Renewal of the Abject; Manure-facturing in the Horowhenua District

Towards a Beautiful Abject

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Two prominent issues are affecting the vitality of regional settlements in the New Zealand context. Firstly, urbanisation has meant the migration of young workers and professionals to creative and economic urban centres, leaving demographic gaps in the regions and a dwindling population. Secondly, the exploitation of regional landscapes by cities has led to severe degradation of extensive wetland ecosystems. Wetlands drained for farming, large-scale deforestation and industrial settlements established to support agriculture and forestry contribute to the artificial landscape morphology. New Zealand’s waterways and lakes now suffer from eutrophication; an enrichment of nutrients caused by dairy run-off and increased sediments, characterised by a build-up of organic matter producing toxic algae bloom.

Titled ‘Renewal of the Abject’, this project is a speculative design that aims to reconcile the problematic relationship between the dairy industry and the environment. Architectural infrastructure and landscape renewal present an opportunity to challenge current urban planning tendencies in the Horowhenua District. The project proposes to reinvigorate small towns with a self-sufficient and forward planning urban framework.

Levin, a prominent industrial town at the centre of the Horowhenua District, clings to the vital transport connection between Wellington and Auckland, feeding off the economic lifeline of passing traffic. With the proposed changes by NZTA to create a State Highway One Bypass east of Levin, the CBD may suffer economically leading to population decline. Lake Horowhenua, west of the town centre, was once the heart of the District with an abundance of food and natural resources. It is now considered one of the worst lakes in New Zealand based on its poor condition.
Integrating infrastructure and megastructure challenges modernist attempts to zone cities by function and aims to build clean infrastructure integrated into compact urban areas. Architecture as infrastructure challenges the public understanding of production and manufacturing and their natural consequences. A redefinition of industry for the twenty-first century could improve its detrimental relationship with the environment. Clean infrastructure eliminates the need to build industries on remote brown sites, focusing on the prevention of adverse effects on the landscape and the population’s health and wellbeing.

The concept of using manure-loam composite as a structural building material provides new opportunities for cost-effective architecture for towns that are economically struggling. The material is renewable and easily accessed in New Zealand, while rammed earth construction enables future growth and expansion. Using an artistic approach in constructing manure-loam buildings has the potential to produce an aesthetic distinctive of rural New Zealand.
I would like to thank all the people who have made this thesis possible. Their consistent and greatly appreciated contributions to my intellectual thinking have been invaluable. This journey has been one of personal growth and self-awareness, and it has challenged me to strengthen my views towards all facets of life.

First and foremost, I would like to thank my family who have supported me in every way possible. To my mum, for nurturing my creativity, providing new meaning to my work, feeding and housing me in each emotional, worn-out state and for providing an abundance of love and support. Dad for involving me in D.I.Y projects and the fascinating world of construction and for giving me the practical knowledge I needed to take on architecture. Also for helping to maintain my sanity with humour and patience. Grandad for your time spent sharing your knowledge of farming and love of the land in your wise and witty manner; a treasured part of my childhood. And Luke, for your knowledge, support and understanding of this journey, you have helped me to accomplish what I set out to achieve.

Secondly, I would like to thank my supervisors Sam Kebbell and Martin Bryant for your unwavering passion and support this year. You have helped me to unravel the true potential of my thesis, introducing me to a whole new way of thinking and pushing me to explore new methods of design investigation. Your knowledge has had a profound effect on the quality and significance of my work.

Thirdly, I would like to thank McKee Fehl Constructors and my fellow colleagues whom have not only financially supported me but have offered advice, opportunity, industry knowledge and valuable on-site experience. This vital network of people have encouraged me and enabled me to develop my professional skillset.

Finally, I would like to thank all my friends who bring joy and happiness to my life through the many experiences and adventures we share. Without these people I would not have made it this far.
Design-Led Research

Design-led research allows the thesis to be ‘made’ as opposed to written (Wilson 2). In the field of architecture the notion of ‘making’ is critical in the design process. The ability to express the subtleties and complexities that are inherent in design is only made possible through presenting a visual argument that details the exact intent the maker is constructing (Wilson 3). My design process is presented visually with annotation, enabling the viewer to understand my process. This process of making is made stronger through the theoretical repositioning of the design. Throughout this process literature review was a means to discover new ways of thinking about the design, positioning it within current architectural discourse. Relevant precedents are spread throughout the visual argument, building a discussion around the design. The developed design lies at the beginning of the thesis to give precedent to the design experimentation and research. The thesis itself is printed on handmade flax paper with approx. 5% recycled dairy waste, further contributing to the idea of abject beauty.
The initial hunch was to improve the condition of Lake Horowhenua and its relationship to Levin.

**SITE ANALYSIS**
Researching prevalent issues in Levin such as poor economics, demographic gaps, pollution, population decline, and cultural conflict helped me to identify a brief that needed to be satisfied.

**URBAN RELATIONSHIPS**
The town neglects landscape amenity with urban activity focused along SH1. The initial design iterations explored reconnecting the town to Lake Horowhenua.

**PROGRAMME**
With the goal to clean the lake, strengthen the dairy industry and economic sustainability of Levin, I looked at combining new technologies that process manure with the presumption that the systems could integrate and work in large scale applications.

**INITIAL DESIGN**
Agresearch and manure processing

**TOO BIG?**
Assuming a new industry could improve population growth and provide economic sustainability, the building was designed as a large scale eco-industrial centre. Integration into the surrounding context led to an investigation of form, detailing and modularