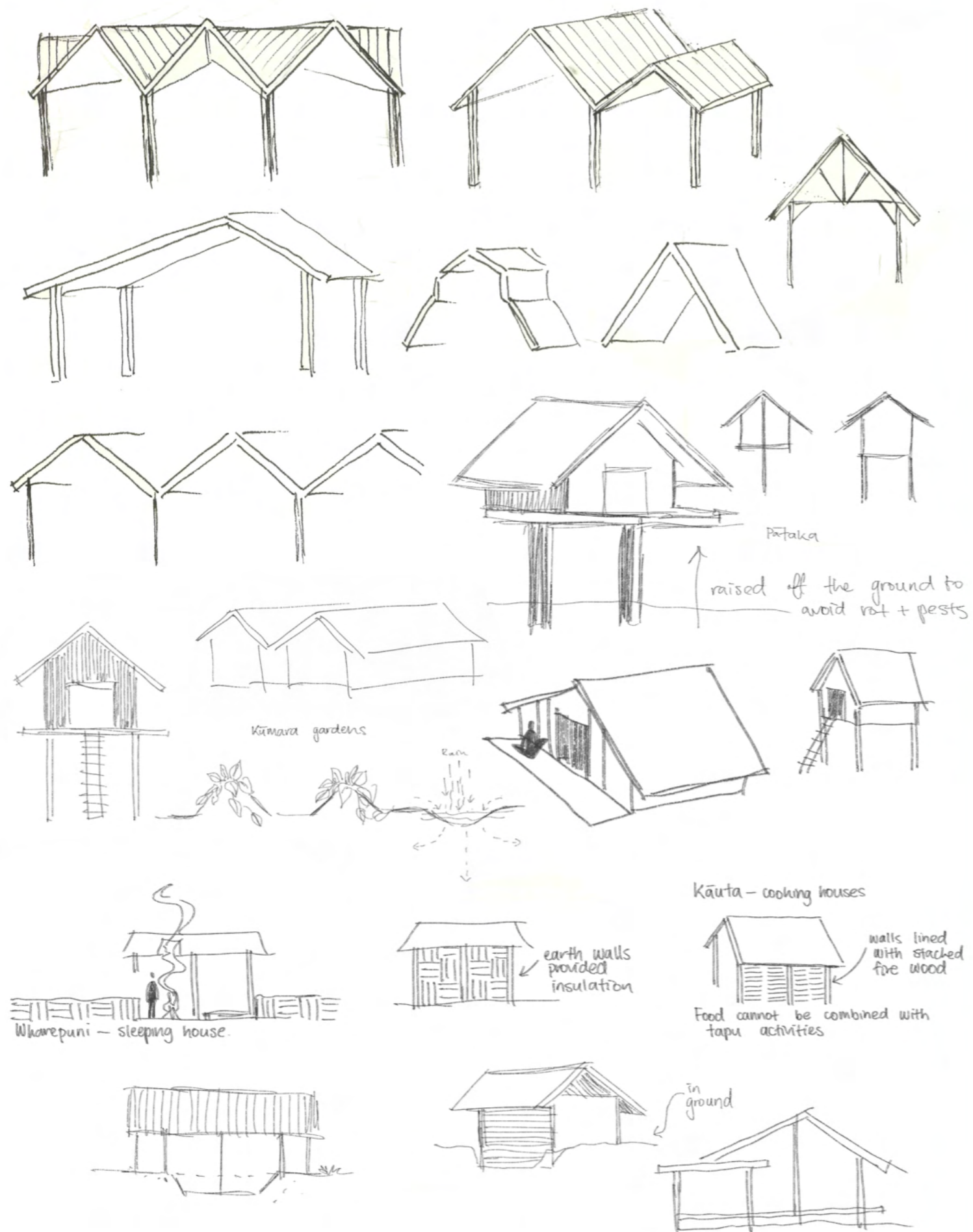


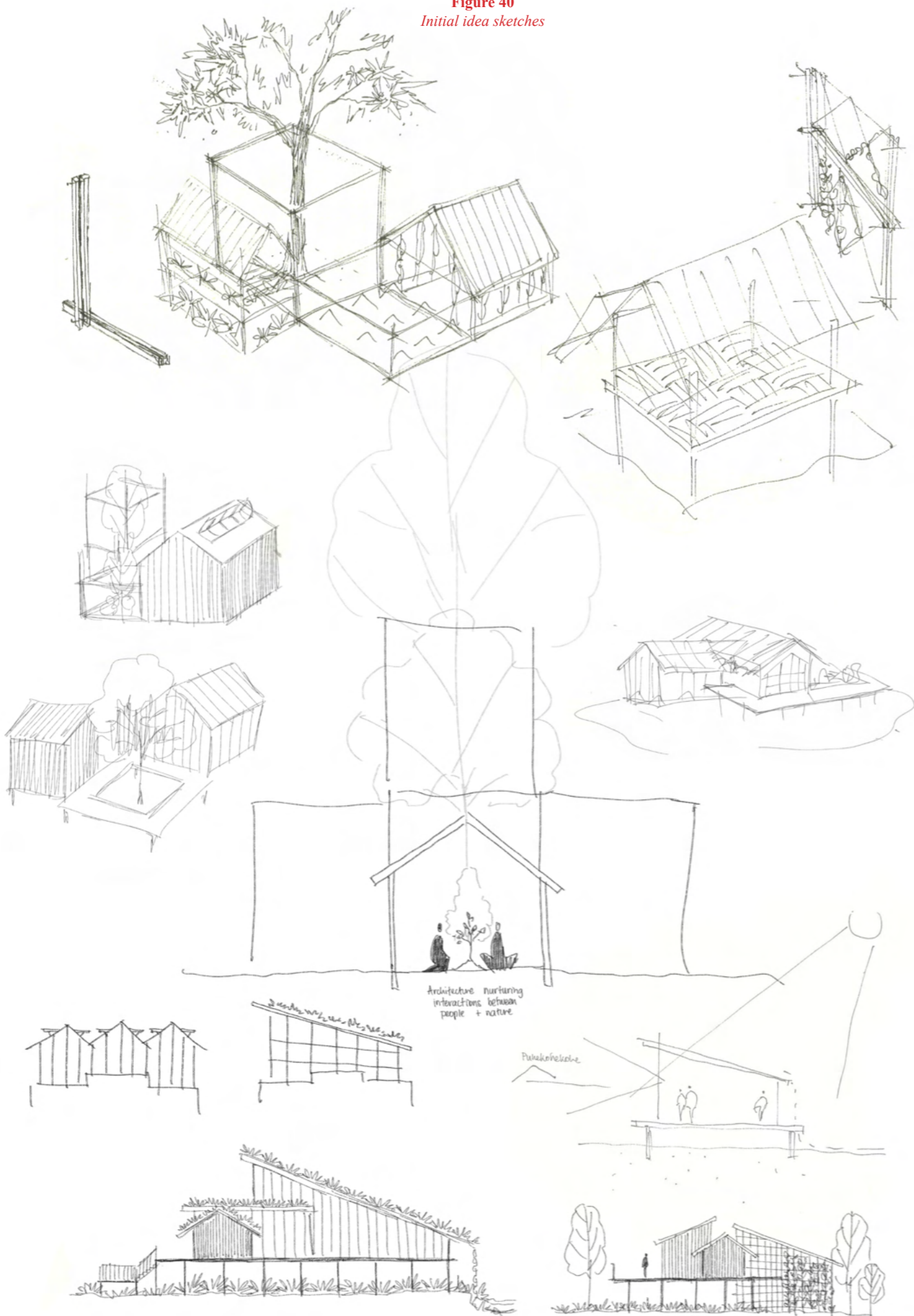
Figure 39
Initial ideas



Note: Sketches exploring vernacular forms inspired by greenhouses, sheds, and traditional Maori buildings interpreted from Brown (n.d)

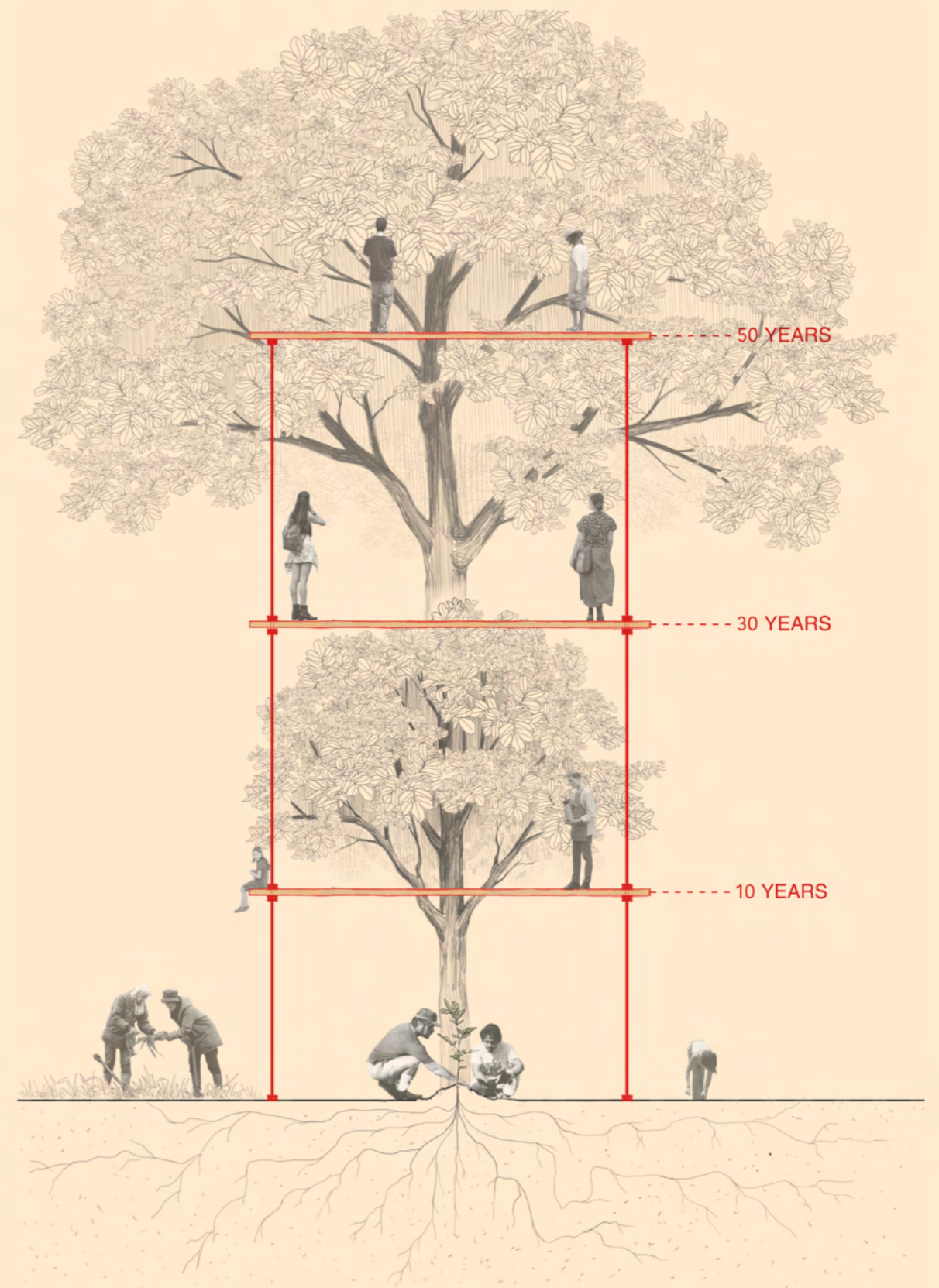
Note: Sketches exploring initial ideas, and a card model displaying potential form for a roof or shelter.

Figure 40
Initial idea sketches



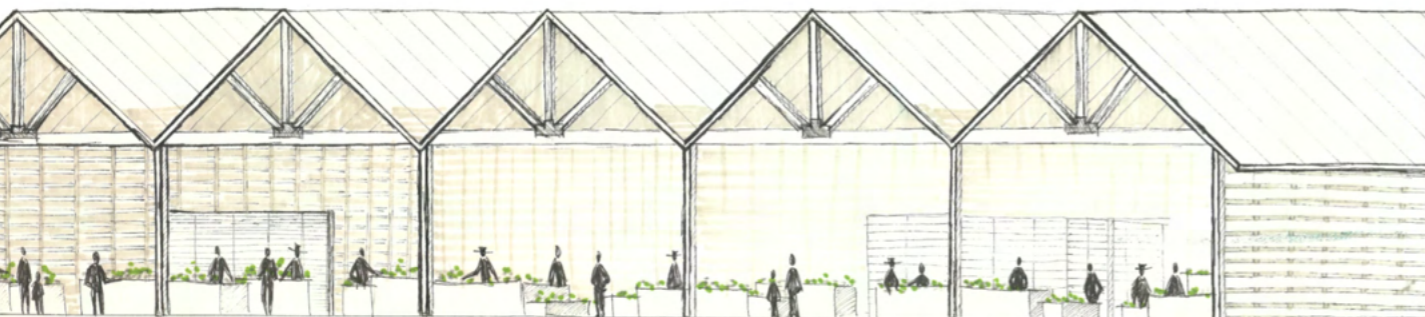
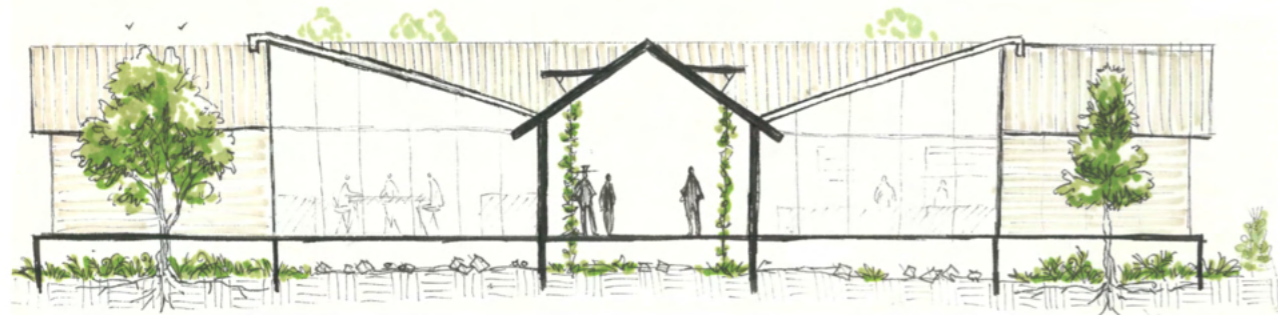
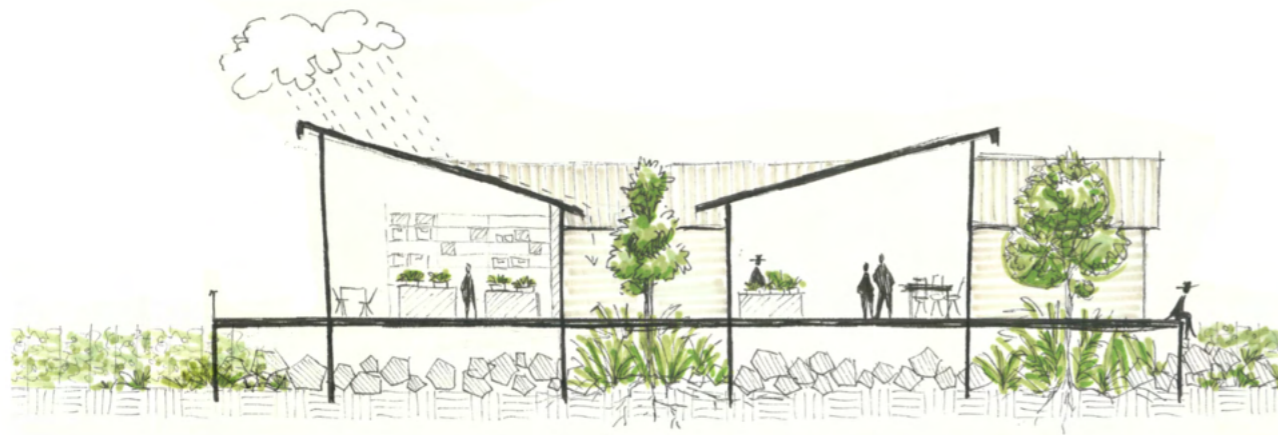
Note: Sketches exploring vernacular forms inspired by greenhouses, sheds, and traditional Maori buildings interpreted from Brown (n.d)

Figure 41
Scaffolding Kaitiakitanga



Note: Sketch depicting Kaitiakitanga and generational interaction with place and ecology across time.

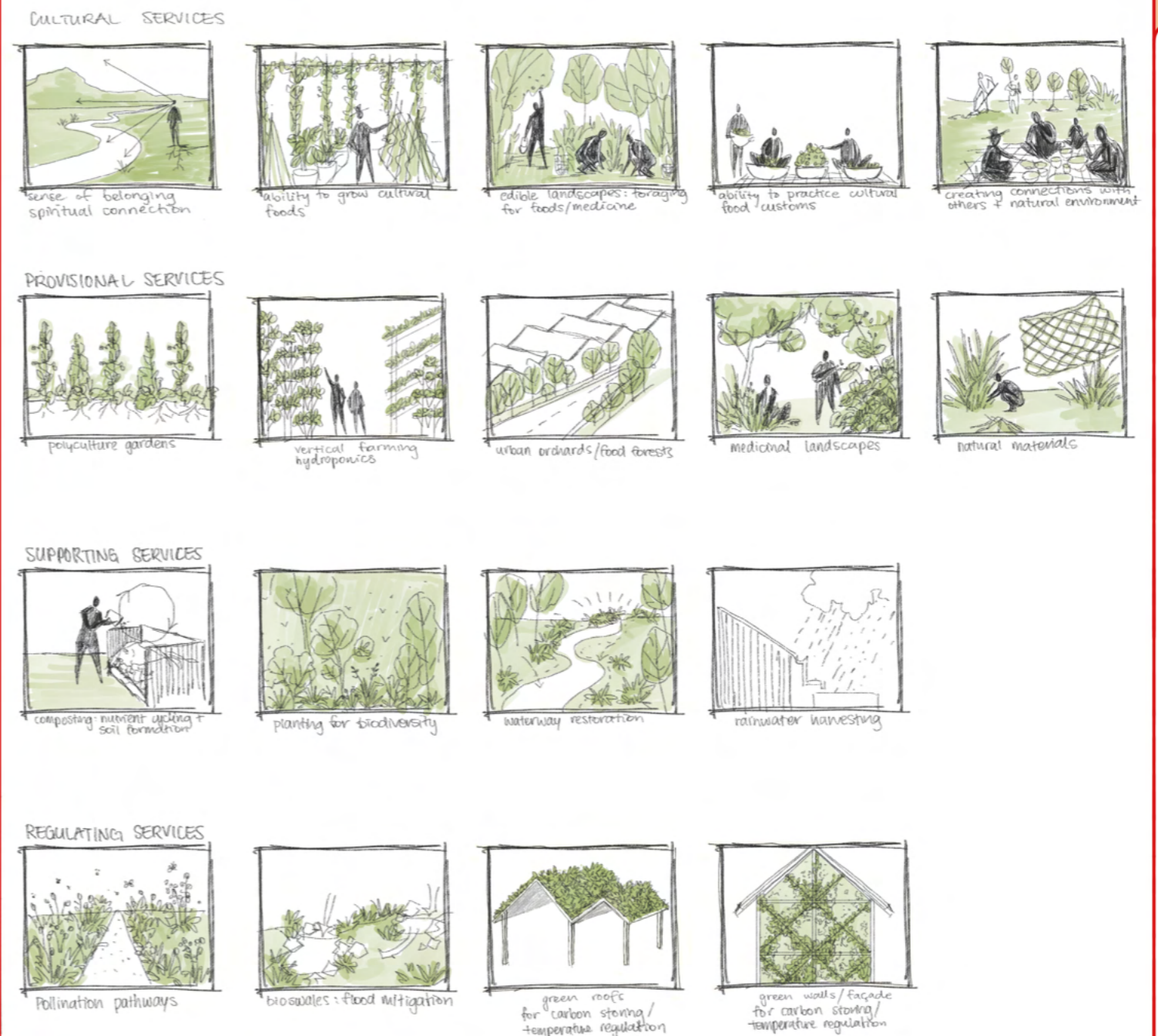
Figure 42
Initial Ideas for buildings, a food hub & markets



Note: Drawings illustrating buildings iterated from initial form exploration and quick start drawings.

From the design sprint and initial ideas, the feedback for the next stage of the research was to investigate sites further and begin a site-selection process identifying where these initial ideas are in Pukekohe, as some of the initial ideas were still quite broad, analysing the different landscapes of rural, peri-urban, suburban and urban, as seen in Figure 36. Building on my previous explorations on food hubs in the past, the research was challenged to focus more on the socio-cultural relationships within Pukekohe, to better understand the relationship between food producers and consumers, to provoke concepts that facilitate cultural and practices exchange, and education on the food system and food-productive processes between different groups of people. In response to that, an initial exploration of cultural services informed by Ecosystem Services and Māori food sovereignty practices informed what socio-cultural services architectural concepts could host, as seen in Figure 43.

Figure 43
Applying Ecosystem Services



Note: Sketches illustrating Ecosystem Services as architectural design programming, landscaping, and tectonics.

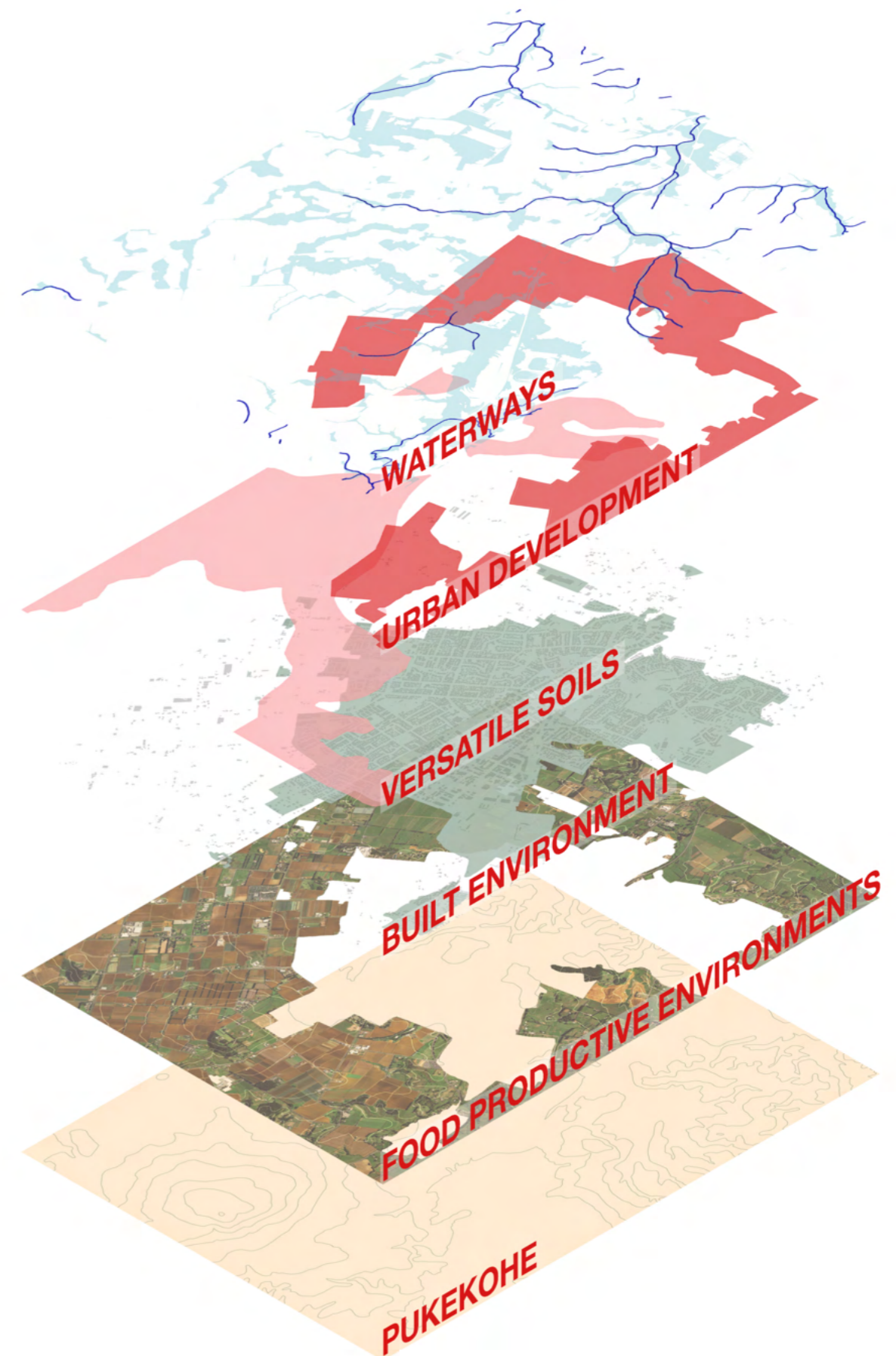
CHAPTER

4.0

SITE ANALYSIS

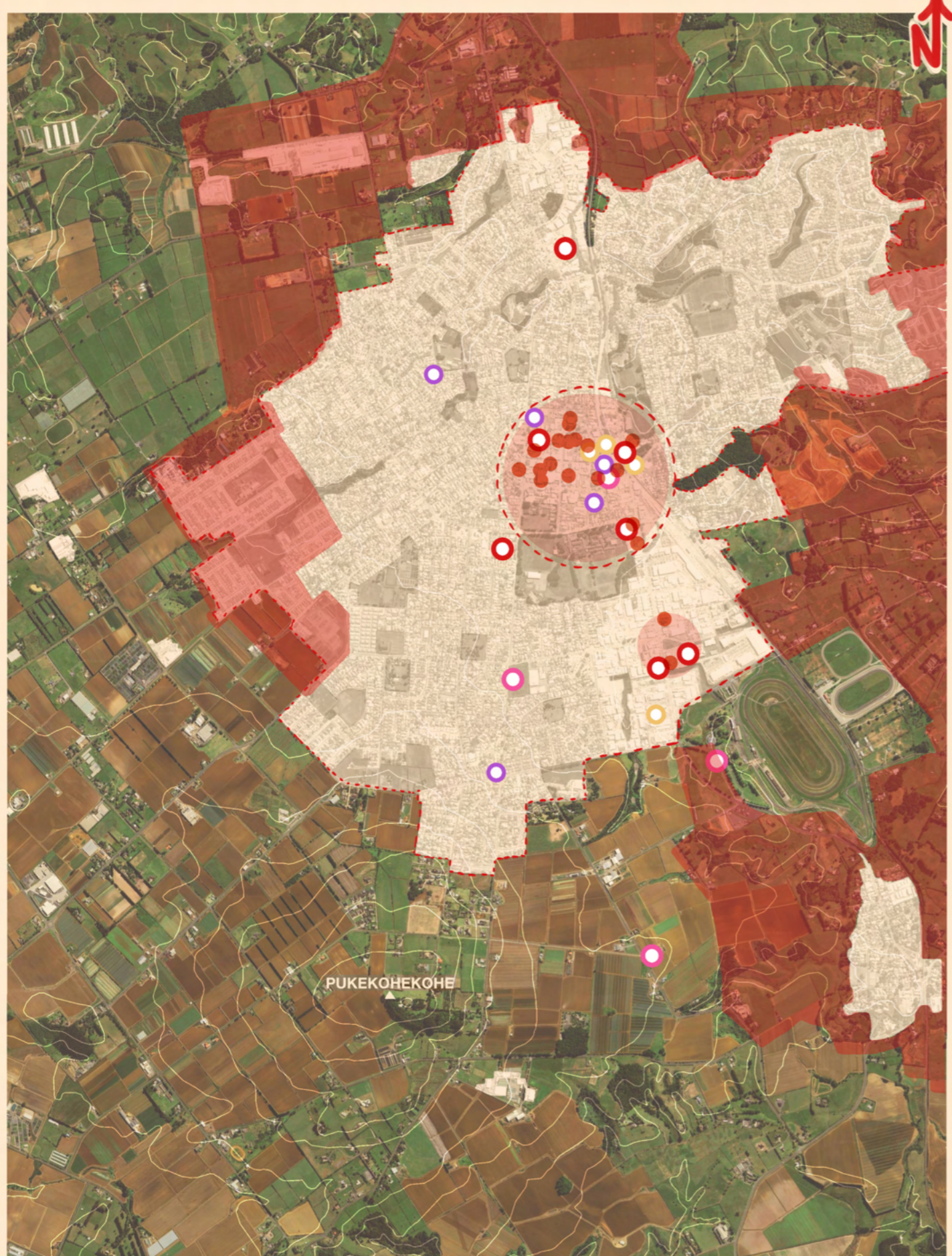
Figure 44
Examining site conditions

Expanding on the initial site analysis and understanding relationships in Pukekohe, this chapter begins a site-selection process to situate the study's architectural research. The selection process analyses the historical, socio-cultural, ecological, and climatic contexts of Pukekohe. Site analysis can identify where our food productive landscapes are, their relation to built environments, and where the stakeholders – food producers, consumers and biodiversity – interact in place. Another part of site analysis is understanding the existing built environment, future development, and its relationship to existing croplands and food producers. The site analysis identifies a single site that can research the architectural applications for food security, sovereignty, resiliency and reconciling food producers, consumers and biodiversity.



Note: Diagram showing Pukekohe site conditions that will be examined in this chapter

Figure 45
Pukekohe's food landscapes analysis



PUKEKOHE : food landscape analysis

1:25,000
at A3

- LEGEND
- SUPERMARKETS
 - SUPERETTES/DAIRYS
 - LOCAL GROCER
 - FARMERS MARKET/ROADSIDE SHOPS
 - FAST FOOD
 - FUTURE DEVELOPMENT

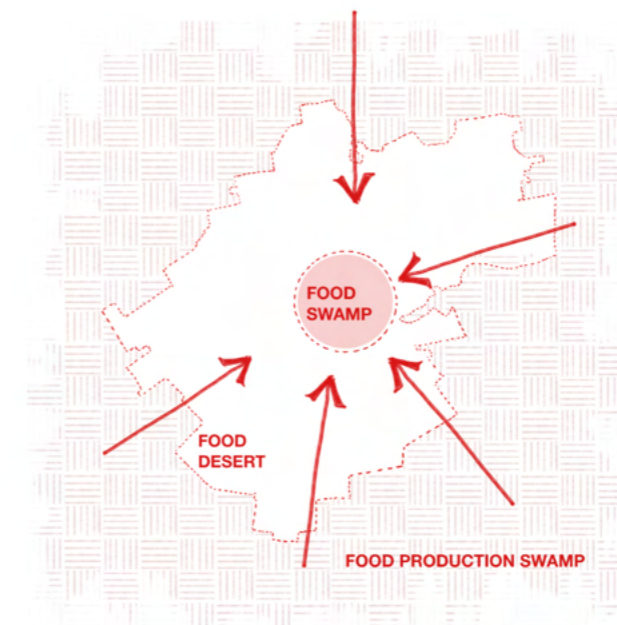
Note: Mapping showing the conditions of Pukekohe's food landscape. At 1:25,000 scale

4.1 CURRENT CONDITIONS OF PUKEKOHE

Zooming in to Pukekohe there is extensive market gardening with the threat of urban sprawling converting food productive landscapes into housing and urban areas as seen in Figure 45. There is tension between farmers and residents of newly developed areas, with reverse sensitivity occurring (Curran-Cournane et al, 2016). New neighbours within the developing areas are complaining about existing food producer's practices (Curran-Cournane et al, 2016). Complaints include smells from livestock, dirt swept off croplands, and noisy machinery; food producers feel hindered, and that new residents who are consumers do not value or understand the operations of food production (Curran-Cournane et al, 2016).

Figure 45 shows the food landscapes of Pukekohe, where residents can access food from supermarkets, small grocers, superettes, farmers markets, and fast-food stores. This analysis shows that the town centre is a food swamp, while residential areas are a food desert, with food-access gaps in south-western, western, northern, and north-eastern areas of Pukekohe. The surrounding market gardens are a food productive swamp, considered the food bowl of Tāmaki Makaurau. Highlighted in red in Figure 45 are food-productive environments rezoned for development; this will broaden the food desert and diminish food production's ability to provide domestic food security for Tāmaki Makaurau.

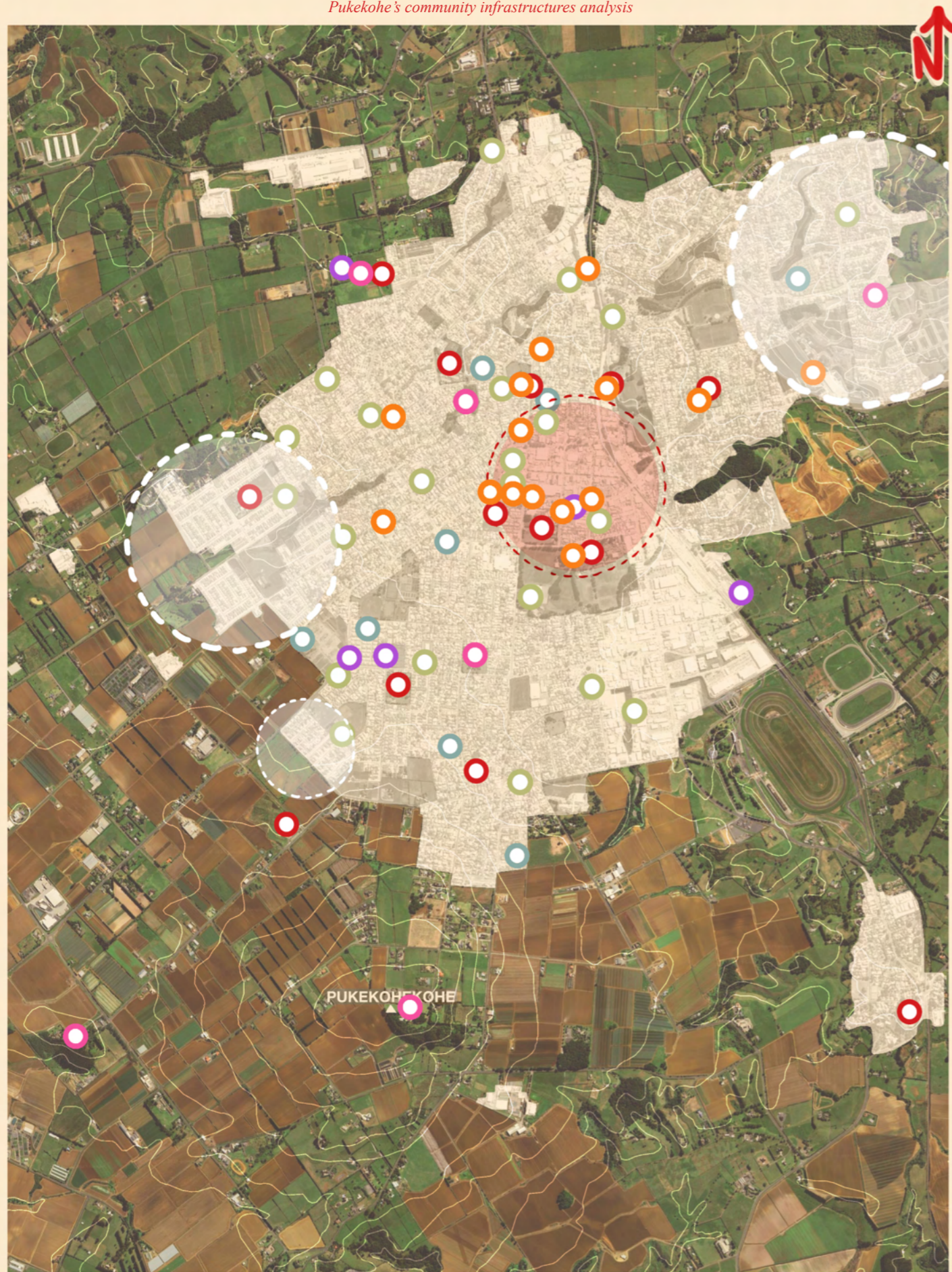
Figure 46
Pukekohe's food environment



Note: Mapping showing the conditions of Pukekohe's food environments: food swamp, food desert & food production swamp.

The duopoly of supermarket chains outnumbers other types of food access as seen in Figure 45, and most of the food outlets are only accessible in the built environment, raising questions of food producer's access to food; do they grow their own? Do they share or exchange with other growers? Or do they travel into town like their consumers to buy foods? There aren't many opportunities for consumers to travel out of the built area into food-productive landscapes to access food. The only opportunity for food producers to directly engage with consumers are at-farmers markets on weekends. This analysis prompts how architectural design could host alternative food access, encourage consumers to engage more with food-productive landscapes and food producers outside of the town centre.

Figure 47
Pukekohe's community infrastructures analysis



PUKEKOHE: socio-cultural context mapping

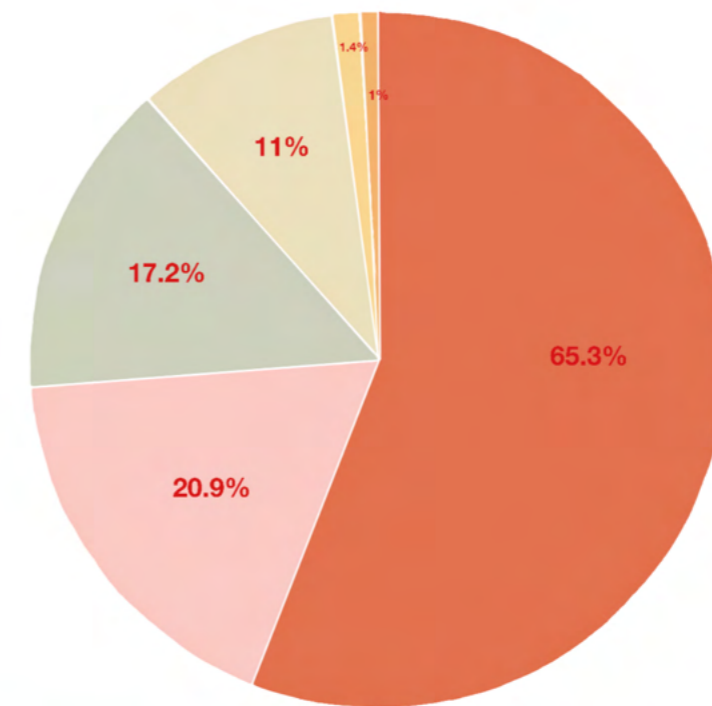
1:25,000
at A3

- LEGEND**
- SCHOOLS (primary - high school)
 - CHILDCARE
 - COMMUNITY HALLS
 - CHURCHES
 - RETIREMENT VILLAGES
 - SIGNIFICANT MĀORI SITES
 - TOWN CENTRE (food swamp)
 - DEVELOPING RESIDENTIAL - community infrastructure gaps

Note: Mapping showing the conditions of Pukekohe's socio-cultural infrastructures. At 1:25,000 scale.

Figure 47 shows community and cultural infrastructure in Pukekohe to identify what facilities are available for community engagement and gathering. The built environment hosts the majority of community infrastructures – if food producers are involved in these communities, they must travel into town to stay engaged. There are not many opportunities for residents in the urban area to travel out into food-productive landscapes for community or cultural activities that could connect and expose consumers to food production. New residential developments aren't providing localised community, cultural, and recreational infrastructure to support these expansions as seen in Figure 47, prompting this architectural research to engage with the lack of socio-cultural activities to bridge new residents with food producers.

Figure 48
Pukekohe's ethnicity groups

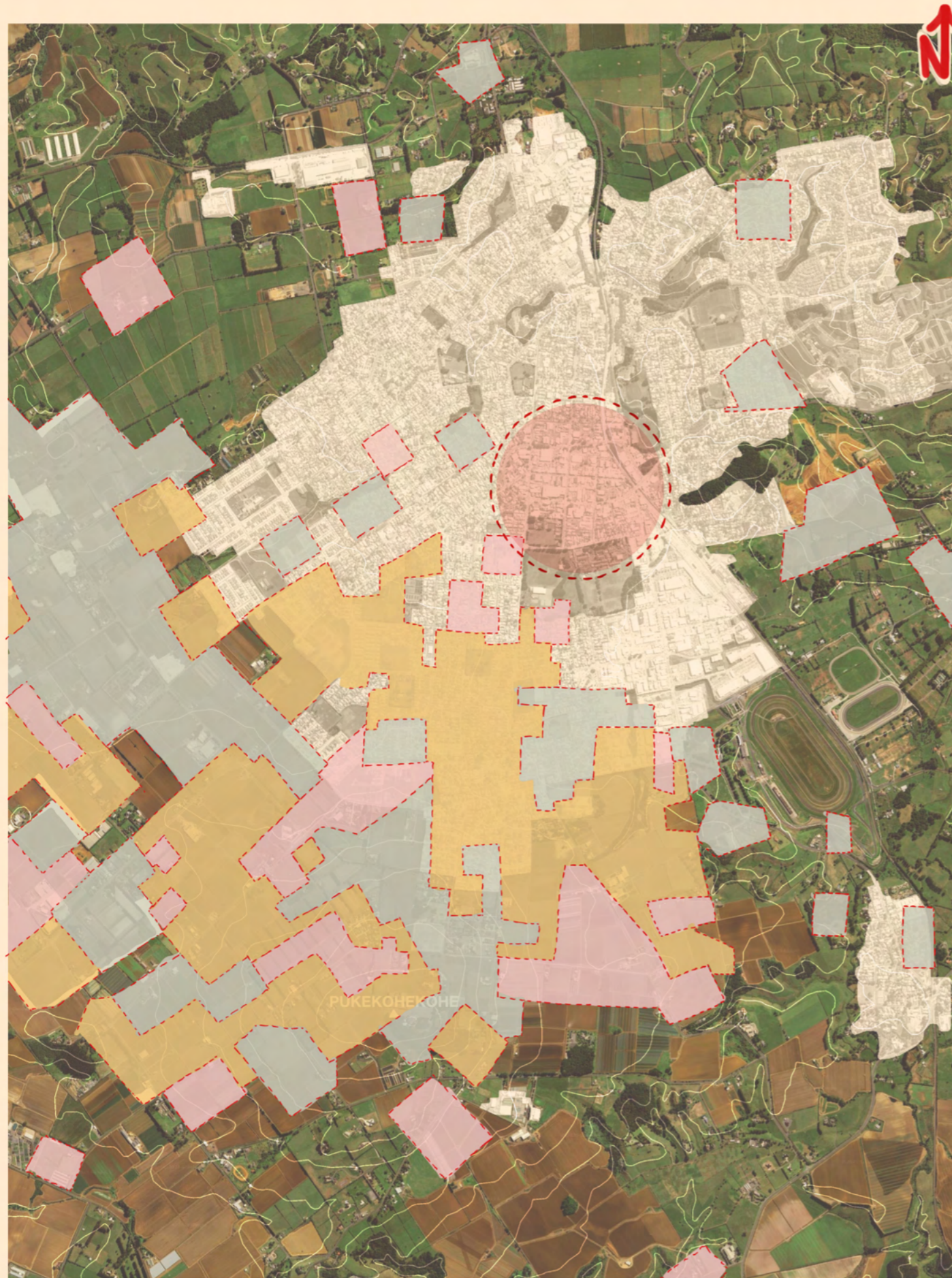


ETHNICITIES IN PUKEKOHE (2023)

- MĀORI
- PACIFIC PEOPLES
- MIDDLE EASTERN / AFRICAN / LATIN AMERICAN
- EUROPEAN
- ASIAN
- OTHER

Note: Statistics informing the diagram are adapted from StatsNZ (2023)

Figure 49
Pukekohe's land ownership by ethnic group in the 1960s



PUKEKOHE: land ownership by ethnic group 1:25,000
at A3

LEGEND TOWN CENTRE (food swamp) 1960s market gardens ownership (Lee et al., 2012) CHINESE OWNERSHIP INDIAN OWNERSHIP EUROPEAN OWNERSHIP

Note: Mapping showing the historical conditions of Pukekohe's market gardens and which ethnic groups owned land. Also shows the extent of Pukekohe's expansion of the built environment onto food-productive lands. Information adapted from Auckland Council (n.d.). Map at 1:25,000 scale.

4.2 HISTORICAL CONTEXTS OF PUKEKOHE

Originally Pukekohe was referred to as Puke Kohekohe, "hill of the kohekohe" named for the abundance of kohekohe trees in the area (Auckland Council, n.d.). Originally Ngāti Tamaoho and Ngāti Te Ata inhabited the area with its rich volcanic soils, with remnants of Māori agricultural practices of māra kai, and earth ovens found in the area (Auckland Council, n.d.).

The colonial history of the 1850's brought land confiscation and displacement for Māori, severing their connections with place. Forests were cleared for cultivation and livestock, to support western models of agriculture. Due to broader land seizures around Waikato and Auckland many Māori shifted to Pukekohe to become labourers for European and Chinese market growers, who would accommodate the Māori labourers and their families in deplorable living conditions (Christoffel, 2022), resulting in poor health and the death of many Māori children (Bartholomew, 2020).

Figure 50
Market garden labourers



Note: Illustration of market garden labourers harvesting potatoes.

Pukekohe has a dark history of racial segregation that only deteriorated in the 1950s. In the 1920's with a significant growth in Indian and Chinese market growers, European settlers felt threatened culturally and economically, resulting in the founding of The White Zealand League in 1925 (Auckland Council, n.d.). This fear and their treatment meant that Māori, Indians, and Chinese didn't have the same access to facilities and activities as white Europeans did, some stores, theatres, and barbers banned their entry, some had "No Māori allowed" signs on businesses (Bartholomew, 2020). Due to the racial treatment, Indian and Chinese Market growers formed their own associations to look after their communities. The first Indian community hall built in Aotearoa and owned by Indian-New Zealanders was in Pukekohe in 1953 (Auckland Council, n.d.). Understanding the dark history of Pukekohe makes the researcher realise that there is more to reconcile between the stakeholders of this study other than food illiteracy: there is, also a need for cultural inclusion in food growing spaces, and sense of belonging.

Figure 51
Pukekohe's indigenous ecosystem species



WF7.2 KEY TREE SPECIES



WF7.2 SECONDARY SUCCESSION



4.3 ECOLOGICAL & CLIMATIC CONTEXTS OF PUKEKOHE

The indigenous ecosystem of Pukekohe is the WF7.2 mixed broadleaf forest that is particularly abundant with Kohekohe (Singers et al, 2017), which is apparent from the town's name: hill of the kohekohe (Auckland Council, n.d.). The ecosystem occurs on fertile soils of volcanic origin within warm climates (Singers et al, 2017).

The key ecological characteristic of Pukekohe is its rich volcanic soils, LUC Class 1 soils are the most versatile land that is highly productive for cultivation, pastoralism, or tree crops (Landcare Research, n.d.). Class 2 and class 3 are still highly productive but aren't as versatile. Pukekohe has the most fertile soils in Tāmaki Makaurau as seen in Figure 31 making it a key cultivator for domestic food security (Curran-Cournane et al, 2016).

Along with the rich soils Pukekohe is a temperate oceanic climate that is frost-free allowing all-year cultivation unlike other regions in Aotearoa, making it the best conditions to produce foods (Chappell, 2014) (Curran-Cournane et al, 2016).

Urban sprawling threatens the quality of versatile soils with land conversions, creating rural and biodiversity fragmentation that loses connections between the modest number of habitats, ecosystems, and microclimates that survive and adapt within these food productive landscapes (Curran-Cournane et al, 2016).

The indigenous ecosystem species provides insight into how landscape design can regenerate the natural environment with intentionally planting key species for secondary succession to then layer it with the key vegetation that make up the mixed broadleaf forest of WF7.2 as seen in Figure 51.

Note: Drawings illustrate the original ecosystem of the Pukekohe area, identifying key tree species, and vegetation for secondary succession that can be applied to regenerate a site cleared for urban development.

Figure 52
Pukekohe's landscapes



Figure 53
View from Pukekohekohe



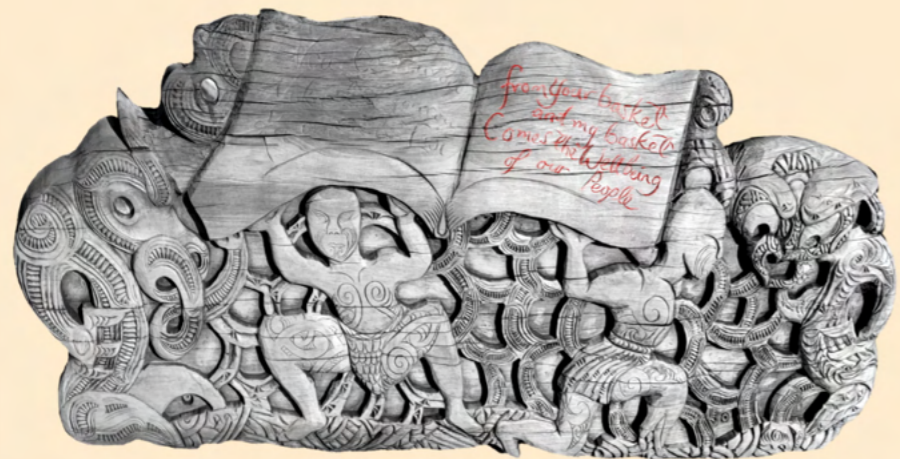
Note: Sketch of distant farmlands seen atop Pukekohekohe- Pukekohe hill.

Figure 54
Kohekohe



Note: Photographs of kohekohe trees found atop Pukekohekohe- Pukekohe Hill, and sketches of kohekohe leaves, flowers and seedpods.

Figure 55
Māori carvings at Pukekohekohe



**"From your basket & my basket,
comes the wellbeing of our people."**

Note: Photographs of Māori carvings found atop Pukekohekohe, showing food baskets, croplands, and a quote that highlights the importance of food production, and connections to place and people through foods.

Figure 56
Pukekohekohe Māori carving statue



Note: Photographs of Māori carvings found atop Pukekohekohe.

Figure 57
View of Tāmaki Makaurau's skyline



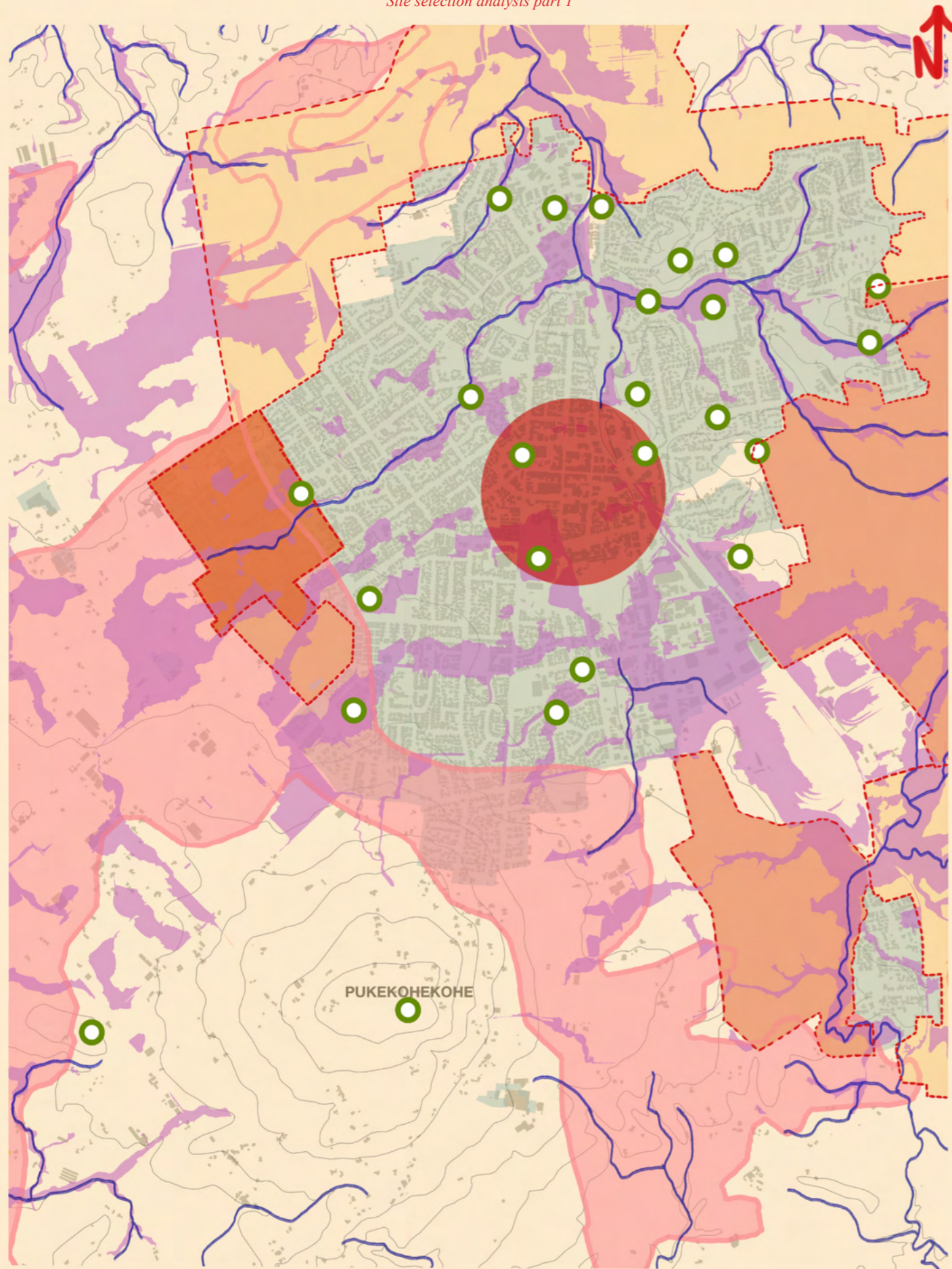
Note: Sketch of view atop Pukekohekohe that sees the Manakau Harbour, the Skytower, and mountains of Tāmaki Makaurau

Figure 58
Pukekohe town centre observations



Note: Sketches of buildings and forms observed in Pukekohe's town centre, colonial architecture is dominant.

Figure 59
Site selection analysis part 1



SITE SELECTION ANALYSIS

1:25,000
at A3

LEGEND	TOWN CENTRE	GREENSPACES	URBAN AREA	WATERWAYS	FLOOD PLAINS
	HPU - LUC class 1	CURRENT DEVELOPMENT	FUTURE DEVELOPMENT - 2035	FUTURE DEVELOPMENT - 2040	

Note: Map at 1:25,000 cross-analysing food-productive layers with urban development, and ecological characteristics that pinpoints overlapping areas.

4.5 SITE-SELECTION STRATEGY

The site selection process begins by mapping where current and future residential development overlaps with highly productive soils, greenspaces, streams, and flood plains to understand the spatial relationships between food producers, consumers, and biodiversity as seen in Figure 59.

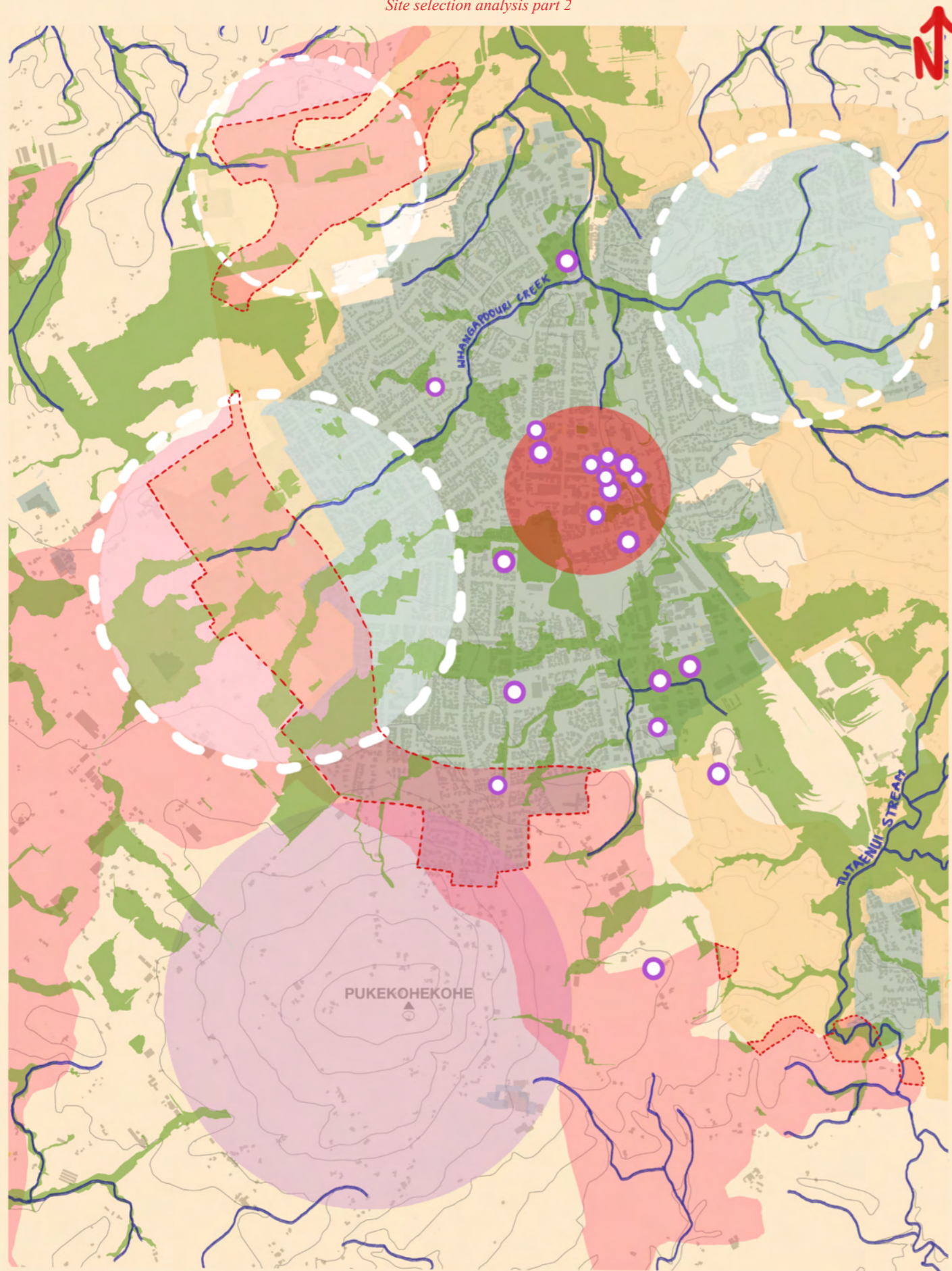
Figure 60 shows the sudden transition between suburban development and rural croplands where reverse sensitivity occurs, as mentioned in section 4.1.

Figure 60
Pukekohe's suburban & food-productive boundaries.



Note: Sketch and photos of the sudden transition between new suburban developments and established food-productive landscapes.

Figure 61
Site selection analysis part 2



SITE SELECTION ANALYSIS

1:25,000
at A3

- LEGEND**
- TOWN CENTRE
 - URBAN AREA
 - WATERWAYS
 - PUKEKOHEKOHE "hill of the kohekohe"
 - FLOOD PLAINS (ecological corridors)
 - HPU - LUC class 1
 - FOOD OUTLETS
 - FOOD GAPS
 - FUTURE DEVELOPMENT
 - - - TENSION POINTS

Note: Map at 1:25,000 interprets flood plains as ecological corridors providing biodiversity regeneration opportunities, and connections to the wider area.

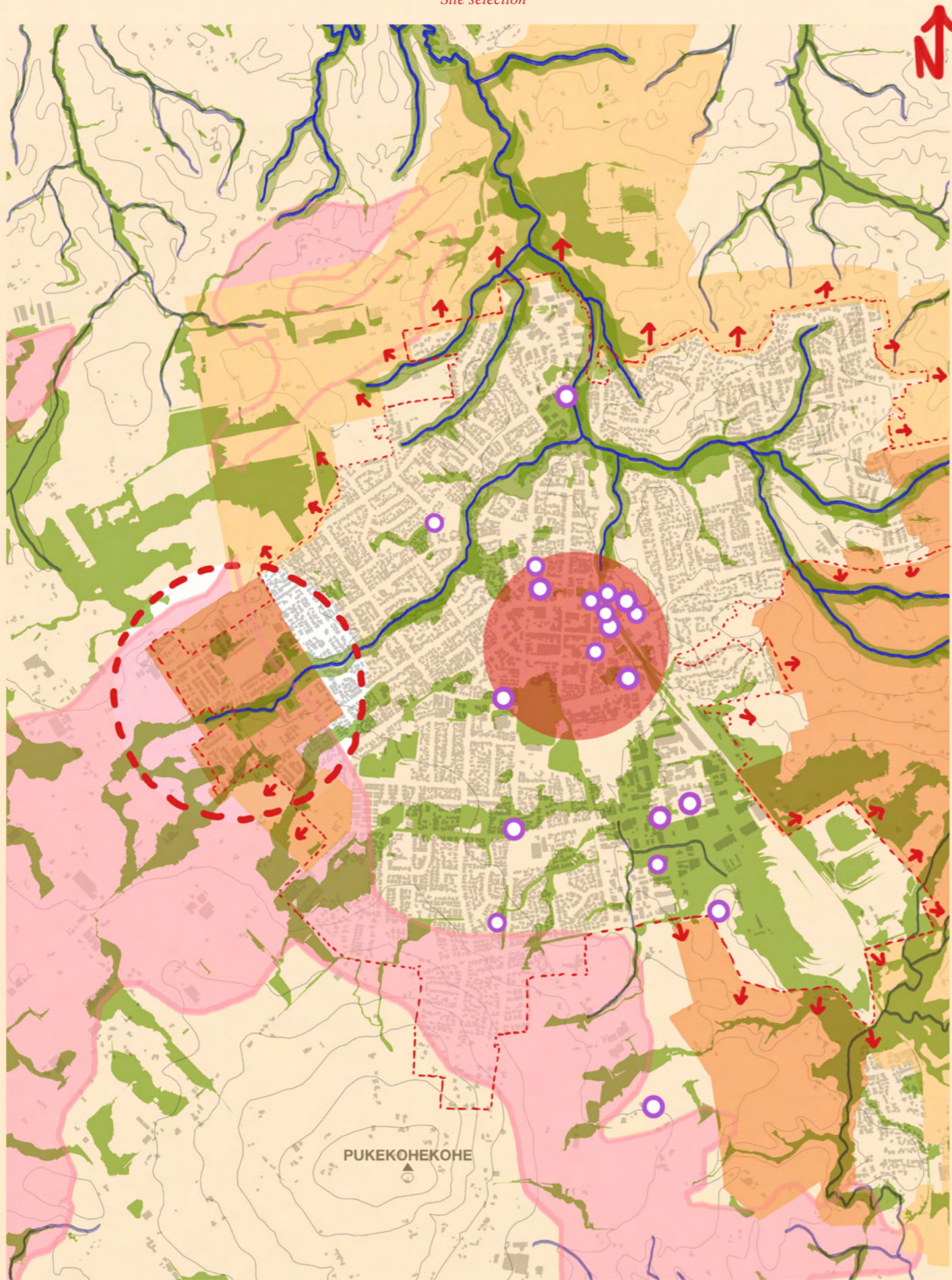
Figure 61 examines the ecological contexts for site selection, highlighting the potential of streams and flood plains as ecological corridors to reconnect urban and rural environments with biodiversity and ecosystem regeneration. These ecological corridors overlap residential development zones, highly productive soils, and identified food gaps from Figure 59. Figure 61 has mapped out conflict zones where developments are planned on class one highly productive soils.

Figure 62
Transforming floodplains into ecological corridors for biodiversity regeneration



Note: Sketch and photos of the sudden transition between new suburban developments and established food-productive landscapes.

Figure 63
Site selection



PUKEKOHE : site selection point of process

1:25,000
at A3

- LEGEND**
- TOWN CENTRE
 - GREENSPACE CATCHMENT
 - FOOD OUTLET ACCESS
 - WATERWAYS
 - POINT OF INTEREST
 - URBAN SPRAWL
 - URBAN AREA HPU - LUC class 1
 - CURRENT DEVELOPMENT
 - FUTURE DEVELOPMENT - 2035
 - FUTURE DEVELOPMENT - 2040

Note: Map at 1:25,000 interprets flood plains as ecological corridors providing biodiversity regeneration opportunities, and connections to the wider area.

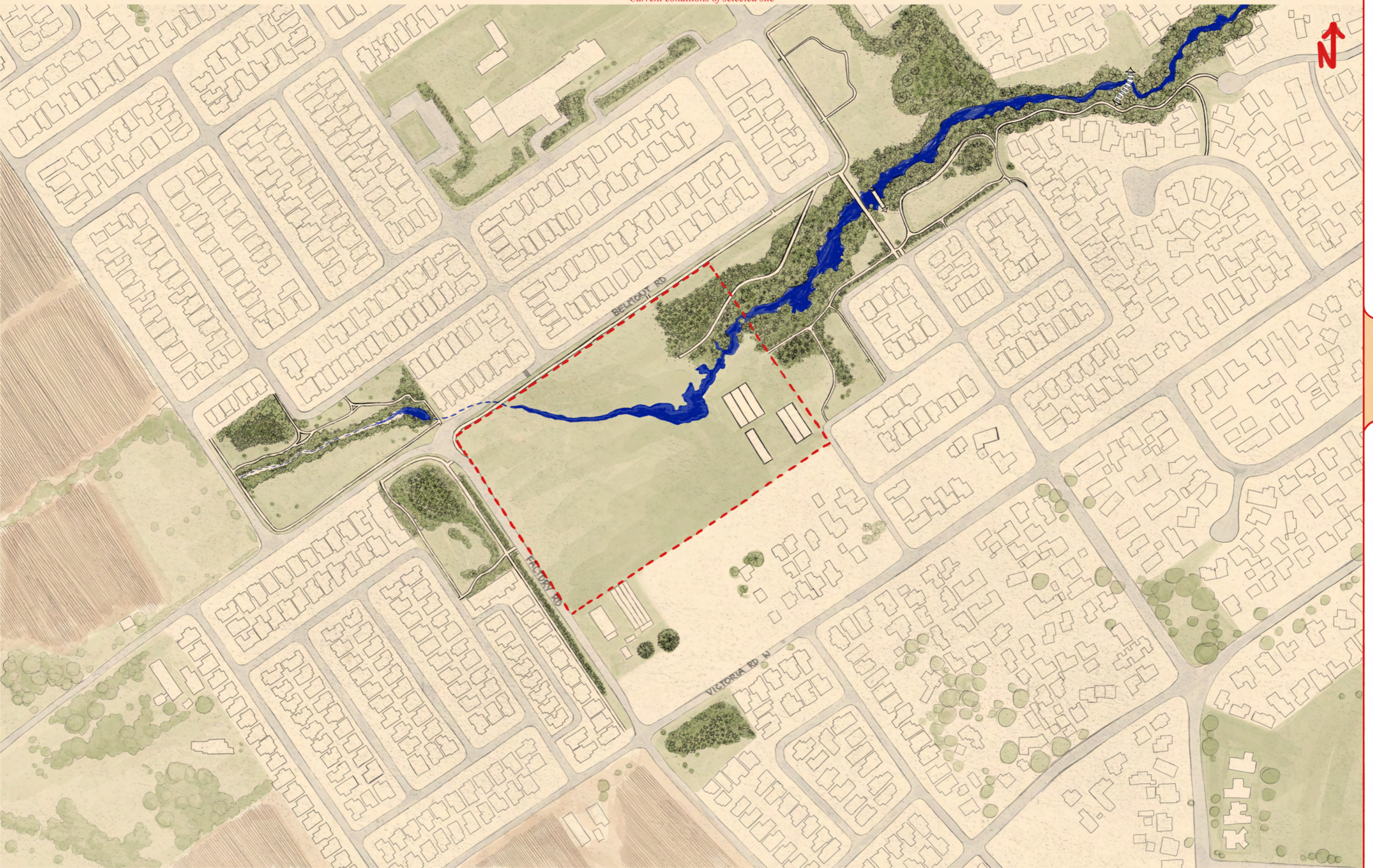
The findings from Figure 59 and 61, have led to Figure 63 selecting a site in western Pukekohe at the end of the Whangapouri creek, as seen in Figure 64. The site was chosen via the criteria of tensions between suburban encroachment onto versatile soils, a transitional landscape of reverse sensitivity between cropland and housing, a food accessibility gap, and the ecological regeneration of the Whangapouri creek.

Figure 64
Selected site.



Note: Visual of selected neighbourhood, showing the overlap of development, versatile soils, and ecological corridor opportunities with the Whangapouri Creek.

Figure 65
Current conditions of selected site



WHANGAPOURI CREEK SITE

1:2500
at A3

Note: Site plan at 1:2,500 showing the current conditions of the neighbourhood. Illustrating croplands, and residential areas.

Figure 66
Celery Farm



Note: Photograph of celery farm that neighbours the site. A truck ready to transport crates full of celery.

Figure 67
Site cleared for development



Note: Photograph of site showing soil cleared in preparation for development. Celery farm and Pukekohekohe seen in the distance.

Figure 68
Surrounding residential development



Note: Photograph of surrounding residential development.

Figure 69
Whangapouri Creek site



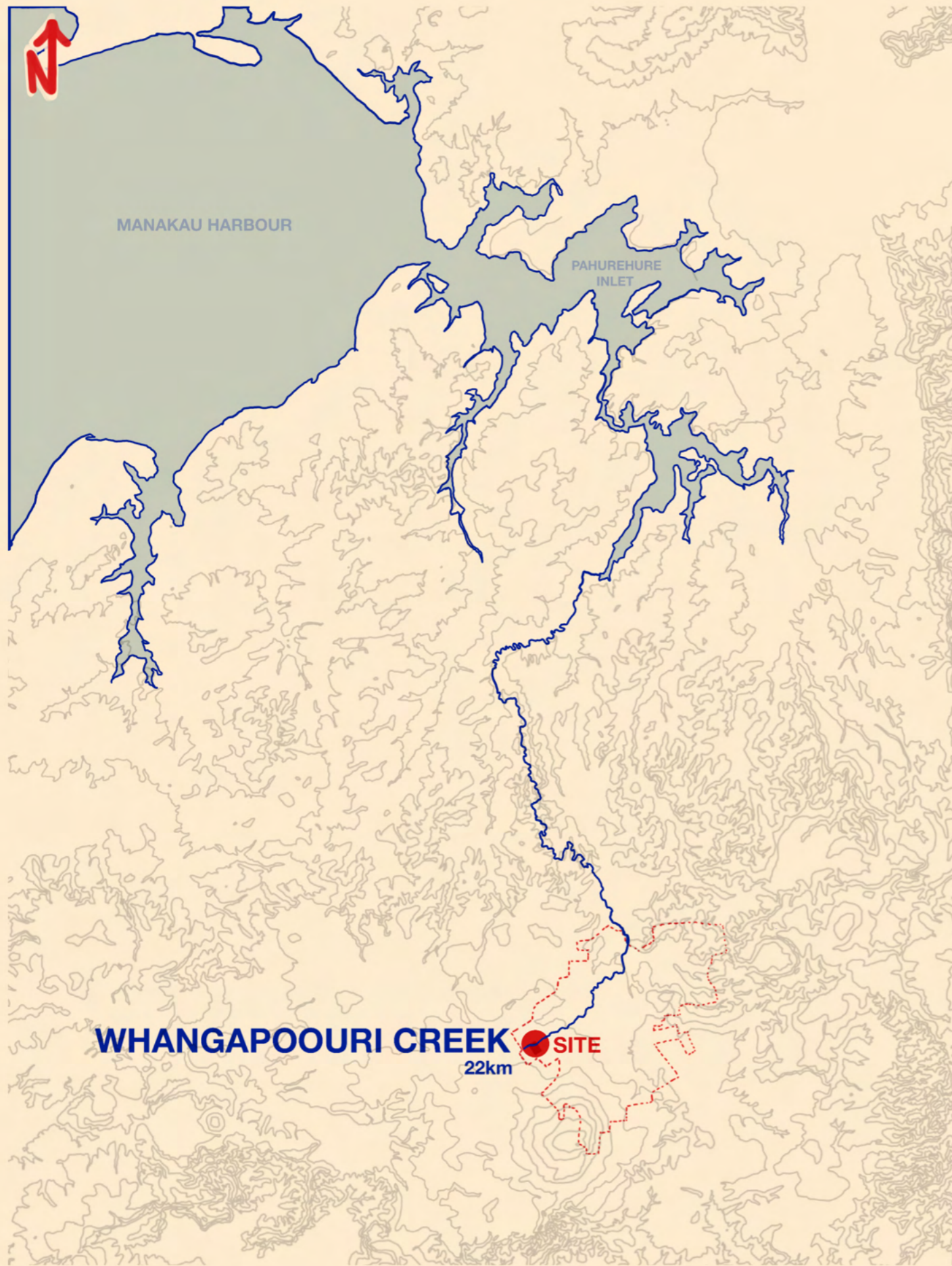
Note: Photograph showing the site from the residential pathway across the road, it is fenced and cleared for construction. View of creek bed and abandoned greenhouses in distance.

Figure 70
Whangapouri Creek documentation



Note: Drawing of the Creek illustrating walkways to access the creek, and photographs showing different sections of the creek. Pukeko seen roaming the creek beds.

Figure 71
The Whangapouuri Creek



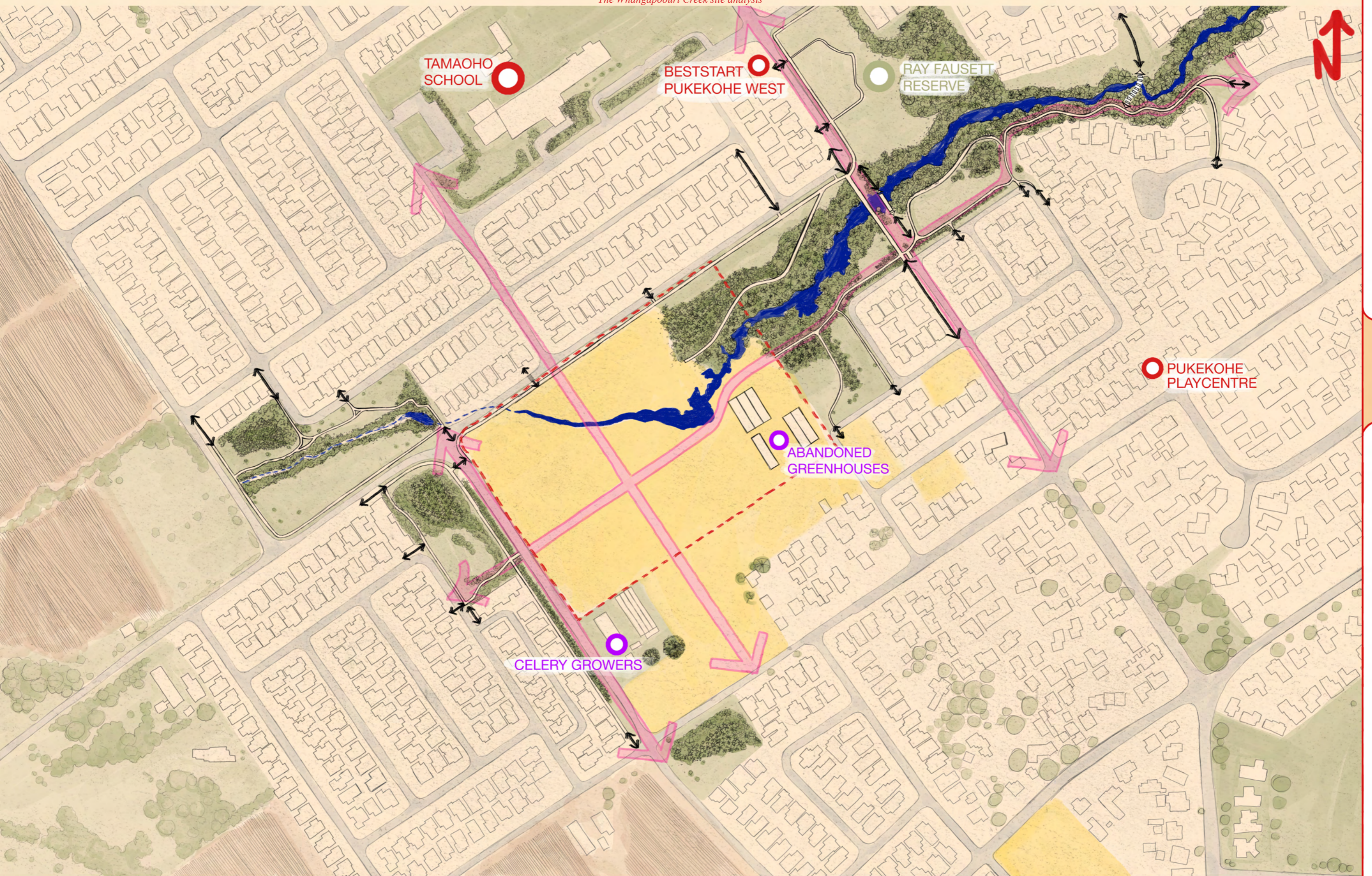
Note: Map illustrating the size of the Whangapouuri Creek and its broader ecological relationships.

Figure 72
Te ara ki Whangapouuri



Note: Photograph of the creek with the Te ara ki Whangapouuri sign that is found on the bridge crossing over the creek towards the school.

Figure 73
The Whangapouiri Creek site analysis



WHANGAPOURI CREEK SITE

LEGEND --- SITE CREEK EXISTING CONNECTIONS INFORMAL CONNECTIONS IDENTIFIED FLOWS OF TRAFFIC ○ SCHOOLS/CHILDCARE ○ FARMS ○ GREENSPACE ○ SINGLE HOUSING ZONE

1:2500
at A3

Note: Site plan at 1:2,500 analysing relationships between food producers, consumers and biodiversity. Identifying flows of traffic that can bridge the three stakeholders on site, and orientate the architectural concepts.

4.6 WHANGAPOOURI CREEK SITE

In Figure 73 potential relationships between the site and local schools were identified that can engage with educational programming to facilitate food literacy for children, like the initial case study of the Sunqiao masterplan, and to respond to 1 in 5 children are food insecure (MOH, 2019). Figure 73 identifies flows of traffic that can connect the Whangapouuri Creek, residential areas, local schools and child-care centres, a park, a celery farm, and abandoned greenhouses surrounding the selected site.

The site analysis has selected a site in Pukekohe – the Whangapouuri Creek site – for the architectural research to mediate between food producers, consumers and biodiversity in a transitional landscape of food production to residential development. The analysis found versatile soils threatened by urban expansion; conflict between existing food producers and new residents in the developing areas, due to reverse sensitivity: a divided food landscape with food accessibility gaps, and potential ecological connections through the creek, and highlighted deeper socio-cultural divisions due to a history of racial tensions, and segregation.

These findings position the architectural response to provide community infrastructure that reconciles food producers, consumers, and biodiversity by facilitating reconnection to place, a sense of belonging through cultural inclusion, indigenous ecosystem regeneration, and provision spaces for stakeholders for their ability to practise food sovereignty, experience food production and expand their food literacy, supporting community unity, engagement, and food security. The next chapter responds to these findings through design research.

CHAPTER

5.0

CONCEPT DESIGN

With the selection of the Whangapouri Creek site, the design process can begin to respond to place-specific relationships and conditions. This section conducts conceptual design research by refining initial design forms, and organising programmes spatially that support socio-cultural exchanges, food security, food production, and biodiversity regeneration through methods of sketching, and model making.

The site analysis found that the Whangapouri Creek site features highly productive soils that have been rezoned for residential development which the conceptual research explores mediation between the two landscapes. As seen in Figure 73, there are opportunities on site to bridge food producers and consumers as there is a celery farm neighbouring the selected site, and nearby croplands bordering the transition between the food productive swamp and suburban food desert. Other key site characteristics is the Whangapouri Creek that is neglected, providing opportunities for ecosystem and biodiversity regeneration. The abandoned greenhouses can be restored to grow native vegetation that rewilds the creek. The local schools provide opportunities for educational programming to take place on site, to provide food practice and literacy opportunities for the next generation and surrounding residents in the neighbourhood to improve their knowledge and ability to access multiple foods through different practices.

To begin the conceptual process, I articulated programmes as seen in Figure 74 informed by the theoretical framework, and initial precedent analysis, to understand what architectural design can accommodate to remediate food-productive vs urban development landscapes, the disconnection between food producers and consumers, a declining natural environment, and food insecurity.

Figure 74
Programme diagram

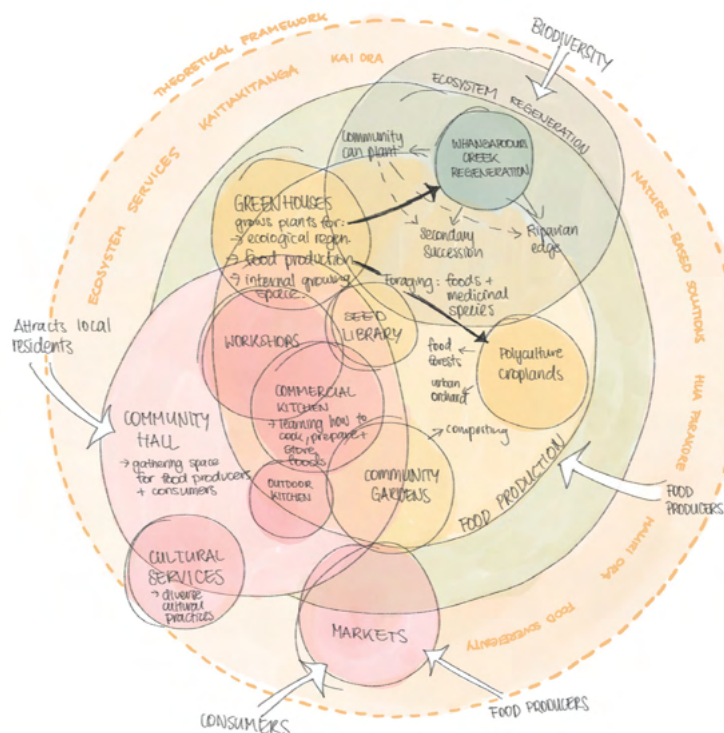
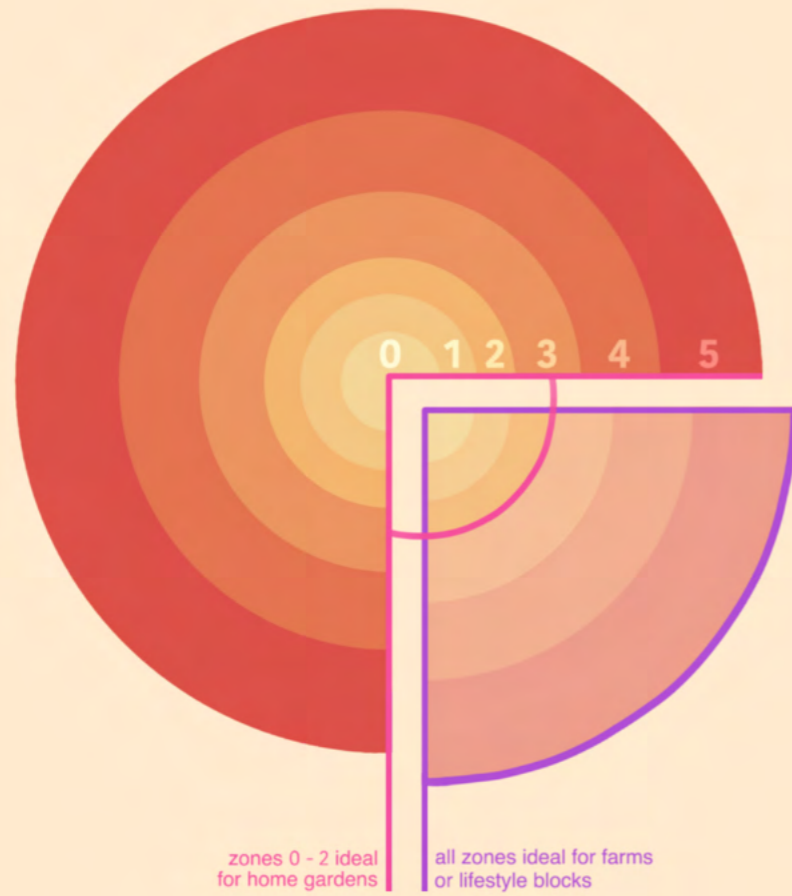


Figure 75
Hua Parakore permaculture zones diagrams



ZONE 0

The Whare



ZONE 1

Kitchen garden
perennial garden



ZONE 2

annual garden



ZONE 3

livestock, fruit + nut trees



ZONE 4

provisional zone
wild foods



ZONE 5

unmanaged zone
native ecosystem restoration

In Figures 75, 77, 78 and 79, they illustrate Hua Parakore permaculture zones and explores vertical structures inspired by the Floating Dairy Farm precedent, which encapsulates a micro food system in a building. Through drawing, the concept explores raised structures off the ground to give the soil back to nature, and allow secondary succession to take place, which prepares the area for the indigenous ecosystem to regenerate, while the interior of the structures would host permaculture zones or emerging food production technology of soilless cultivation, as integration of agriculture into the building's structure.

However, this concept strays from this study's intentions of reconnecting people with the natural environment. This study's framework outlines meaningful engagement with living systems – especially soil ecologies – that is informed by indigenous ecological practice. Having physical and spiritual connections to soil and land is essential to Māori identity and practice, connections that historically have been severed through displacement and land confiscation (PHAC, 2024). The practice of Kaitiakitanga is the strength of relationships between people and nature: removing people physically by raising structures and removing soil from food production processes adds another layer of disconnection to people's relationship to the natural world, and their understanding of living systems that ensure healthy food landscapes. The intention of this research is to reconnect people with the natural world. Structures could be still raised to softly interact with soils, but the architecture overall must encourage interactions with soil and the natural landscape, through programming such as food growing and gathering practices.

Figure 76
Soilless cultivation technology

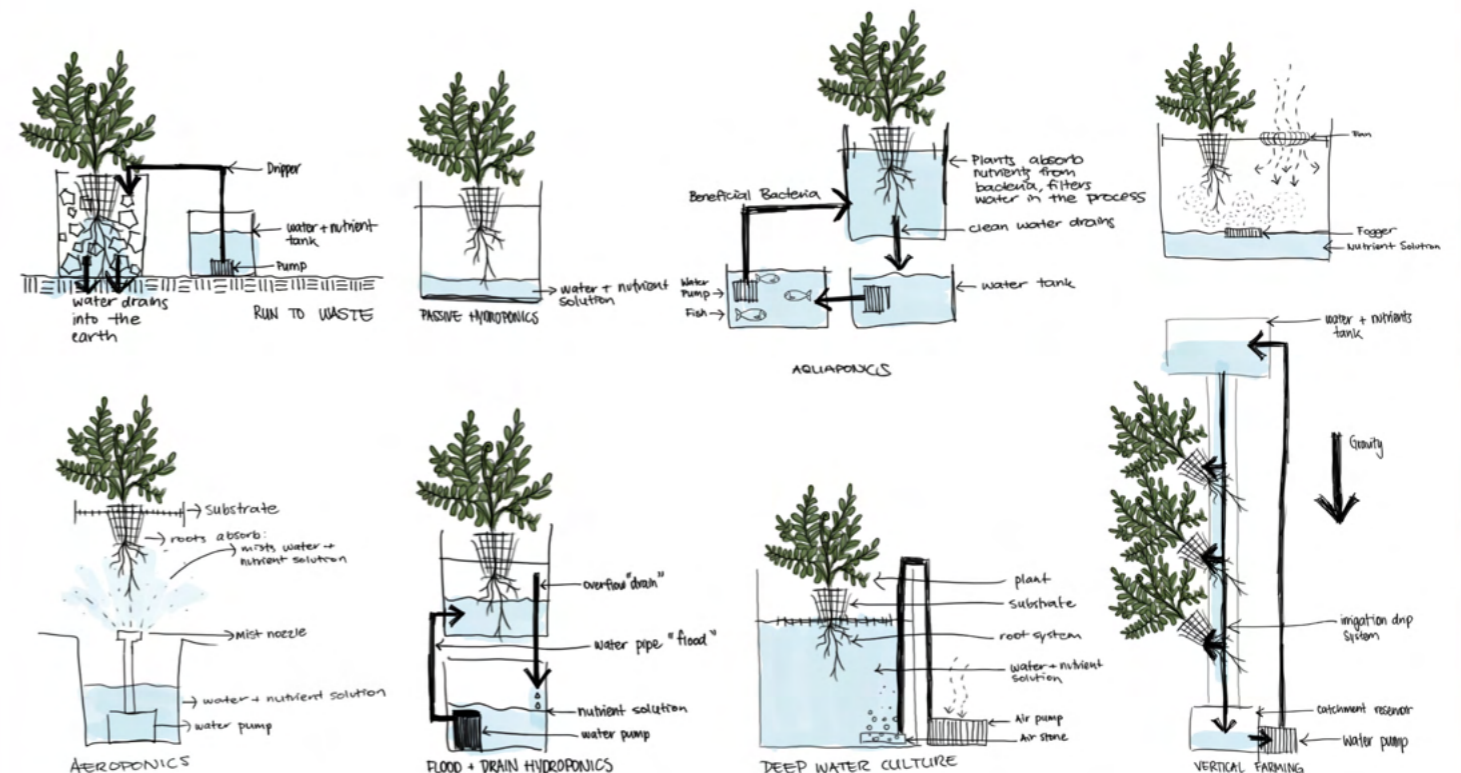


Figure 77
Hua Parakore permaculture zones interpreted vertically

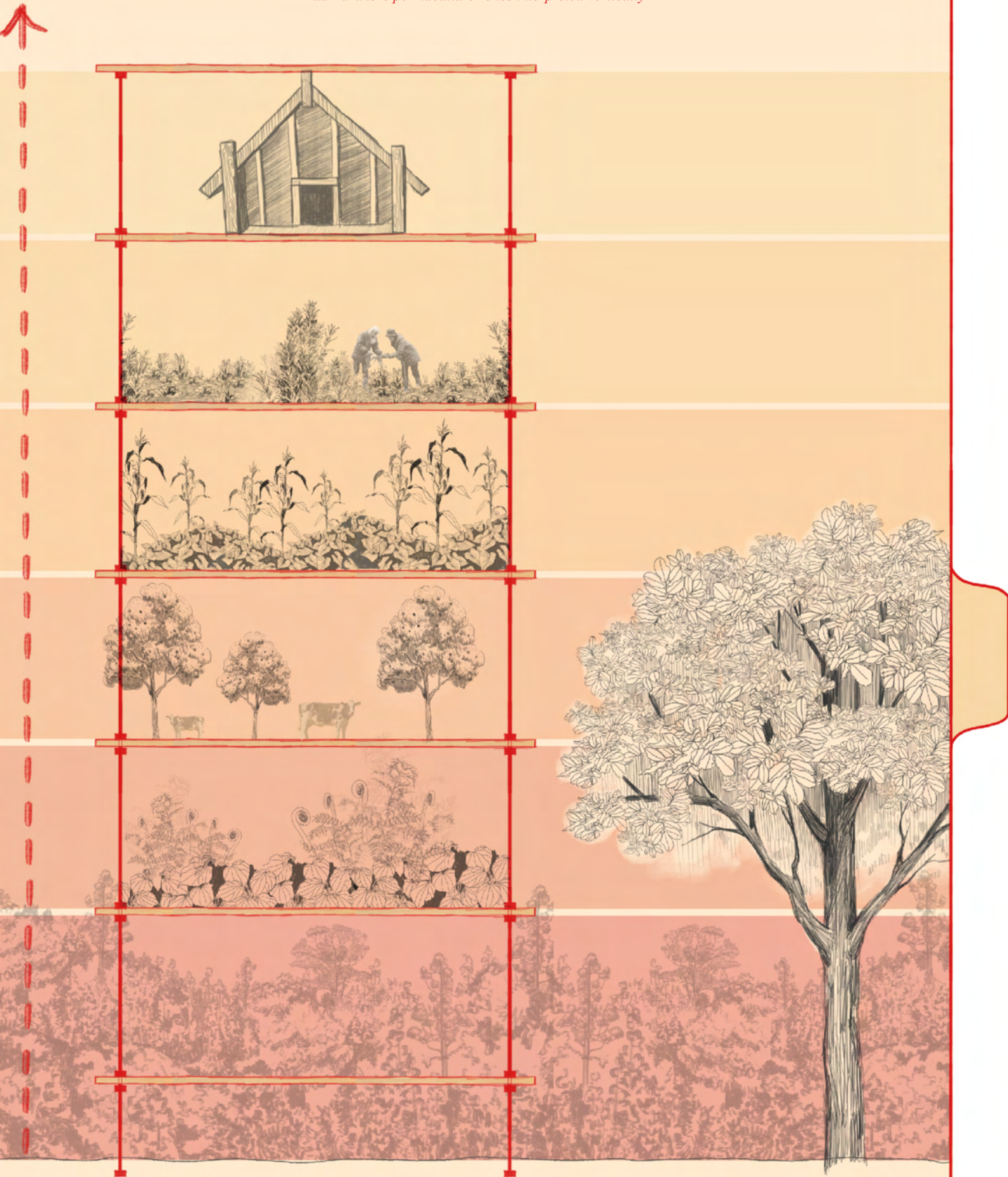


Figure 78
Concept design sketches part one

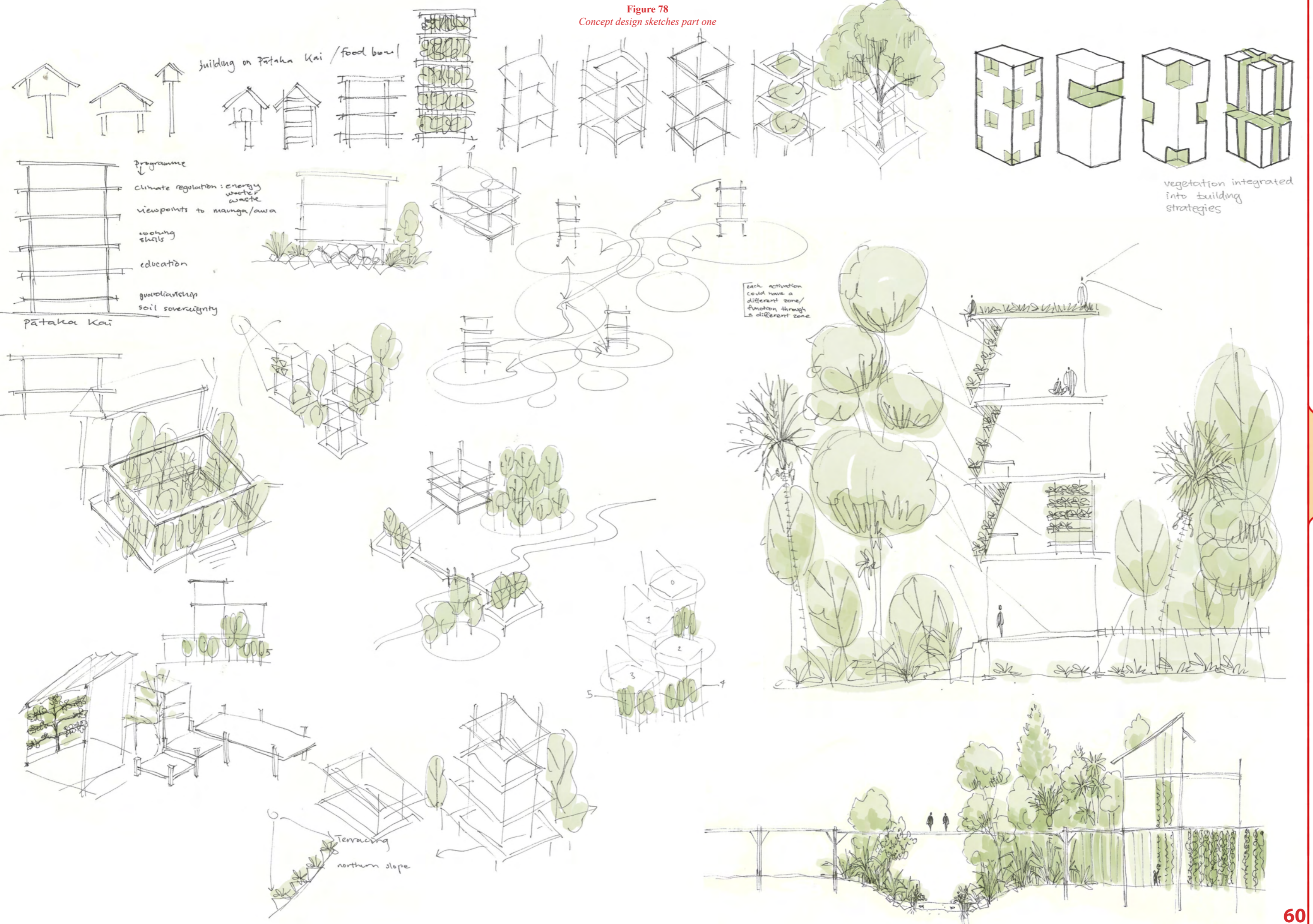
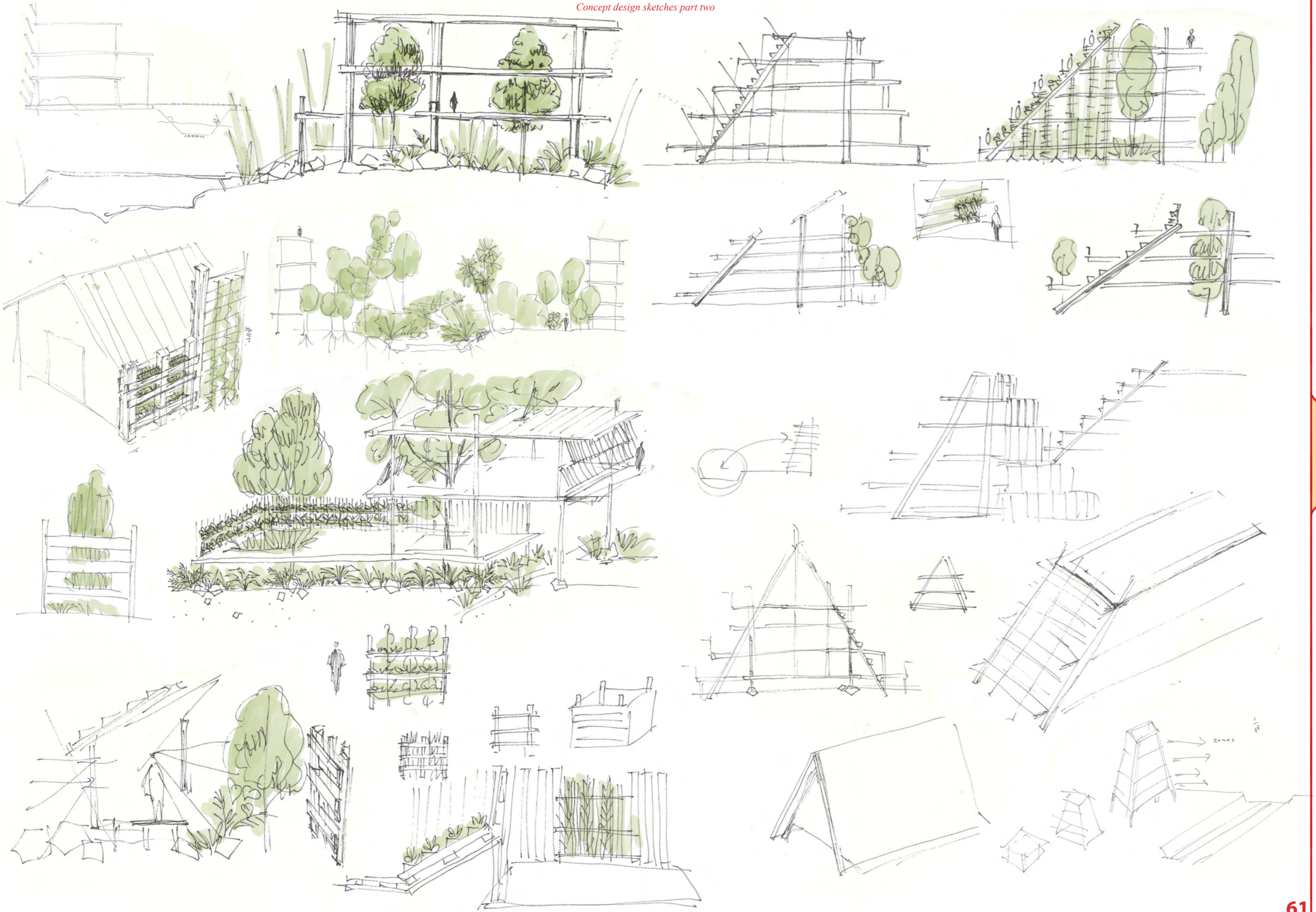


Figure 79
Concept design sketches part two



In response to the first concept, there was additional exploration developed from initial drawings of vernacular forms through model making that arranges the models in different formations as seen in Figures 81, 82, 83, and 84. Sketching is also used to test arrangements inspired by the models as seen in Figure 85 and Figure 86, and exploring those forms situated by the creek. The models and illustrations test the spatial arrangements of programmes from Figure 74.

This concept prompted further research into how architecture engages with the creek to facilitate interactions between people and living systems, where the principle of Kaitiakitanga or the Kai Ora approach could be embodied. As seen in Figure 86 and Figure 87, it illustrates architecture facilitating engagement with the creek with shelters and bridges. The concept draws on the creek's name: Whangapouri, the 'dark-coloured bend' (Auckland Council, 2025) and interprets it by landscape restoration of the riparian edge. The vegetation creates shadows over the creek, where eels could return to inhabit. The concept also interprets a dark shelter in the structure to reflect the creek's original canopy seen in Figure 86.

Figure 80
Concept design sketch



Figure 81
Concept models part one

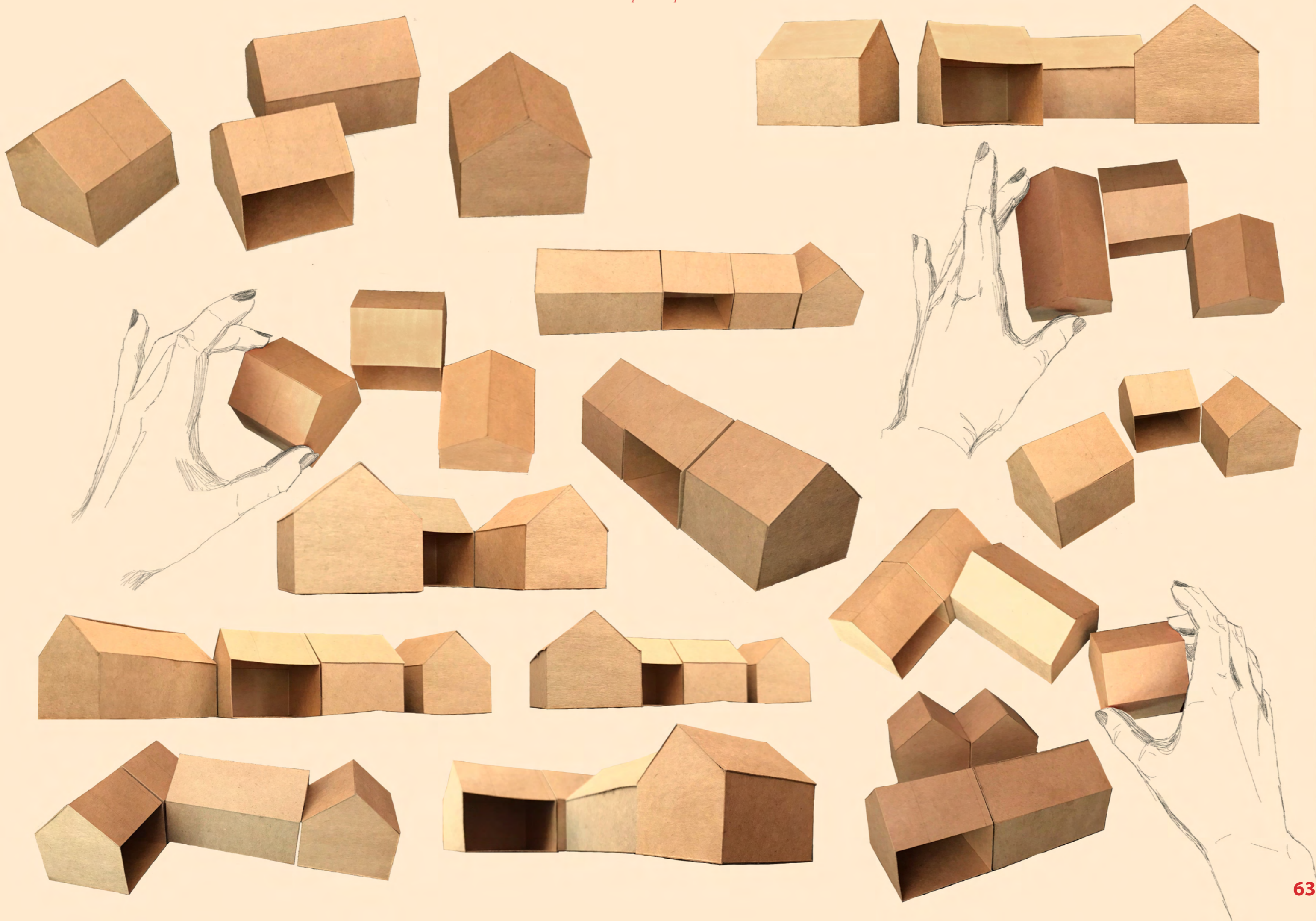


Figure 82
Concept models part two



Figure 83
Concept models part three



Figure 84
Concept models part four



Figure 85
Concept design sketches part three

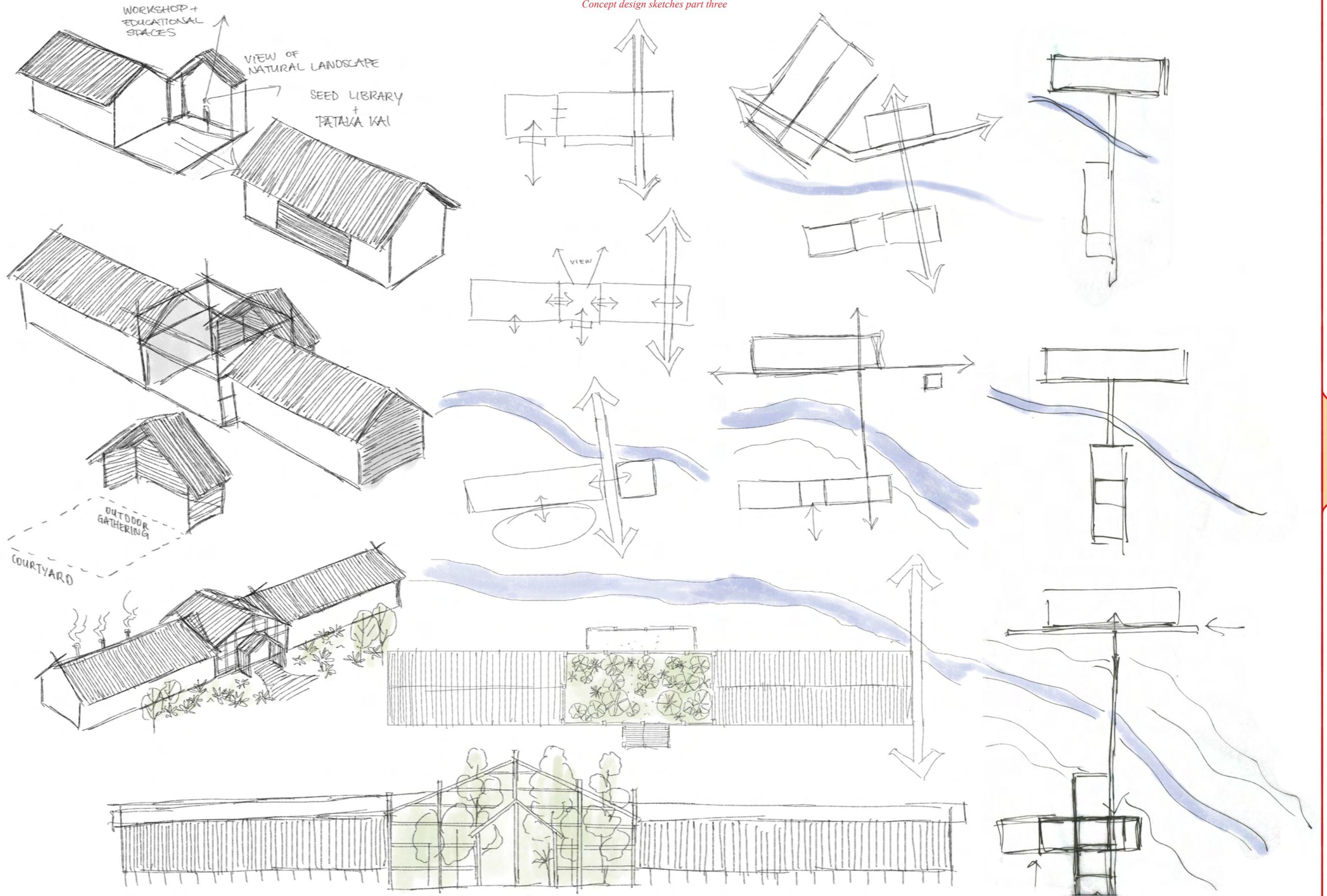


Figure 86
Concept design sketches part four

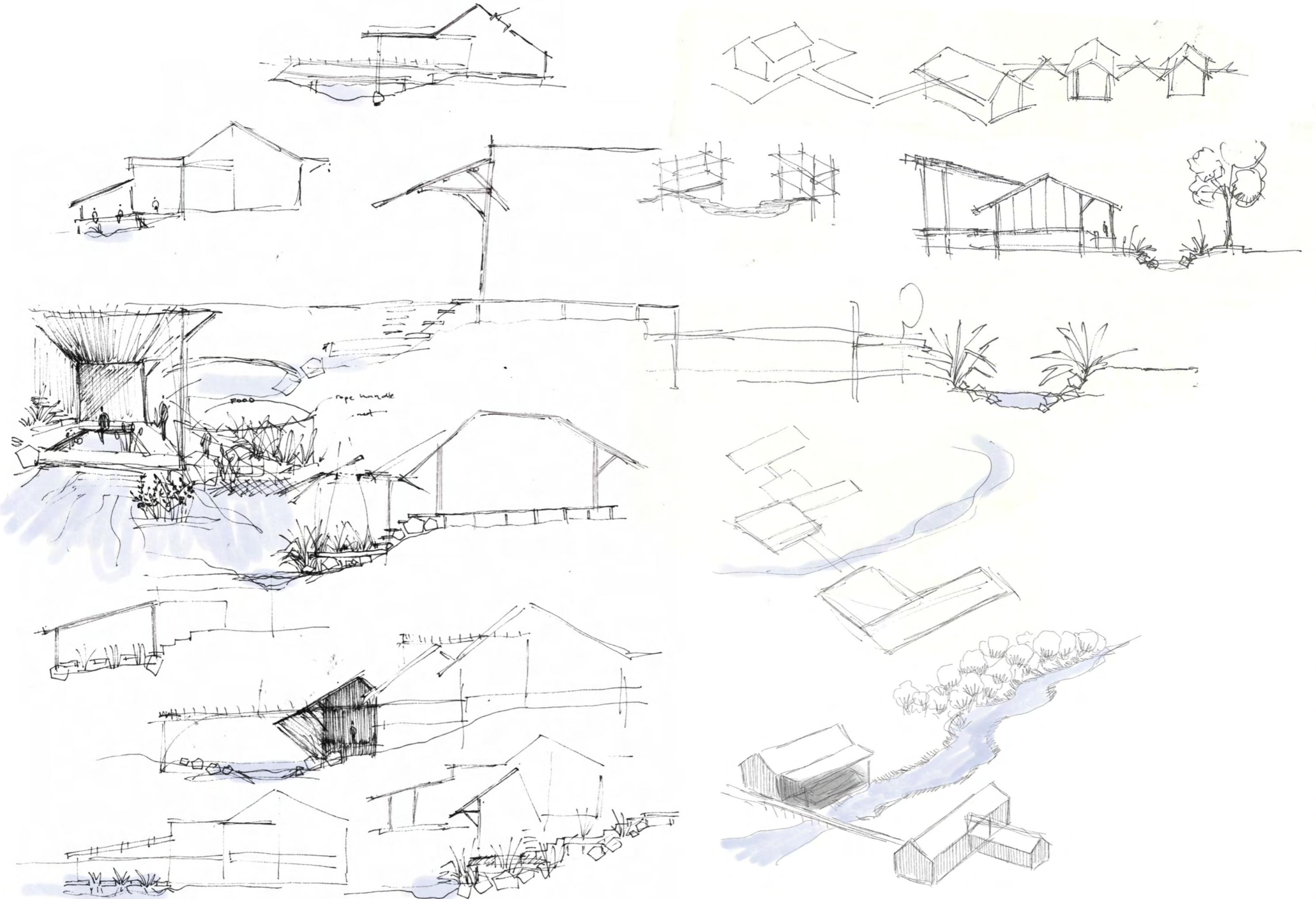


Figure 87
Concept design sketches part five

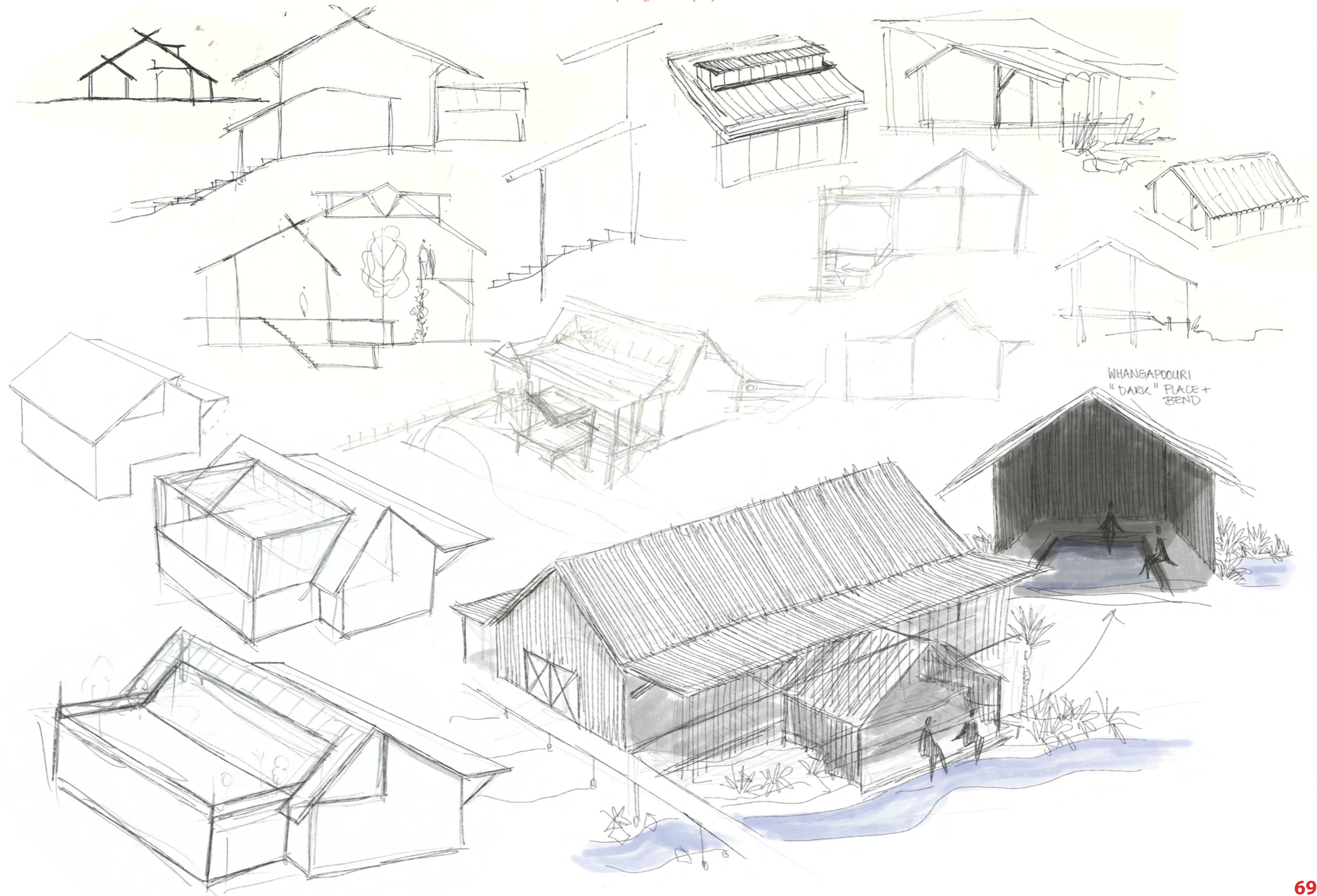
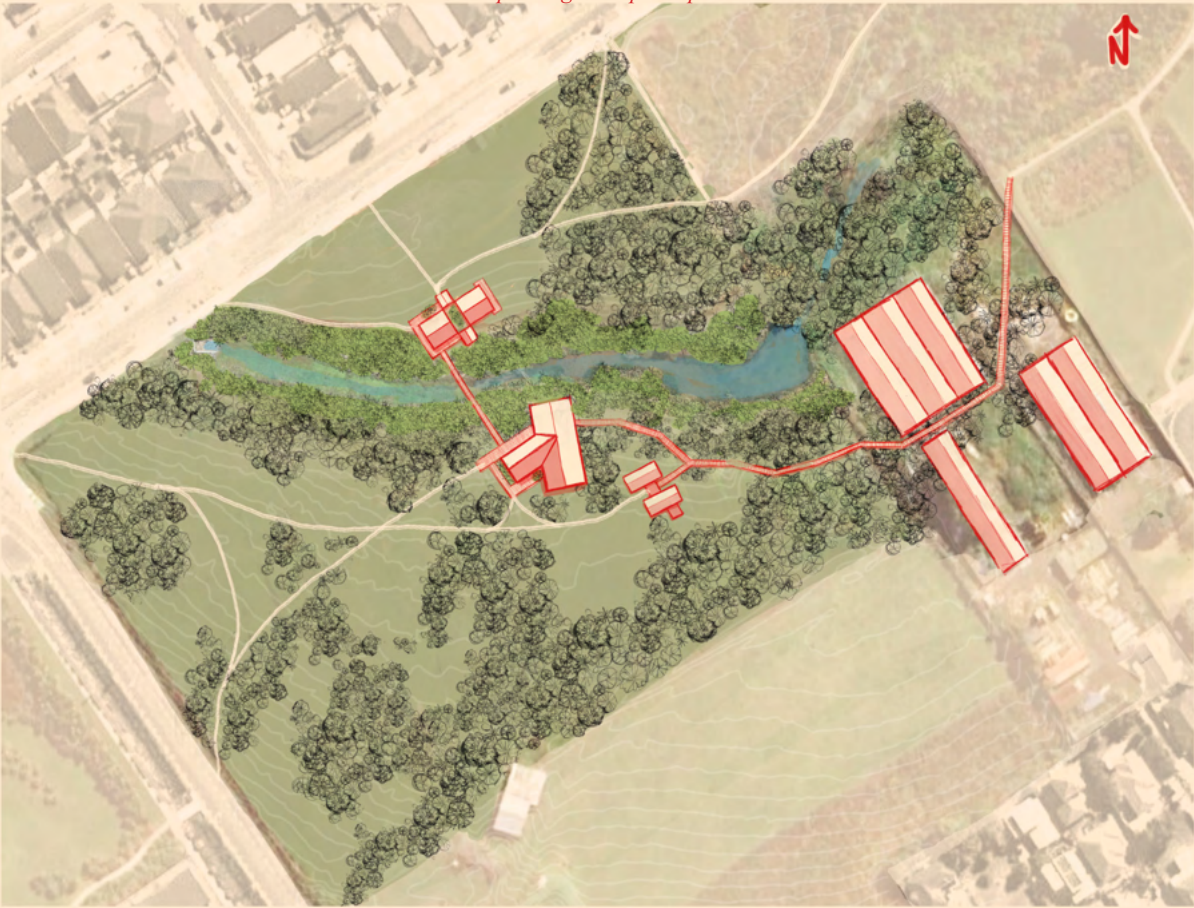


Figure 88
Concept design site plans part one

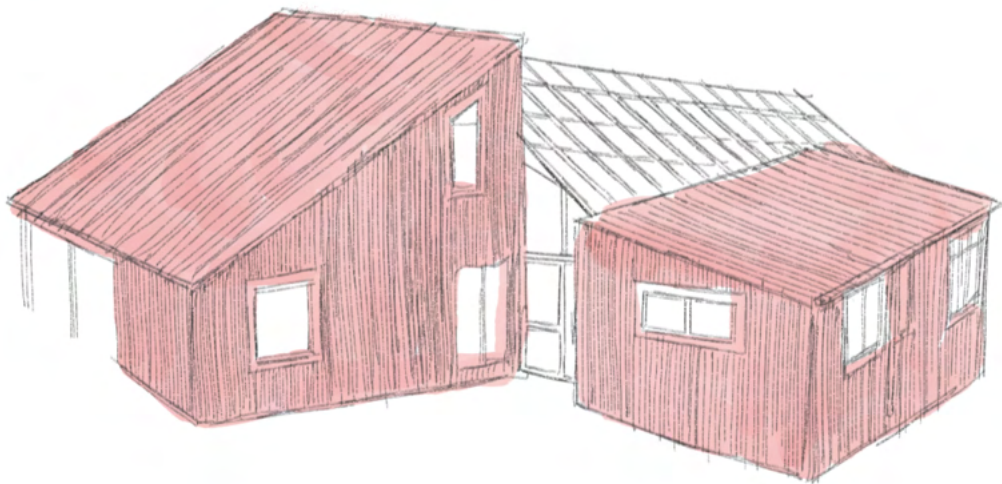
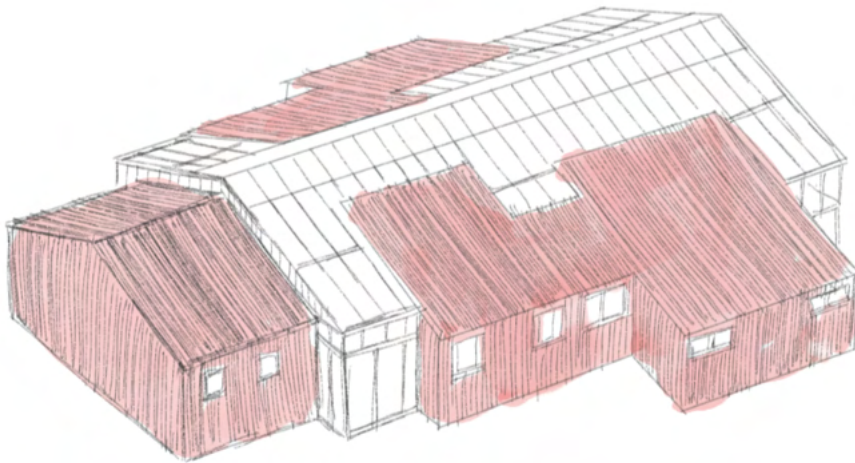
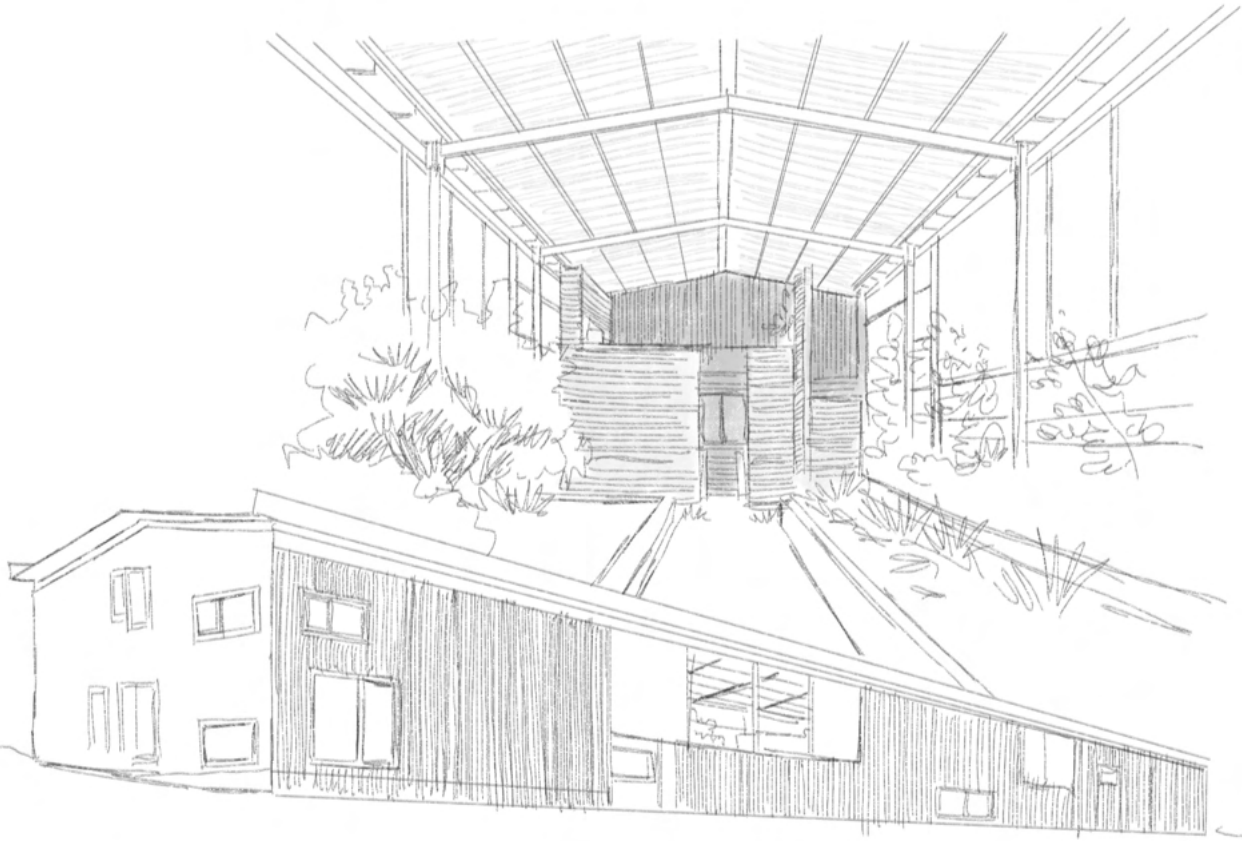


Note: Bottom site plan applies Hua Parakore permaculture zones.

Figure 89
Concept design site section part one



Figure 90
Concept design precedent analysis



Note: Sketches of precedents: Daylesford longhouse, and Wind & Rain houses,

Figure 91
Concept design sketches part six

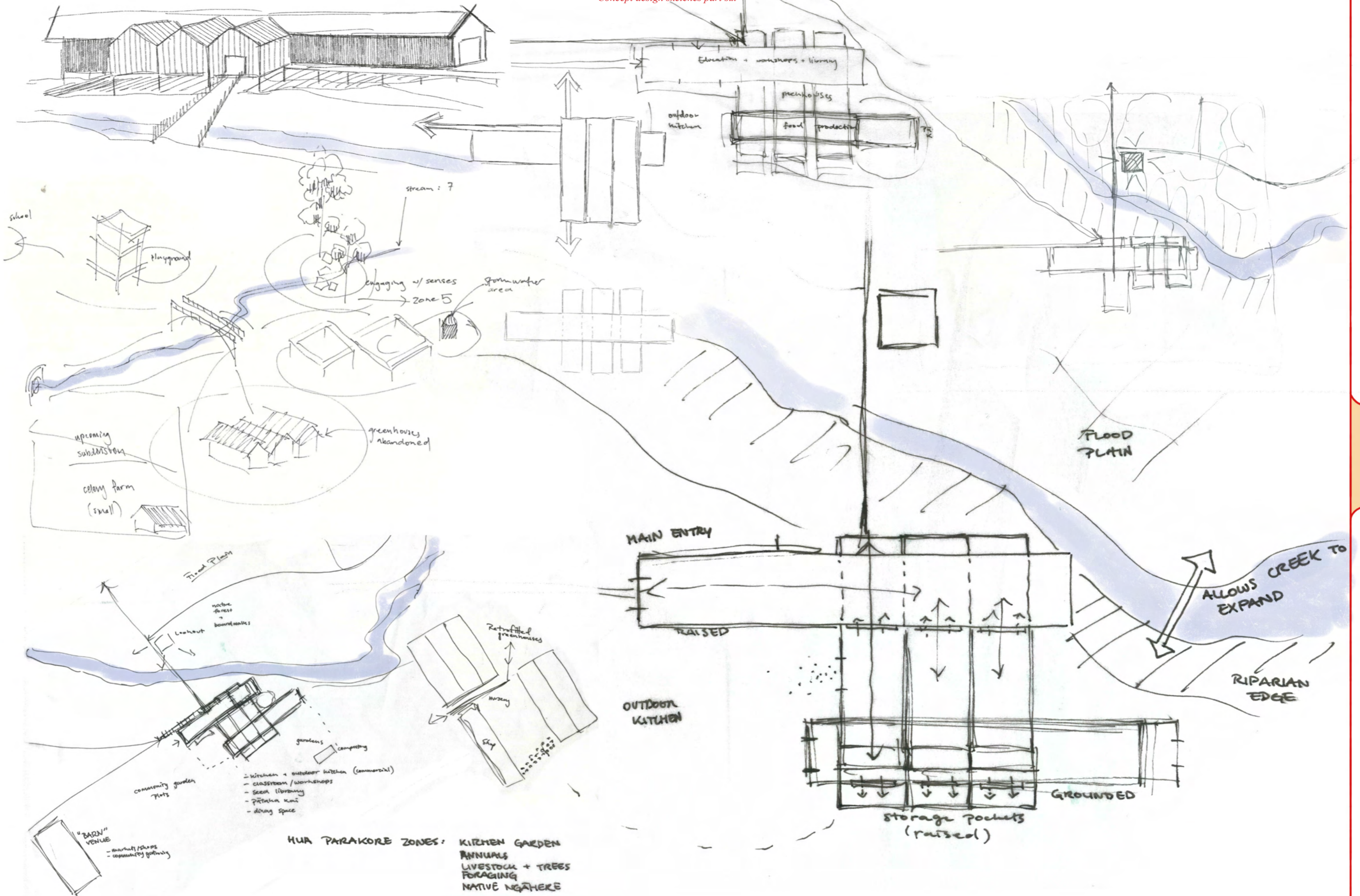


Figure 92
Concept design site plan part two

SITE PLAN 1:800

LEGEND

1
THE BARN.
- venue hire
- market hall
- gathering space

2
COMMUNITY GARDEN.
- personal plots
- shared plots
- composting station
- pātaka kai

3
THE SHED.
- workshops
- commercial kitchen
- classroom/studio spaces
- kitchen garden
- outdoor kitchen
- greenhouses
- seed library

4
THE FOREST.
- viewpoint tower
- ecological corridor
- raised boardwalk

5
THE NURSERY.
- reutilising abandoned
greenhouses
- growing native & edible plants
to sell, or for site use



Figure 93
Concept design Hua Parakore permaculture zones site plan



ZONE 1



ZONE 2



ZONE 3



ZONE 4



ZONE 5

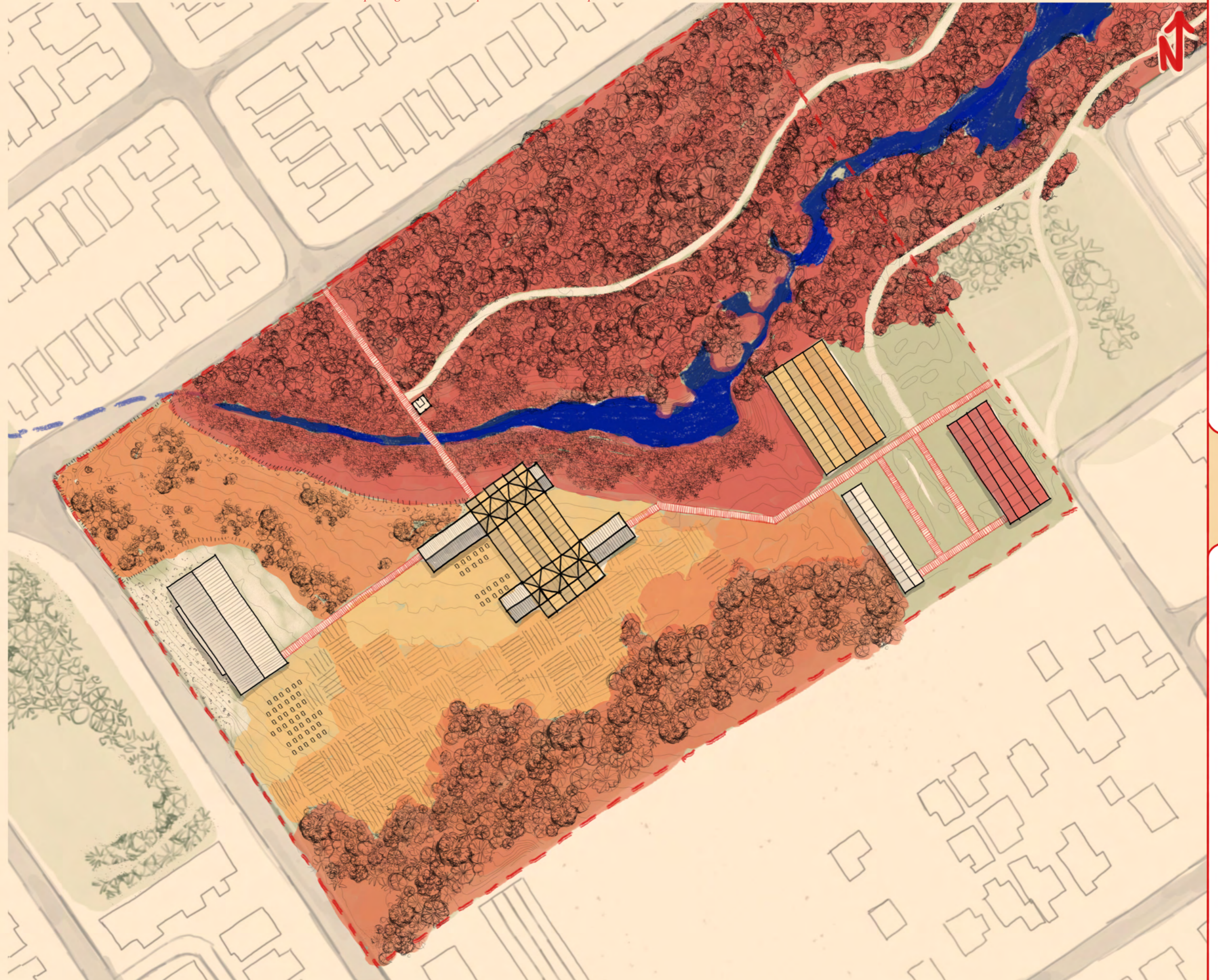


Figure 94
Concept design floorplan

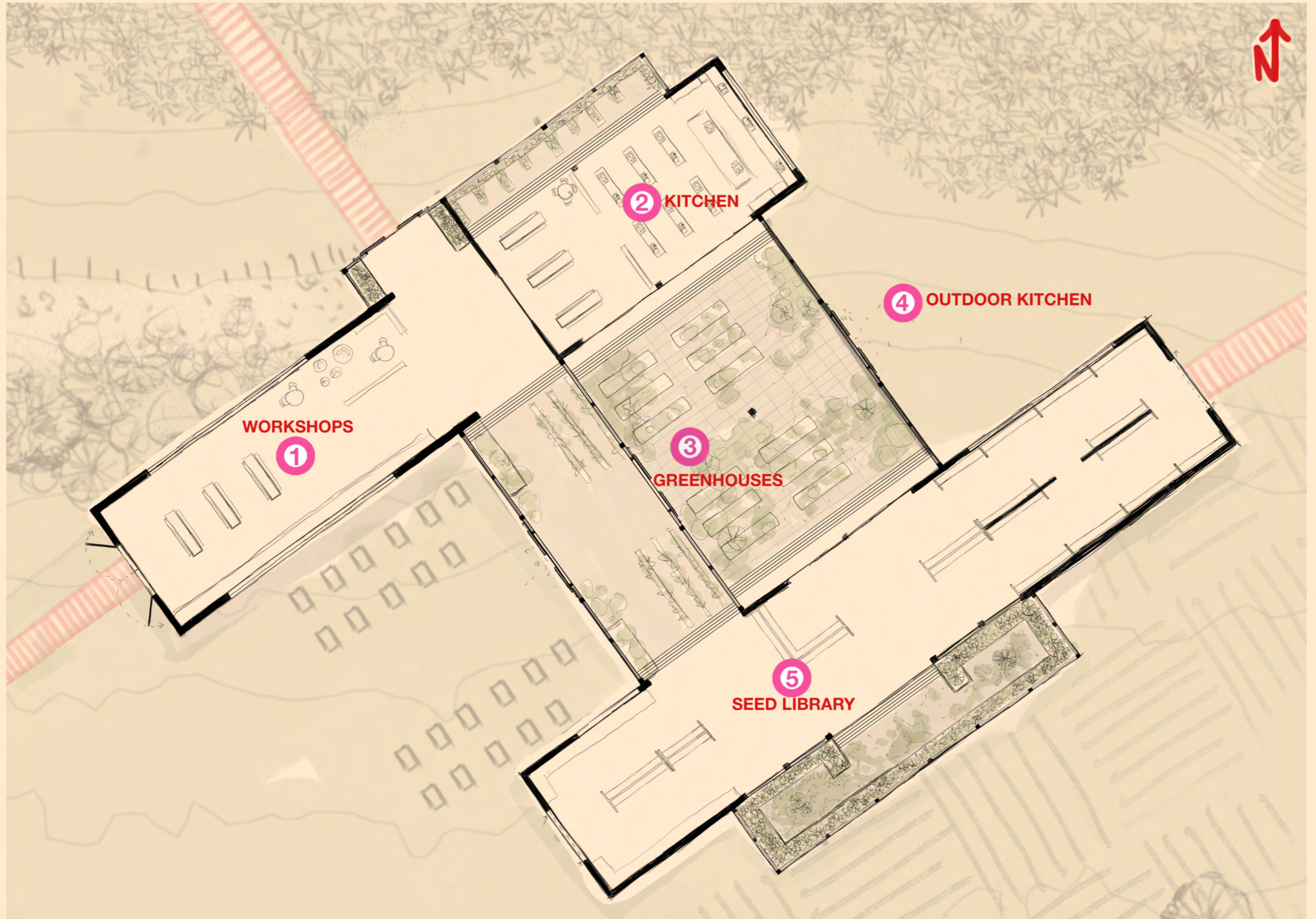
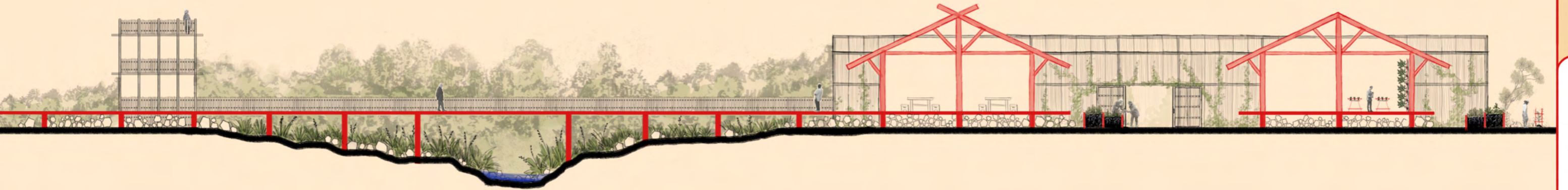


Figure 95
Concept design site section part two

This chapter demonstrates a series of conceptual iterations informed by the theoretical framework, initial design research, initial precedent analysis, and site analysis findings. The concepts clarify the intentions of the research and indicates how architecture can facilitate community relationships between food producers and consumers through articulating building forms and arrangements with specific food-centred programmes the architecture hosts to facilitate interactions between the stakeholders. These concepts are refined in the next chapter to resolve into a final design proposal that finds how architecture can remediate landscapes and community relationships to foster food security and community resilience.



CHAPTER

6.0

DEVELOPED DESIGN

Developed design process refines the conceptual designs explored in the previous chapter into a resolved architectural proposal. Developed design articulates tectonic decisions, spatial arrangements, and material choices that build up the architecture to function and foster interactions between food producers, consumers, and the site's ecology to enhance community relationships, resilience, and food security.

From the conceptual design research, I realised having multiple buildings fragmented the research's intentions of wanting to achieve a space that reconnects food producers, consumers, and biodiversity. The concept was developed to unify the separate buildings into one space. This was refined through sketching that tested circulation to enable overlapping programmes for users to have opportunities to interact with others, the natural environment, and be connected to the surrounding neighbourhood as seen in Figures 96, 97, and 101. The abandoned greenhouses remain separate from the main building as it is restored as a reminder of Pukekohe's food productive histories and identity within a developed suburban area that had caused the abandonment of these greenhouses.

Unifying the programmes into one main building creates a hub that welcomes different groups of people into one space where they can exchange their experiences, knowledge, and receive community support. The one building reflects the principle of manaakitanga, to host diverse food production and preparation practices, and provides food to situate common ground between different cultures, food producers and consumers. From the conceptual design research, the concepts that explored creek interactions, Hua Parakore permaculture zones, vernacular forms, and food-centred programming were refined through the one structure.

Figure 96
Reconfiguring the concept form

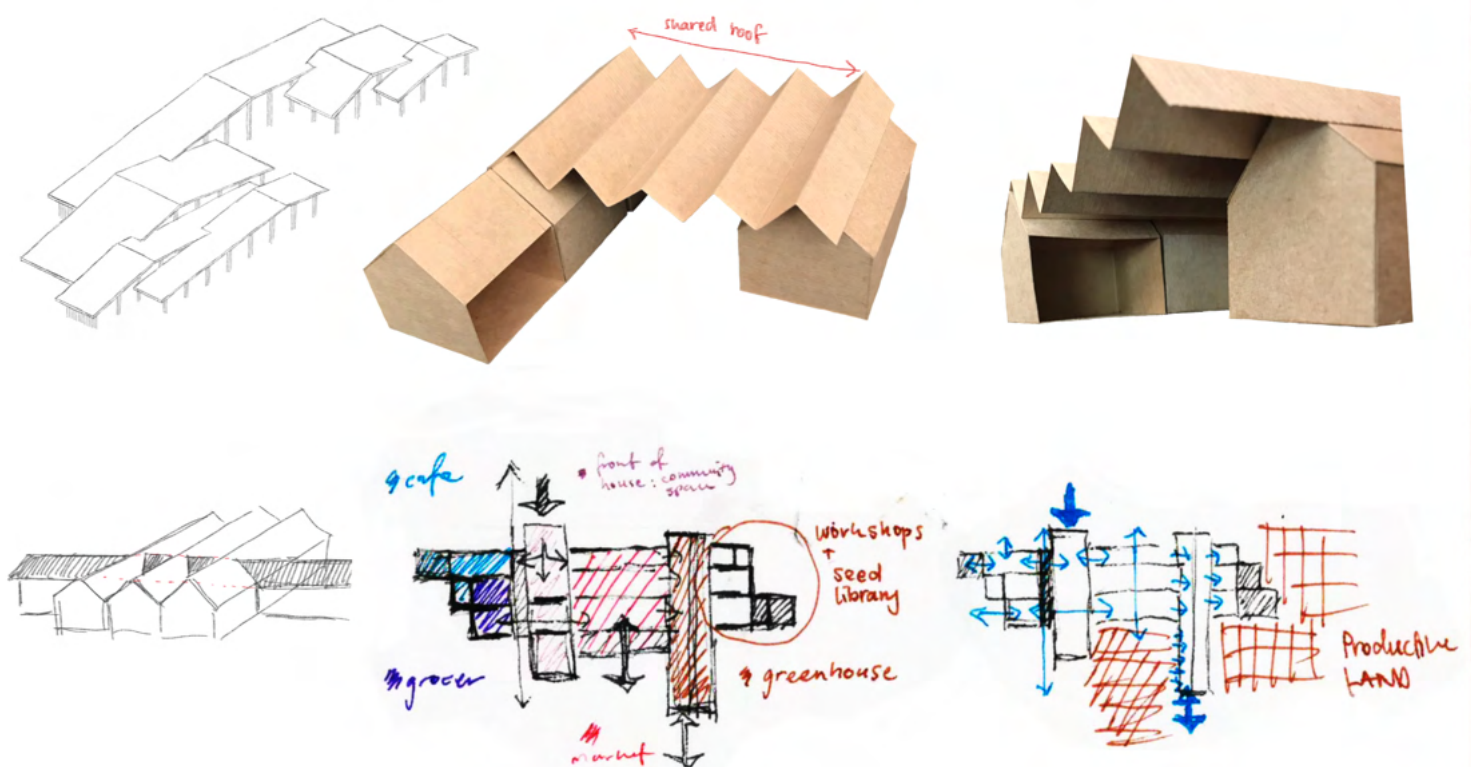
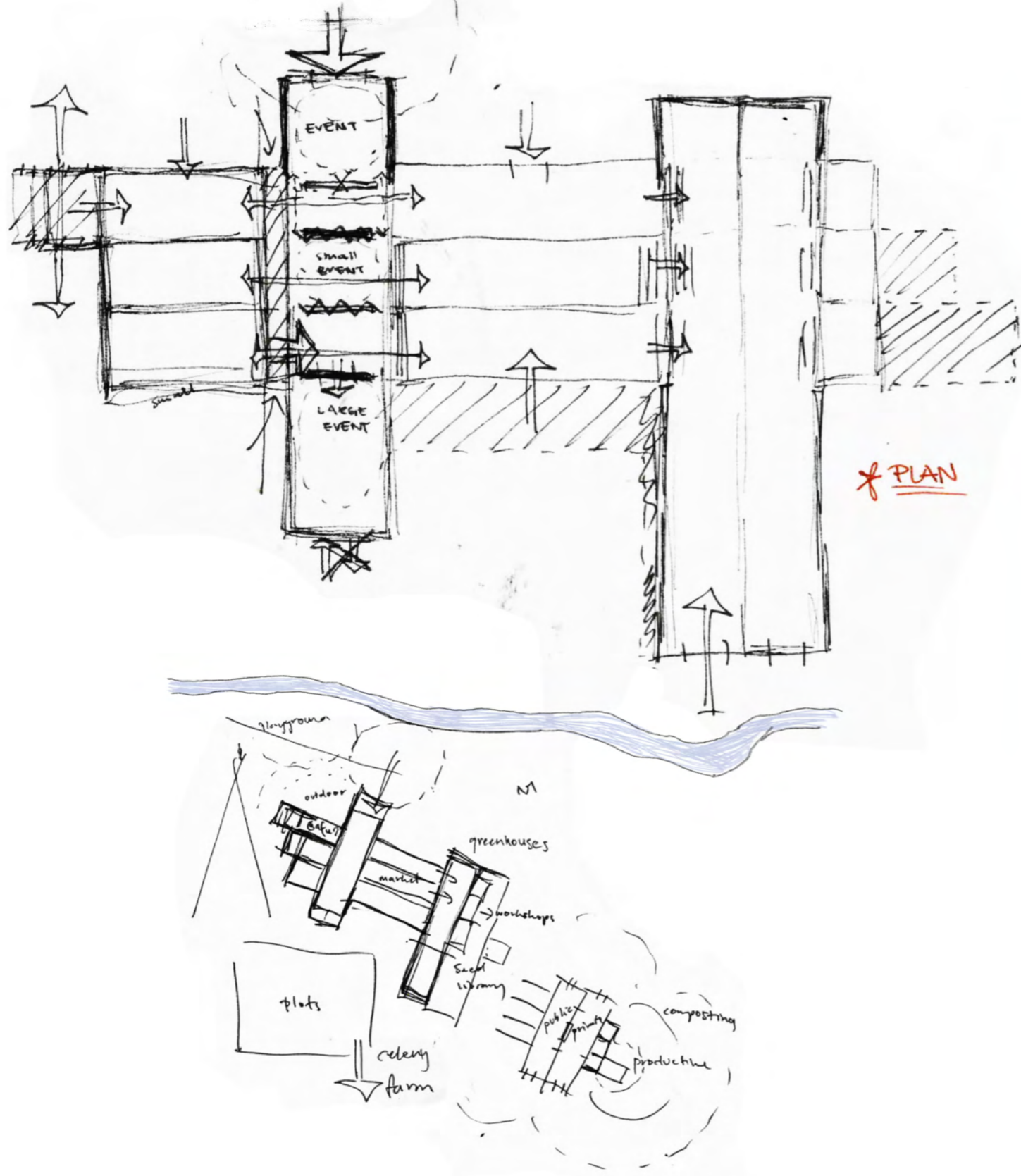


Figure 97
Developed design sketch part one



The programming of the developed design proposal include:

Local grocer that local food producers can supply their produce and food items, creating opportunities to engage with their consumers locally.

Café that foods from the site's gardens and local farmers can supply to attract surrounding suburban residential consumers to dine in and observe the workings of the food haven.

Commercial kitchen that can prepare meals for local schools, provide the tools for local food producers to utilise for their businesses, and provide food literacy and preparation workshops for consumers to expand their access and choices of foods that cooking skills can limit. The commercial kitchen is open to the public to provide facilities that people might not have access to, this enhances people's ability to self-determine their food access.

Pātaka kai, a scaled-up pantry that provides free foods for the most vulnerable in the community experiencing food insecurity. The food in the pantry is donated from local food producers, others in the community, or produced from the gardens on site.

A community garden is in place that provides plots for residents who may not have the space in their own homes to produce their own foods. The community garden could be extended into the residential blocks with small-scale installations that bring food production into the built environment. There is a farmers' market that can provide opportunities for food producers and consumers to have direct relationships with one another to foster awareness and understanding for each other's needs and practices.

Greenhouses are attached to the main structure that is accessible to the public to experience, and be exposed to the processes of sowing seeds, nurturing, planting, maintaining, and harvesting in an internal space. These greenhouses function more as an educational facility for school kids or interested visitors to learn from and engage in, compared to the restored greenhouses that produces plants for rewilding, and supply the croplands on site.

A seed library is also provided in the structure to enact food sovereignty, allowing people to freely access, trade and store seeds, knowing the origin of the seed and its reliability to produce again.

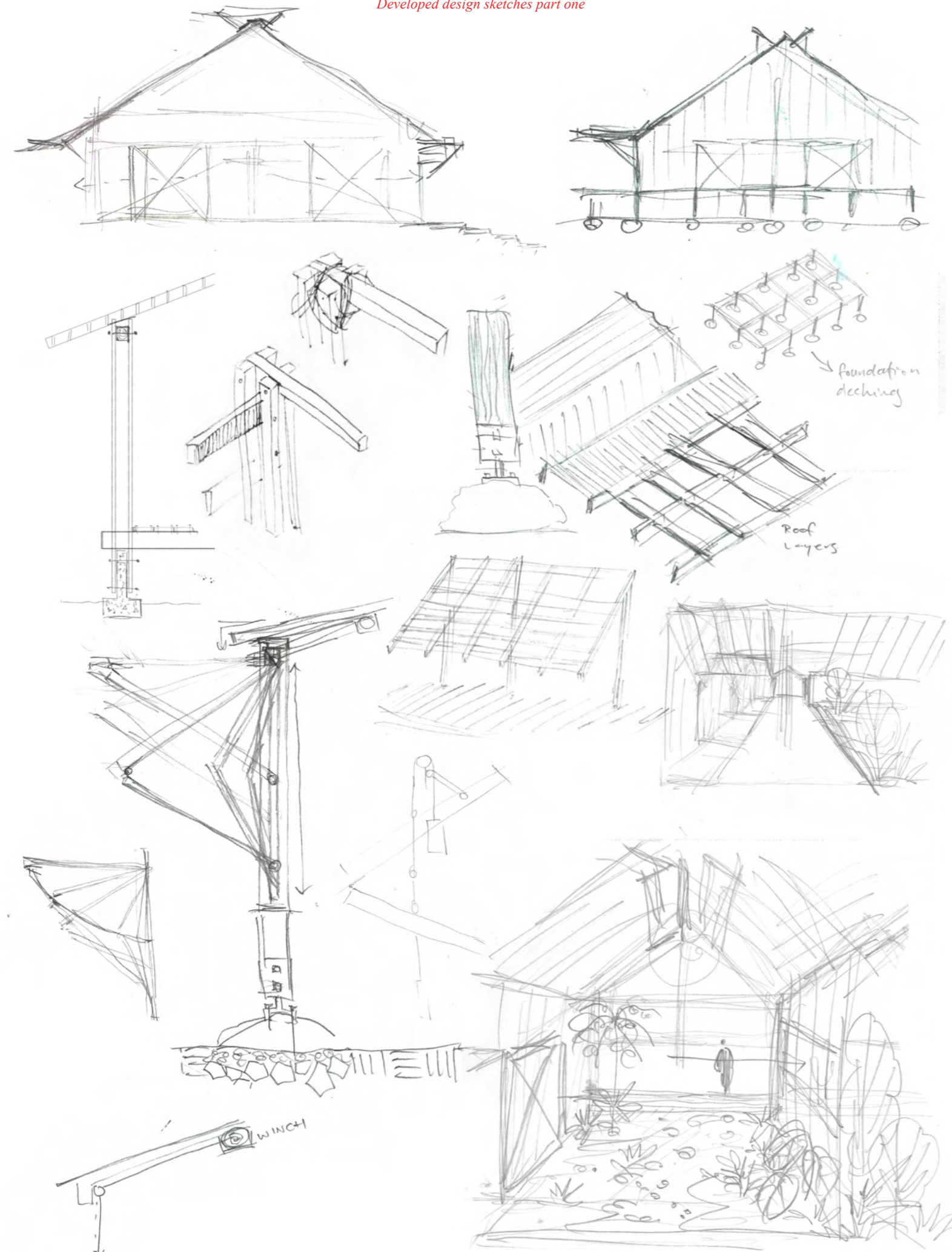
Regeneration of the Whangapouri Creek ecology, providing biodiversity to flourish, the indigenous ecosystem to return bringing in wildlife and opportunities for foraging foods and medicine.

Polyculture croplands, provide an alternative model of food production that improves the health of the natural landscape and people. These croplands provide foods for the Food Hub and the local community.

Food forests are grown on site for the community to have free access to fruits and vegetables. Spaces for people to rest, eat, and engage with their community through food production, gathering, preparation and sharing.

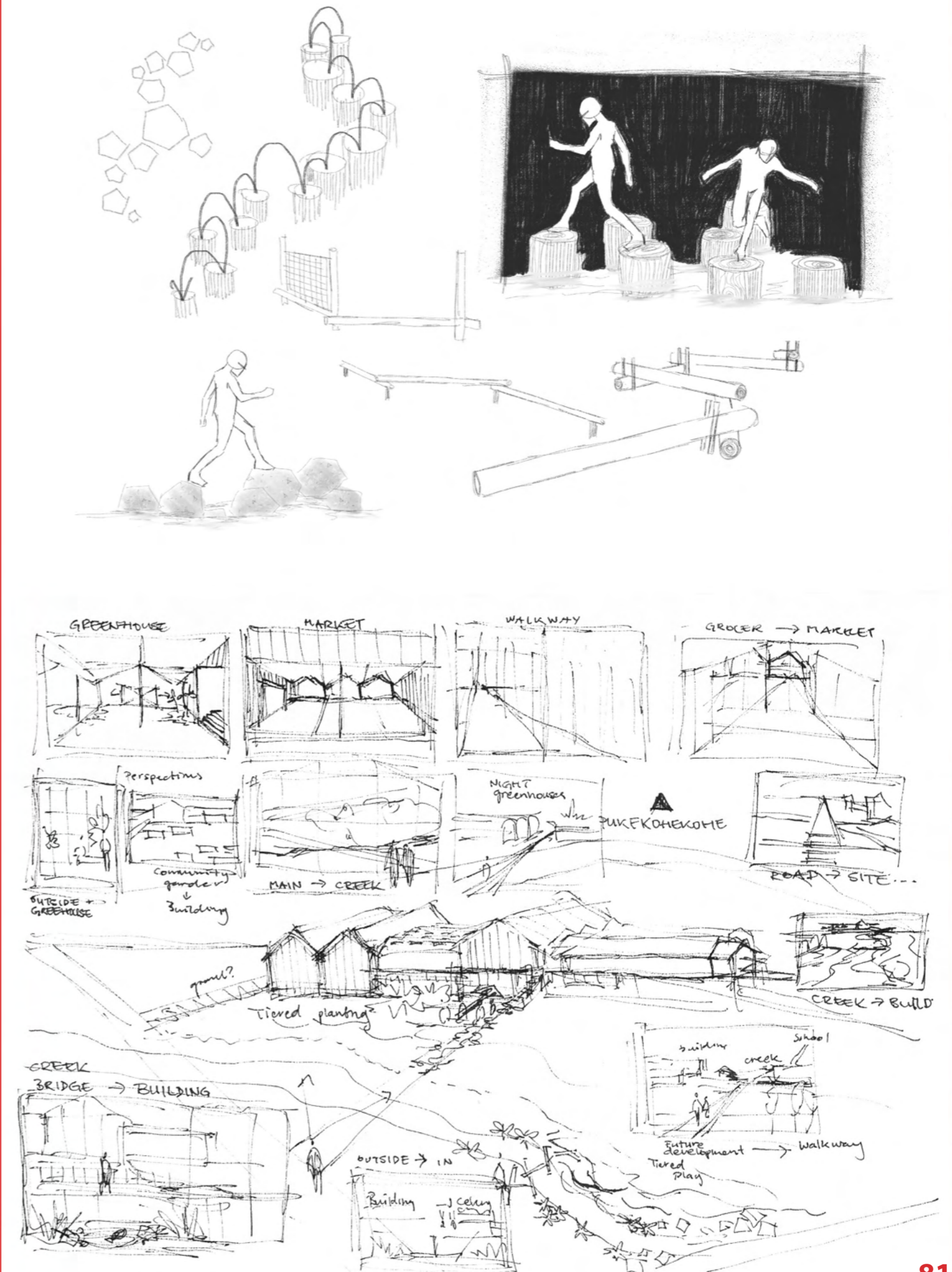
Restored greenhouses that perform as a garden centre, it grows native trees, shrubs, grasses to help with the regeneration of the Whangapouri Creek's ecology but the vegetation can also be supplied to the community if they want to regenerate other sites around Pukekohe or activate their own home gardens. The greenhouses also grow fruit and nut trees, and edible plants to be planted on site.

Figure 98
Developed design sketches part one



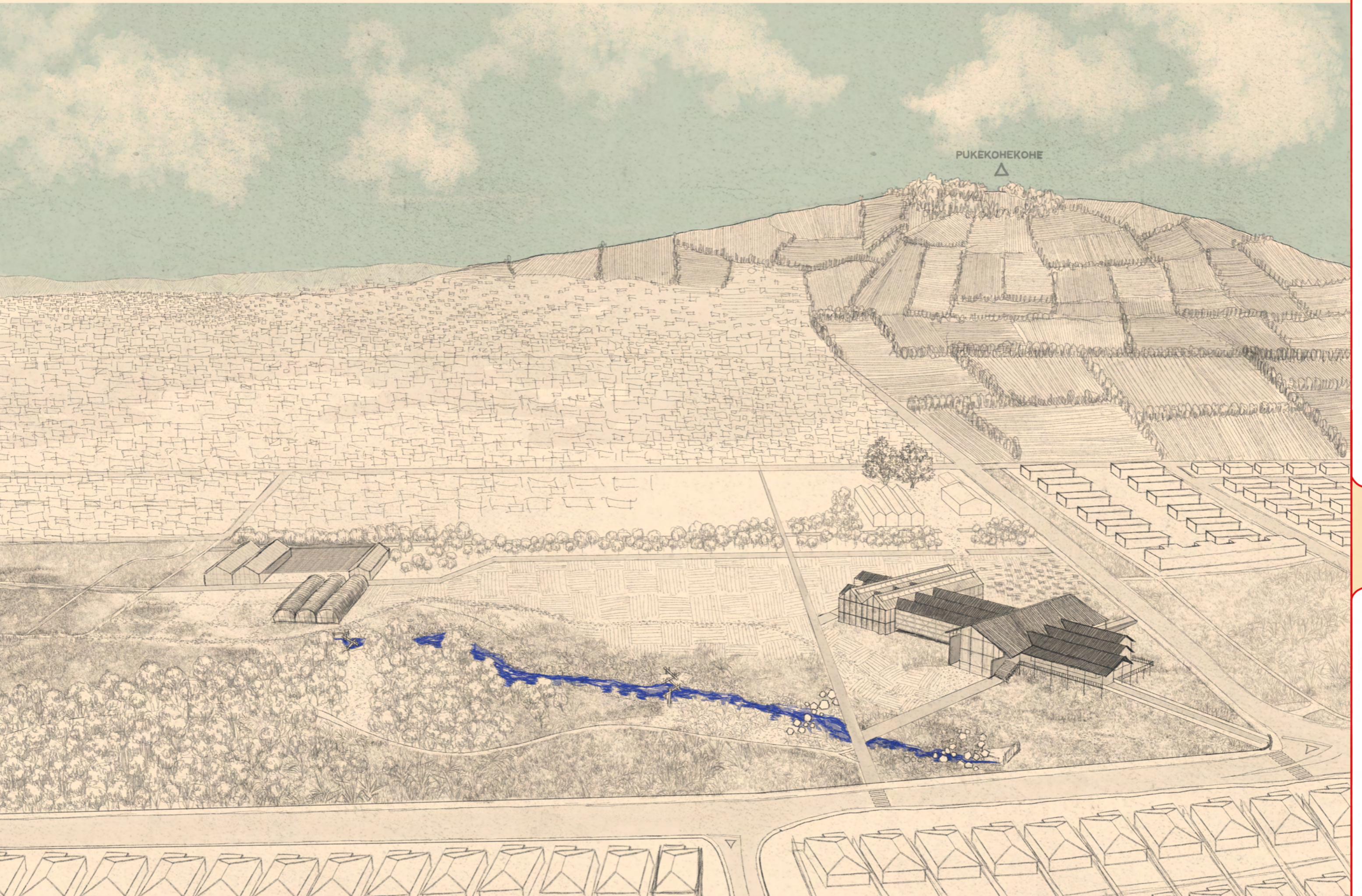
Note: Sketches exploring window and door mechanics, construction details, and experience in the spaces the food hub is facilitating

Figure 99
Developed design sketches part three



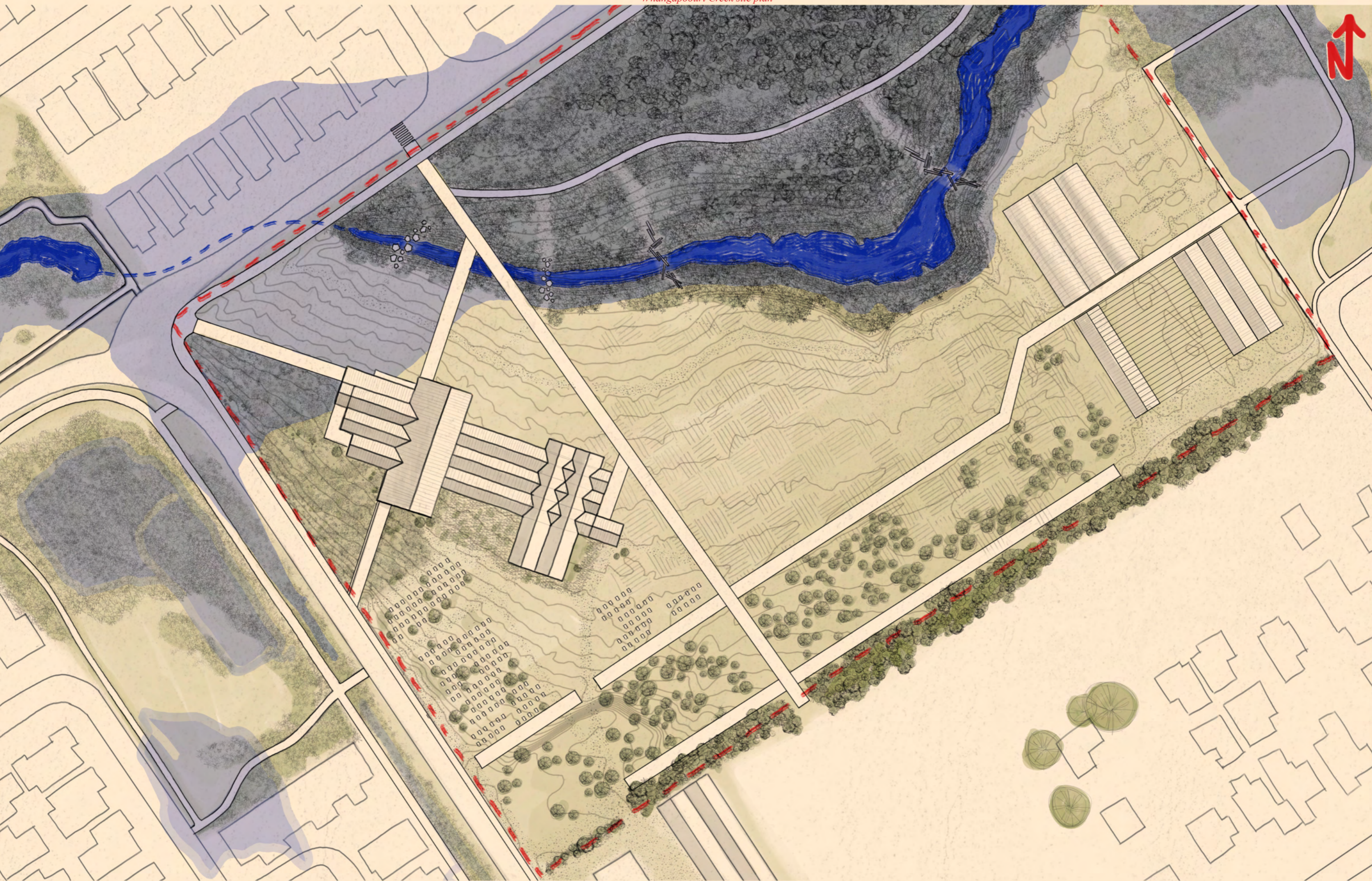
Note: Sketches illustrate architectural installations to facilitate creek play and engagement. Sketches of refined structure from developed design process

Figure 100
Whangapouri Creek Food Hub



Note: Illustrating the architecture situated on site with broader site surroundings.

Figure 101
Whangapouri Creek site plan



LEGEND - - - SITE  CREEK  FLOOD PLAINS

Note: 1:800 scale at A2

Figure 102
Whangapouri Creek floorplan



Note: Floorplan 1:200 at A2

The programmes are facilitated through landscape design and internal spaces as illustrated in Figure 102. The integration of landscape and building design addresses the interconnected relationships between more-than-human and human that provides appropriate responses to mediate and enhance the natural environment, food-productive, and built environments and landscapes within the Whangapouuri Creek site.

As seen in Figures 99, 103, and 104 the design research process articulates architectural designs that facilitate human engagement with the Whangapouuri Creek. The architecture creates opportunities for people to interact with the creek – whether through participation in the creek’s regeneration through planting secondary succession species and rewilding the indigenous ecosystem or using the architectural installations to cross over or play and interact with the creek. The regeneration of the Whangapouuri Creek also provides food gathering opportunities and more choices to access foods, as seen in sketches exploring the interactions architectural design facilitates for foraging landscapes and permaculture zones. The regeneration of the Whangapouuri Creek and the active integration of it into the Food Hub celebrates and enhances its critical role in the living system. Exposing this role to visitors that observe and engage with it. This builds relationships and appreciation for the natural environment with people understanding that their health is tied to the health of the environment, and for them to continuously engage with those systems with a kaitiaki approach.

The developed design process includes the selection of materials that make up the structure and provide visual cues that negotiate the relationship between productive and residential landscapes seen in Figures 105, 106, 107, and 108. The choice of using rammed earth was to have soil exposed to visitors not only as the foundation for food production but also as the walls that support this community hub. The materials also differentiate sections of the hub, exterior materials acting as markers for people to know where the café, grocer, markets and greenhouses are located within this large structure. Transparency through the materials of glass and translucent polycarbonate panels exposes the interior programmes to be more inviting and intriguing. The transparency is also chosen due to the light requirements for growing plants and foods, optimising orientation to northern lighting. The materials negotiate relationships between what is the residential area and the food-productive environment. The developed design process also explores windows and door mechanics as illustrated in Figure 98 and 107, to open the structure to the public for better circulation of people, and ventilation especially for passive greenhouse temperature regulation.

The developed design chapter refines the research into a resolved architectural proposal by reorganising programmes within a single building, defining the architecture’s tectonics through material selection and construction details to host the programmes and people. The design decisions facilitate and foster the research’s intentions to establish connections between food producers, consumers and the natural environment illustrating how architecture can support collective well-being, resilience and food security through designs that respond to site conditions and existing relationships.

Figure 103
Whangapouri Creek regeneration



Note: Community comes together to regenerate the creek's ecology with native plants grown in the restored greenhouses.

Figure 104
Whangapouri Creek pathway



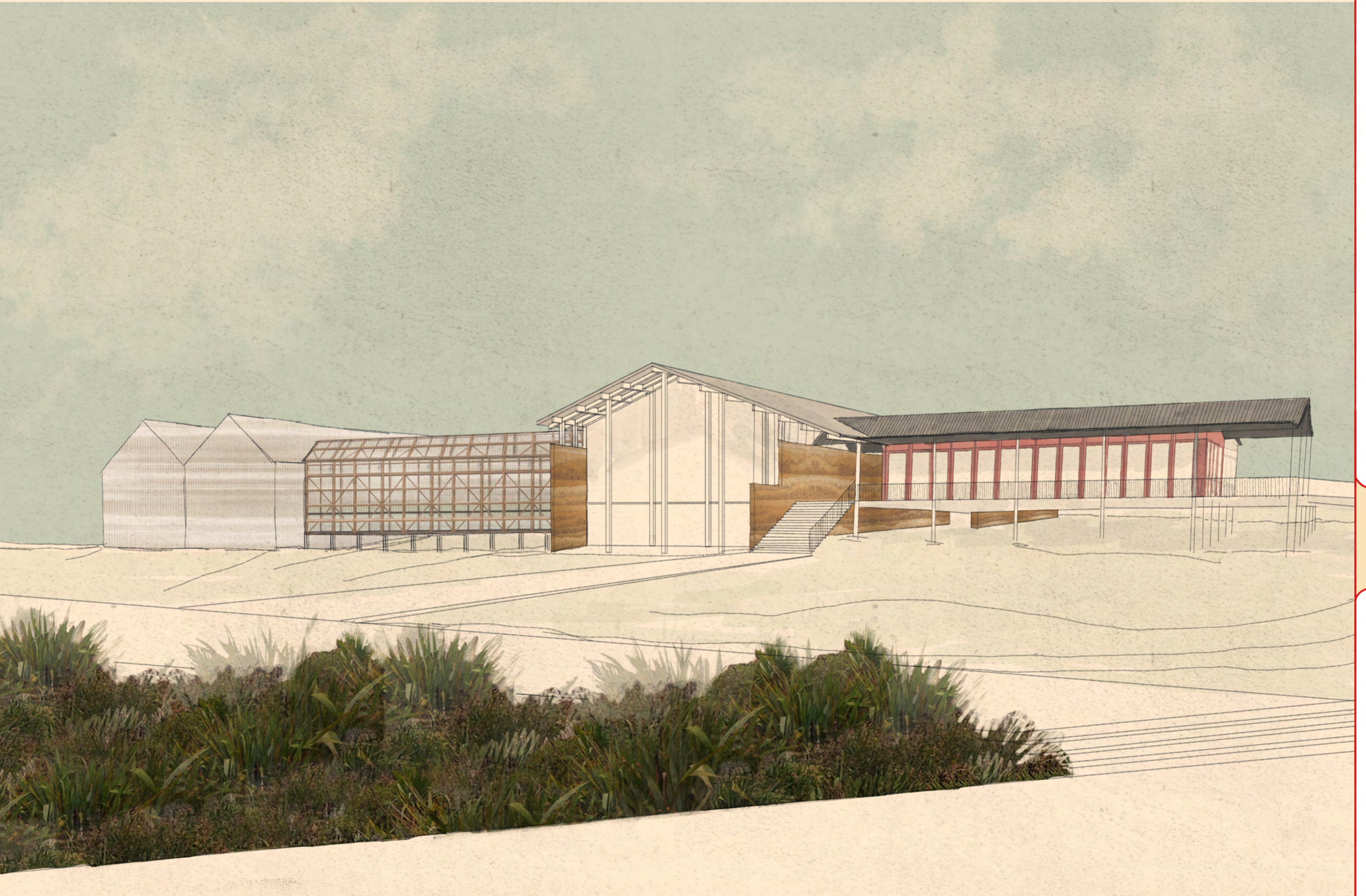
Note: Visualisation of architecture facilitating playful interaction with the creek.

Figure 105
Food hub elevation part one



Note: Visualisation of western elevation of the hub.

Figure 106
Food hub elevation part two



Note: Visualisation of northern elevation of the hub.

Figure 107
Market section

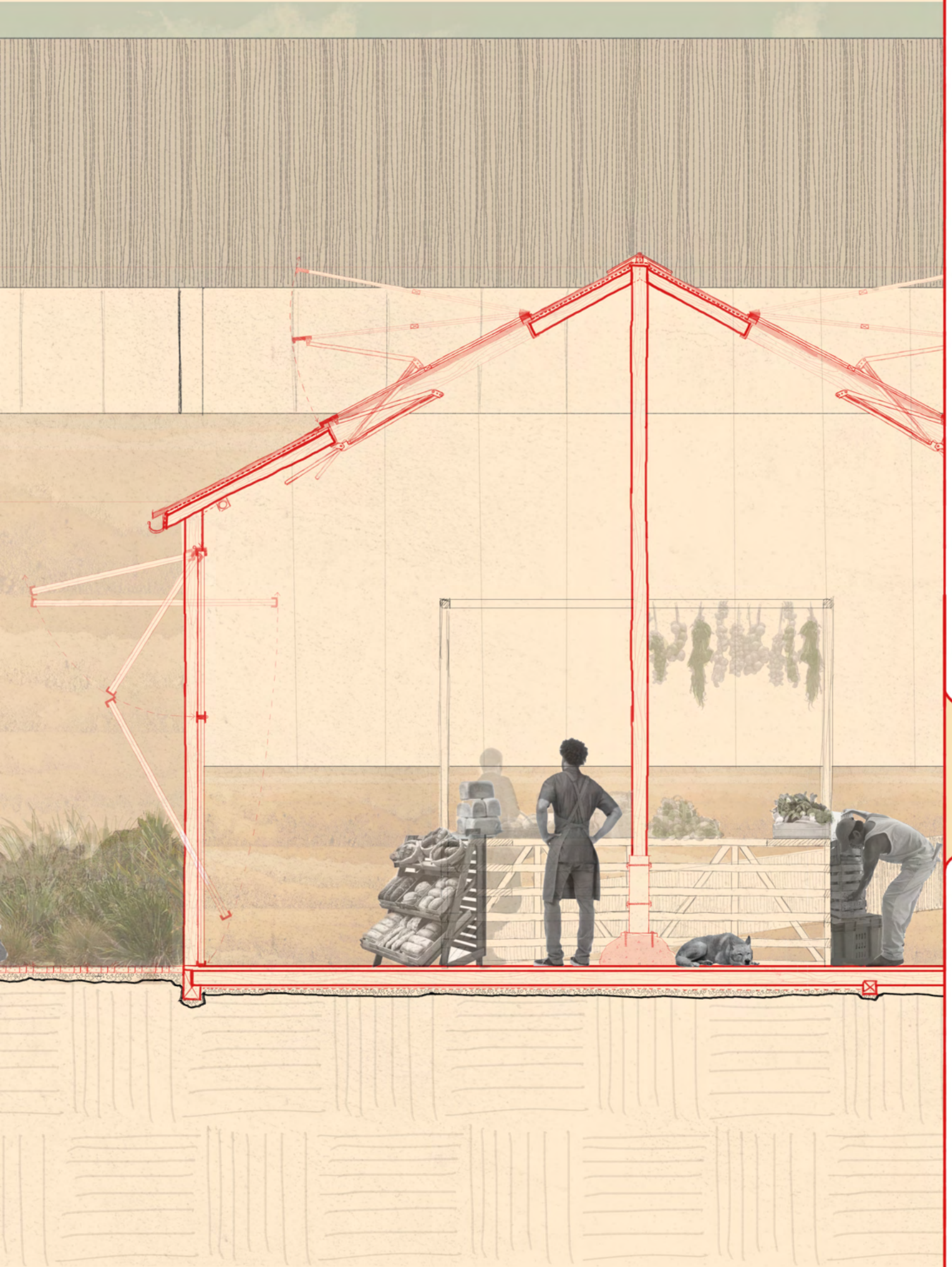


Figure 108
Food hub thoroughfare



Note: Visualisation of southern entrance.

Figure 109
Food forest

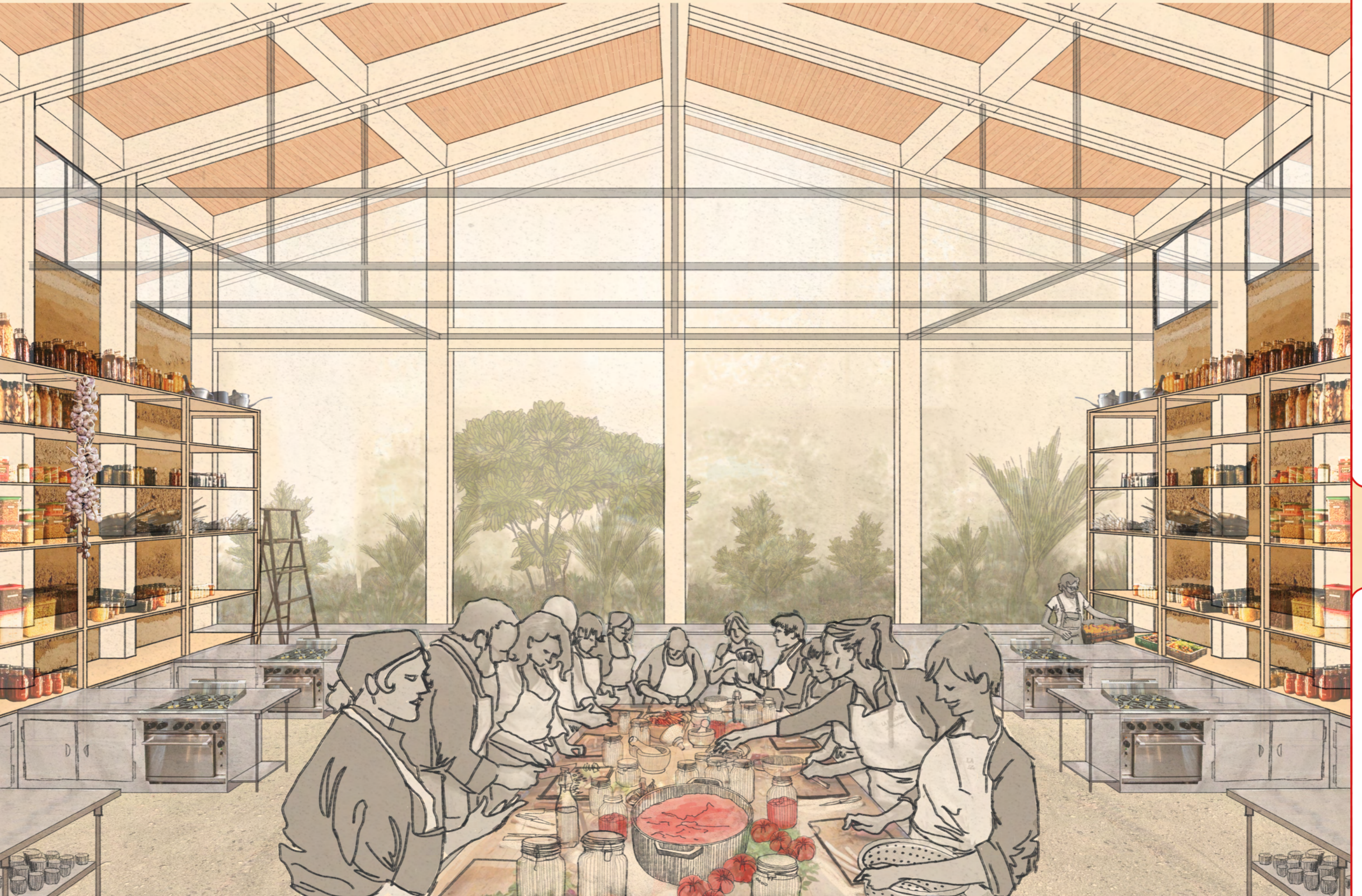


Note: Visualisation of kids walking to school through the food forest, picking fruits to snack on or save for lunch.

Figure 110
Hāngī

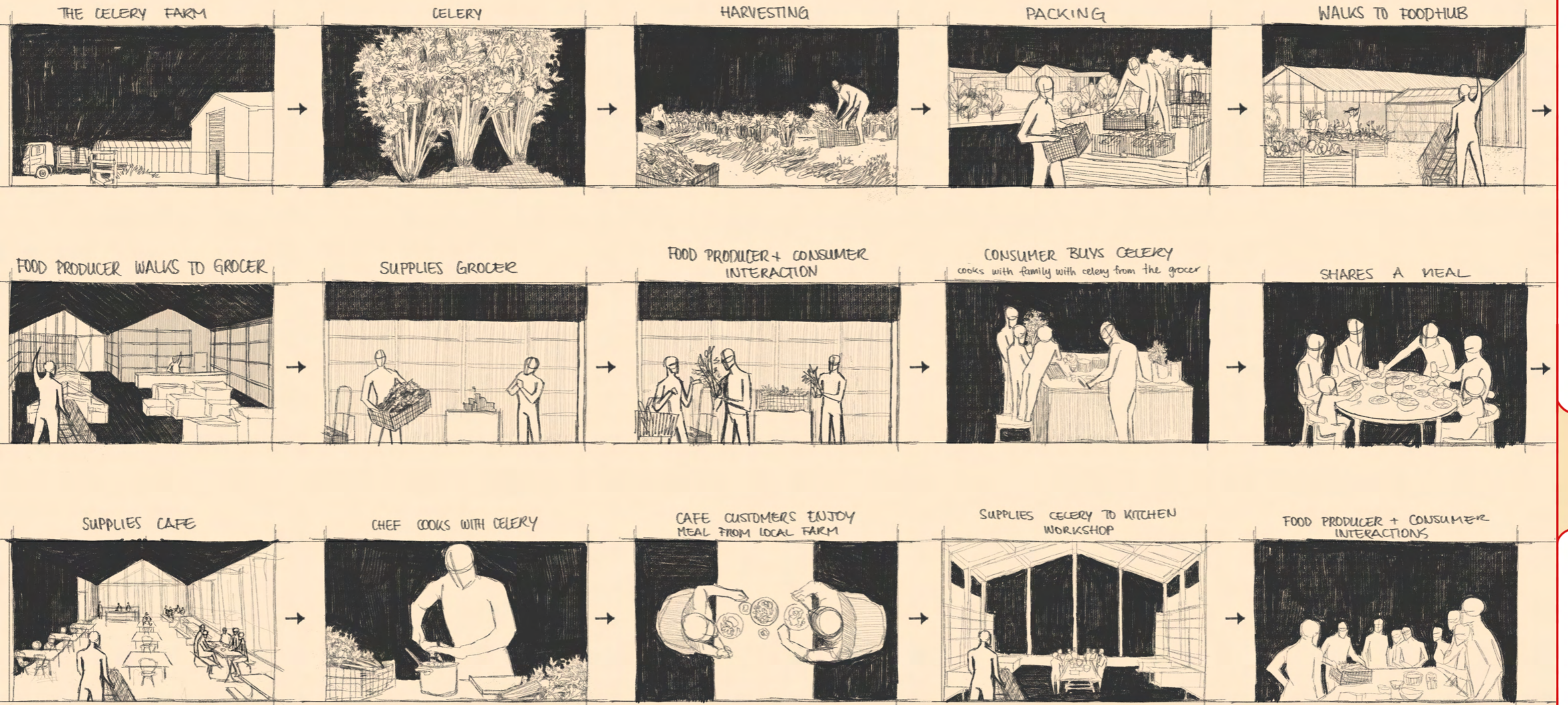


Figure 111
Food literacy & preserving workshop



Note: Visualisation of a group learning how to preserve tomatoes in the food hub's commercial kitchen.

Figure 112
Storyboard of the celery farmer



Note: Storyboard of the celery farmer - who neighbours the food hub - interacting with programmes and consumers facilitated by the architecture.

CHAPTER

7.0

FINDINGS & DISCUSSION

This design research thesis aims to explore how architecture could mediate suburban residential and agricultural programmes, reconcile food producers, consumers, and biodiversity within food-productive landscapes threatened by urban sprawling to facilitate food security and community resilience.

The first aim of this thesis is to investigate the extent to which architecture can be a catalyst for food systems change. Engaging with literature on the current conditions of Aotearoa's food system and its operations, it was clear to me that the system is failing; food is treated as a product, not a right (PHAC, 2024). Along with the findings that the food system is failing, I found the system deeply complex, with many interconnected factors across political, health, economic, socio-cultural, and ecological systems; as illustrated in Figure 7: the system is too broad for the architectural response to provide meaningful change.

To address this complexity, I reviewed alternative food models and regenerative frameworks that prioritise socio-cultural and environmental factors as the literature showed the food system underserves those dimensions the most, with 1 in 5 children experiencing food insecurity and 50% of Aotearoa's total gas emissions come from the food sector (PHAC, 2024). Adapting practices from Food Sovereignty (Wittman, 2023) and Agroecology (Somashekar et al, 2024), Hua Parakore (Hutchings, 2015), Kai Ora (Hutchings et al, 2020), and Kaitiakitanga (Kawharu, 2000) into architectural design strategies informed by the Mauri Ora Compass (Yates et al, 2022), Ecosystem Services (Blahna et al, 2017), and Nature-Based Solutions (Pedersen Zari et al, 2024), helped clarify and strengthen this thesis's intentions on enhancing socio-cultural and environmental factors within the food system.

Architecture alone cannot solve the failings of the food system, but it can facilitate socio-cultural and ecological regeneration that provide the tools for communities to push for systems change. In this thesis the architecture becomes a facilitator to drive change, rather than be the source of change itself. Understanding this, the architectural response focuses on facilitating relationships between three stakeholders: food producers, consumers, and biodiversity. Facilitating these relationships and interactions in place will act as a catalyst for community-led initiatives that build resilience in response to food insecurity. Evidenced by examples of small-scale community-led instalments that create a broader support network to address food insecurity that doesn't rely on a failing food system, like South Tāmaki Makaurau's food network and Tipu Matomato Te Harakeke, this study finds that smaller activations of food sovereignty can branch out into larger communities to engage in food-systems change to ensure domestic food security.

The next aim of the research is to investigate architecture as a mediator between landscapes. This thesis finds and focuses on the conflict between food-productive environments and encroaching-built environments. Engaging with literature and design processes of mapping, led me to find conflict with future residential development threatening the conversion of highly productive soils, diminishing overall domestic food security. This strengthened the relevance of this thesis to investigate how architecture can alleviate food insecurity due to the findings that the built environment directly strains the food system's ability to produce foods because of land-use competition (Soliman & Greenhalgh, 2020).

Through the initial design research, I explored how architectural integration of food production manifested across rural, peri-urban, suburban, and urban landscapes, illustrating architecture's potential to mediate diverse contexts.

The theoretical framework I adapted provides agrifood practices that is informed by indigenous ecological knowledge which comes from a holistic worldview that understands the intricacies between the more-than-human conditions that contribute to food production, food systems, and the wider ecosystem. Understanding the holistic network, existing precedents, previous personal work, and food network analyses, I found different architectural landscape and building strategies that mediate the transitions between food-productive landscapes, urban areas, and natural environments which will bridge the relationships between food producers, consumers, and biodiversity.

I found that Pukekohe features the country's most versatile soils that produces over 20% of Aotearoa's vegetables in the country's largest urban city, with conflict zones between development and cropland. This made it a suitable site to test the architectural design research to mediate relationships and facilitate community attitude shifts on the food system. The thesis's chosen site, the Whangapouari Creek, is an area of highly productive versatile soils that has been rezoned for suburban development. It highlights the tensions generated from land-use conversions that the built environment enables, neglected natural ecology, and reverse sensitivity to agricultural programmes from newly moved-in residents.

The architectural response on this site mediates the tension between food-productive landscapes and suburban development by proposing built community infrastructure that connects the wider urban community to engage with a food-productive landscape. The design research re-negotiates the site's potential by denying plans for single-unit housing and instead provides polyculture landscapes that regenerate the indigenous ecology of the Whangapouari Creek and promotes an alternative model of food-growing practices that embody the frameworks of Hua Parakore, Kai Ora, and Kaitiakitanga through permaculture food landscapes, food forests, and having architecture encourage and mediate relationships between people and the natural environment.

The last aim of the research is to position architecture as a link between the three stakeholders. Through the design research process of this thesis, food-related programming was key to bridging the stakeholders as food is universal across all cultures and people. Food is the conduit that connects people with others and place, culture, and the natural world (Hutchings et al, 2020) (Chu-Ling, 2022). Architecture can facilitate this common ground through food-centred programming to provide the environmental, socio-cultural, and food access services to enable food security and collective well-being.

To mediate these relationships and facilitate strong socio-cultural programming around food experiences, the architecture proposes a food hub, focusing on providing spaces that empower the local community with food and living

systems literacy, food sovereignty, ease-of-access to foods by shortening the food supply chain, and an overall sense of belonging in the local and wider community.

This thesis finds there is more to reconcile other than the disconnection between food producers and consumers, through site analysis I found that Pukekohe had a history of racial segregation, racial tensions, disconnection to place, and exclusion, prompting this thesis to emphasise collective reconciliation with designs that are inclusive, unifying and allows for positive cultural exchanges.

The localised food system on site has food producers, consumers, and biodiversity directly engaging with each other through regenerative food practices that supply a 'from farm to fork' system. In this thesis, architecture provides spaces for users to express their food practices or learn from other's food practices to foster collective well-being and strengthen bonds between food producers and consumers so that they can come together in a space enabled by the architectural landscape and structure to support community food security.

The study also found that the application of indigenous and ecological frameworks supported the thesis's ability to propose a holistic design that decentres the individual to focus on collective well-being and broader implications of living systems that are tied to food production and people's well-being. Applying principles and strategies from the theoretical framework allowed the design to challenge conventional agrifood practices and suburban development to provide a food hub that puts the community and natural environment first.

Specifically, this thesis's architectural proposal mediates tensions between food producers, consumers and biodiversity through a built food haven in Pukekohe on the Whangapouri Creek site. The food hub features a grocer that enables direct relationships between the community retailer and consumers as a response to distanced food supply chains, and disconnection between consumers and food producers, allowing consumers to have direct relationships with food producers and knowing where their food comes from and who produces it.

The café attracts consumers who may not have been initially enticed by the community hub but are interested in dining in, attracting these types of consumers exposes them to the working food productive landscape that may not have been visible to them before, which builds on their food literacy and understanding of food production processes.

The commercial kitchen was a response to food illiteracy and cooking skills limiting one's food choices, the commercial kitchen provides workshops that can teach the community different practices of preparing, cooking, preserving and storing foods that expands their knowledge and ability to determine their own food security. The community is also welcome to use the facilities of the commercial kitchen if they don't have access to equipment elsewhere, so that consumers aren't restricted from eating certain foods due to not owning the right equipment. Food producers can also utilise the commercial kitchen for their own food endeavours, supporting their livelihoods. The commercial kitchen can also provide meals for the most vulnerable in the community, such as providing cooked meals for the local school as children are severely impacted by food insecurity.

The market space facilitates organic relationships between food producers and consumers, resulting in knowledge exchange, strengthened trust, and more transparent food practices.

The greenhouses of the main food hub structure hosts workshops that educate the lifecycles of growing foods, by sowing seeds, nurturing seedlings, plant care, when and how to harvest foods, and general gardening skills to expand the community's knowledge and skills.

The community garden accommodates garden plots for residents who may not have the space or facilities at home to grow their own foods due to dense suburban development and the loss of private garden spaces. The croplands that cover the site are designed to follow natural cycles and enhance biodiversity, the croplands include food forests and permaculture systems that resist conventional agricultural practices and instead promote the regeneration and symbiosis between food producers, people's well-being and the natural environment.

The Whangapouuri Creek's ecology is regenerated to enhance biodiversity on site, improving the overall health of the natural landscape. The creek will be regenerated following indigenous secondary succession and eventually the mixed broadleaf forest that will attract pollinators and birds to assist in food-productive living systems but also allow food producers and consumers to experience the beauty of the natural landscapes and the unique ecology Aotearoa has, building up that obligation to care for the natural environment, the original food producer.

CHAPTER

8.0

CONCLUSION

This thesis investigated how architecture can alleviate food insecurity through reconciling relationships between food producers, consumers, and biodiversity within landscapes that are conflicted with urban sprawl onto food productive environments. The findings concluded that architecture alone cannot solve the failings of the food system but can design spaces and experiences within a landscape that influences people's relationships with others and their environment to determine their own food security, sovereignty, and resiliency.

In this research, architecture provides spatial experiences that build people's relationships with food supply processes, other groups of people within those processes, and ecology to understand each other's reliance on a living system, how people's actions and practices influence the health of others and the environment. It encourages engagement between food producers, consumers, and biodiversity to share experiences for greater understanding of each entity's contribution to the food system and broader well-being for all, currently, and for future generations.

The research came to this understanding and findings through literature reviews, precedent analysis, site research, and iterative design processes to understand architecture's role and practice within the problem of a failing food system. Literature reviews and precedent analysis provided a foundation of understanding of the problem from interdisciplinary perspectives, alternative models of food systems' thinking, and indigenous frameworks to propose a challenge to conventional food systems through architectural design. Precedent analysis provided multi-scalar architectural responses that provided guidance on the design process's direction, as architecture and food systems are not commonly linked subjects. The comparison of different food systems' thinking applied in built forms influenced the scale and intentions of this research to make design decisions that were value-driven based on regenerative outcomes for food sovereignty, ecological, and socio-cultural contexts. These values were represented in the culmination of Māori and Western theory adapted to be applied to design thinking. The collaboration of interdisciplinary knowledge and cultural frameworks heavily informed an in-depth approach that provides appropriate responses, deepens, and emphasises that the architecture's role is more than a building but to produce meaningful transformation of site and the people that will engage with it.

Existing frameworks provided insight into design considerations, adapting principles such as whakapapa, manaakitanga, and kaitiakitanga with overall holistic frameworks to have the design research consider how architecture hosts, influences, and improves broader site implications across environmental, socio-cultural, and temporal contexts.

Within this research the theoretical framework informed design decisions to consider broader site implications and the intentions of the research in alleviating food insecurity and reconciling relationships between people and landscapes. Through the conceptual design process of sketching and planning, the theoretical framework and precedents informed the decision to develop separated buildings across the site into one larger building that would be spatially laid out to reflect the food supply chain process, the 'from farm to fork' movement, and making it adaptable to the users' needs due to different periods of time. Principles such as whakapapa emphasise the understanding of past practices and learning from the past narratives to inform current practices that will lead to an improved future through the emphasis of hosting food literacy programming to improve future generations' education and understanding of food processes and considering within the design how the project will span across different generations over a 100-year timeline. The design decisions embody a living systems approach to putting the architecture's connection to people and place within a food system context. Architectural practices of sketching, model making, master planning, plans,

and sections can translate and conceptualize the application of theoretical frameworks, values, and principles are lived and embodied through spatial qualities and vernacular forms that are welcoming to stakeholders.

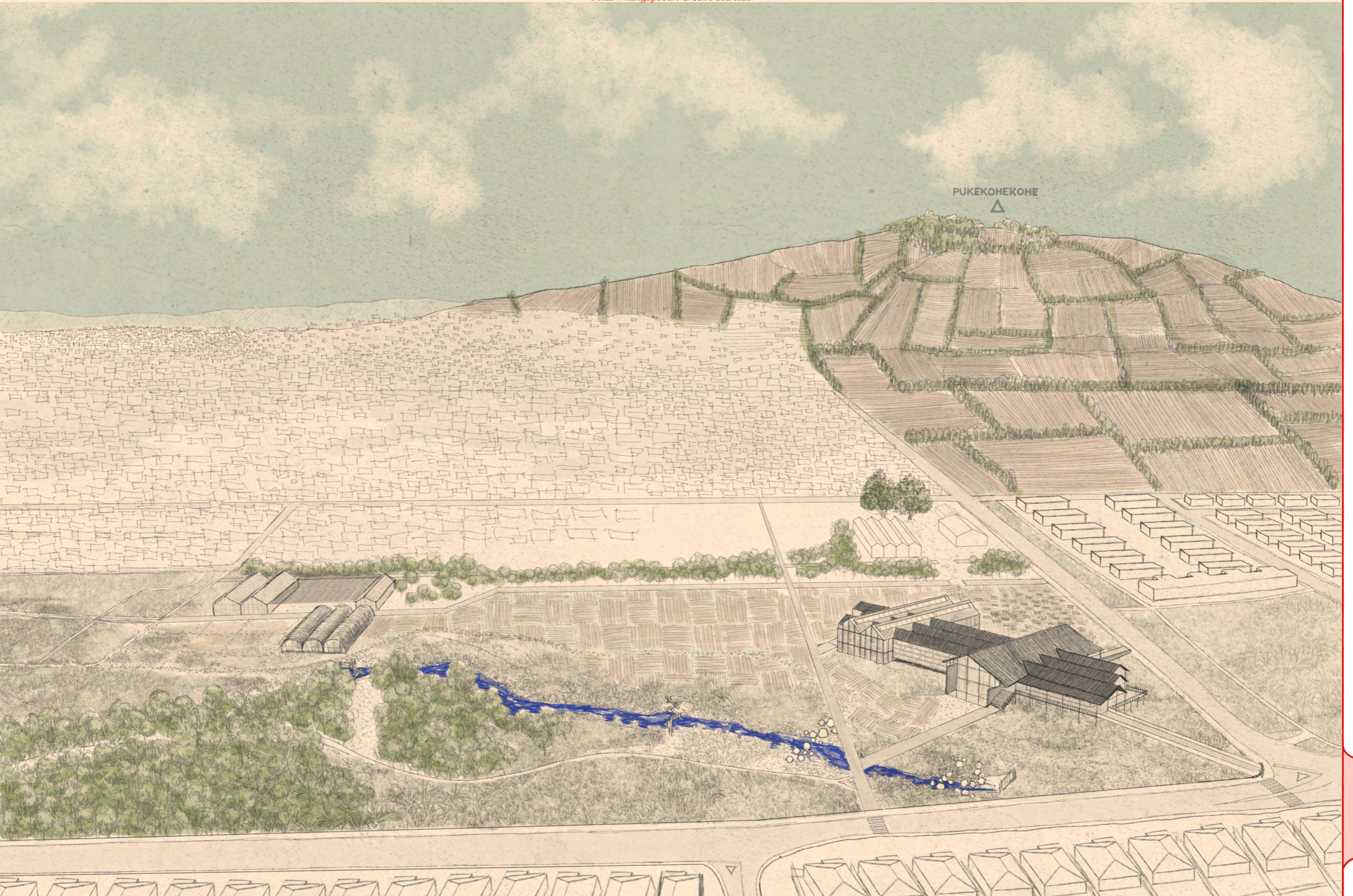
From this thesis the research process that determined much of the study's design outcomes was extensive site analysis. The site analysis through the use of top-down mapping that investigated existing and potential relational networks followed by ground-up field work provided in-depth information on where areas are experiencing conflict between encroaching development and loss of food-productive landscapes. Identifying tension points for the research to respond and be applied more meaningfully and successfully. Further specific site analysis of the Pukekohe area and Whangapouari Creek site provided information on past narratives, current relationships, and the potential future environment of the area. All this information weaved through design decisions provides better responses and engagement to respond to specific site needs and current conditions. This research understands and emphasises the importance of site analysis, understanding relationships, history, and ecology beyond a site's boundaries that provide more sincere information determines architectural responses to be unique to place, to the local people, and how the architectural responses can improve or diminish an area.

To conclude, architecture has the potential to be a catalyst for regenerative transformation of place, people and policy. Architecture can spatially engage, reconcile and strengthen connections and experiences between communities, the environment, and food systems. Architecture is not just a built form, but a living space situated in an interconnected network that weaves time, people, and place together. Architecture is supporting infrastructure that can empower communities and the natural landscape to be resilient and food-secure for future environments.

APPENDICES

FINAL PRESENTATION VISUALS

Figure 113
Final Whangapouiri Creek Food Hub



Note: Note: Revised visual for final presentation - illustrates the architecture situated on site with broader site surroundings.

Figure 114
Final Whangapouiri Creek regeneration



Note: Revised visual for final presentation - Community comes together to regenerate the creek's ecology with native plants grown in the restored greenhouses.

Figure 115
Final Whangapouiri Creek site plan



SITE PLAN

1:800

Note: Revised visual for final presentation - site plan 1:800 scale at A2

Figure 116
Final Whangapouiri Creek pathway



Note: Revised visual for final presentation - visualisation of architecture facilitating playful interaction with the creek.

Figure 117
Final food hub elevation part one



Note: Revised visual for final presentation - visualisation of western elevation of the food hub.

Figure 118
Final food hub elevation part two



Note: Revised visual of final presentation - visualisation of northern elevation of the food hub.

Figure 119
Final food forest



Note: Revised visual for final presentation - visualisation of kids walking to school through the food forest, picking fruits to snack on or save for lunch.

Figure 120
Final food hub thoroughfare



Note: Revised visual for final presentation - visualisation of southern entrance to food hub.

Figure 121
Final hāngī



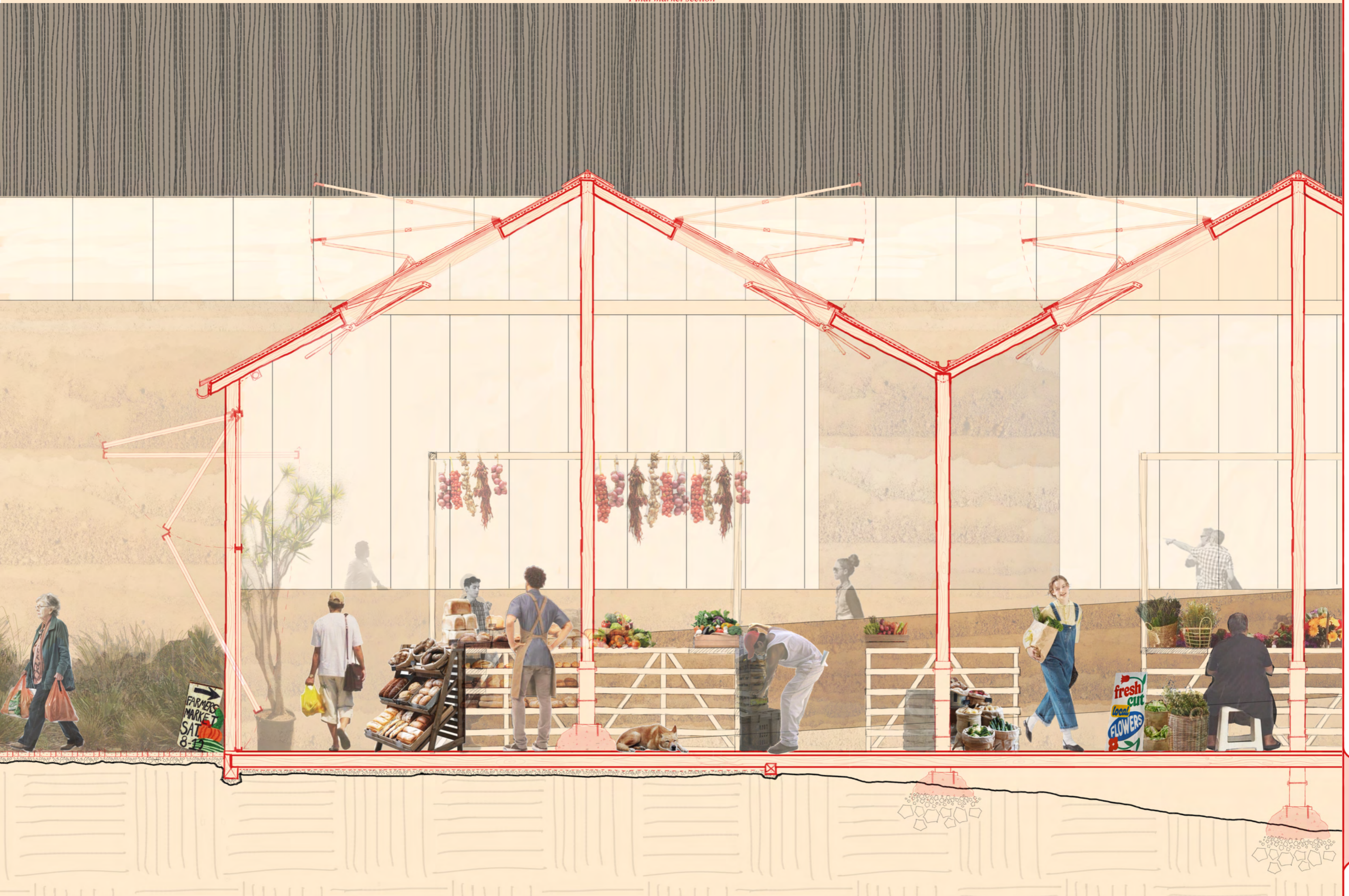
Note: Revised visual for final presentation

Figure 122
Final food literacy & preserving workshop



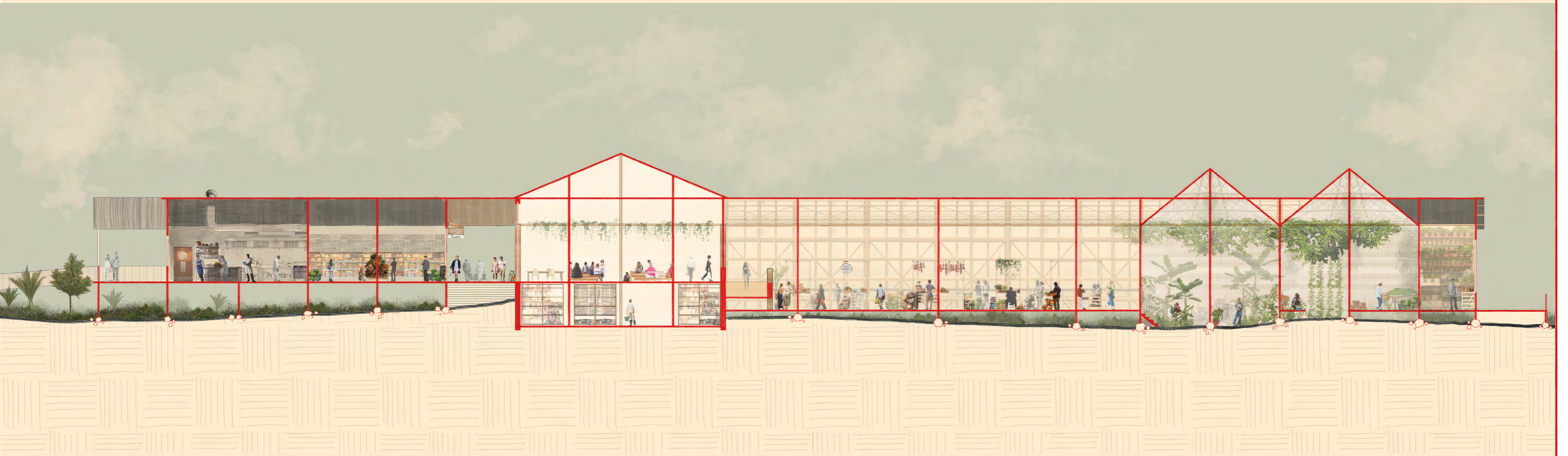
Note: Revised visual for final presentation - visualisation of a group learning how to preserve tomatoes in the food hub's commercial kitchen.

Figure 123
Final market section



Note: Revised visual for final presentation - section visualisation of farmers market

Figure 124
Food Hub Section



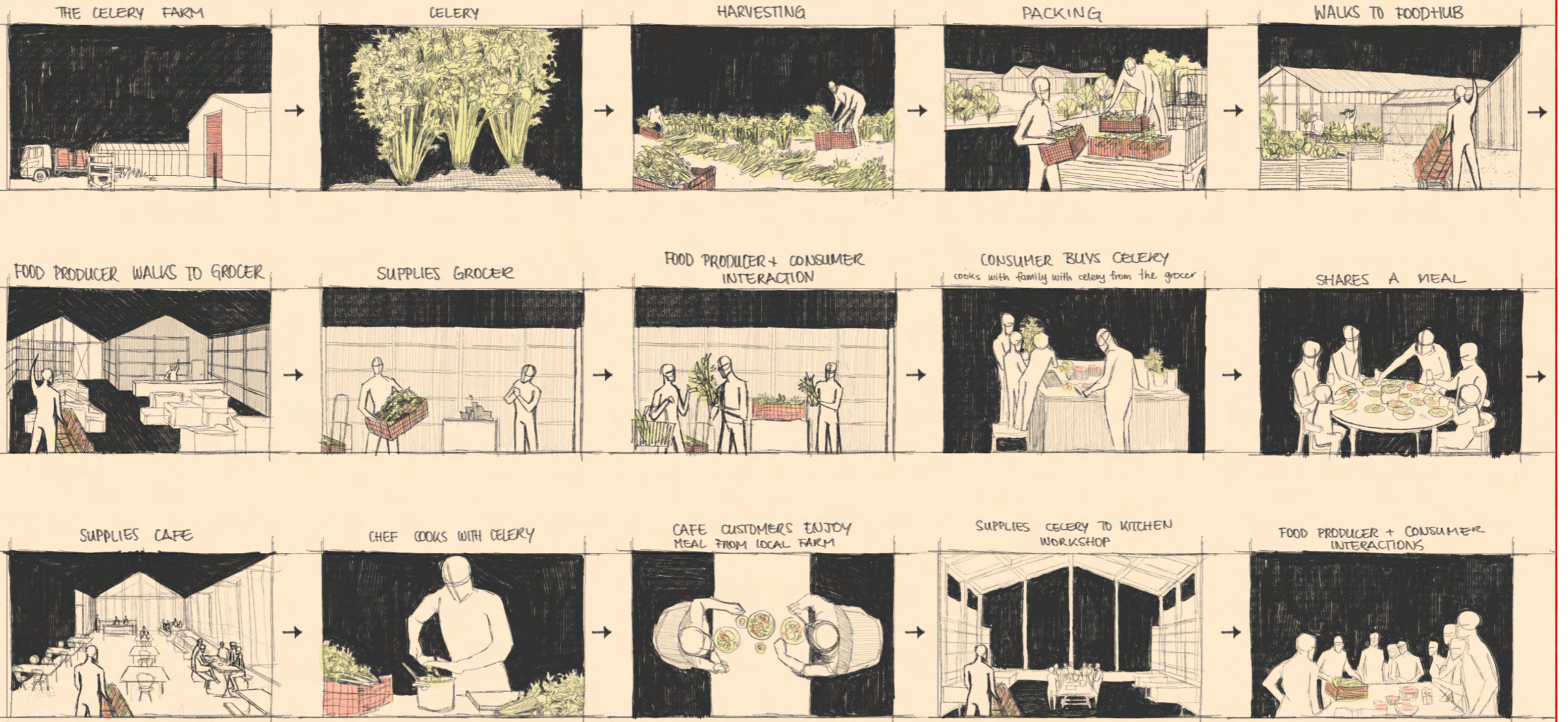
Note: Section drawing of food hub.

Figure 125
Greenhouse to market



Note: Interior visual of food hub that shows the greenhouse, and market area.

Figure 126
Final storyboard of the celery farmer



Note: Revised visual for final presentation. Storyboard of the celery farmer - who neighbours the food hub - interacting with programmes and consumers facilitated by the architecture.

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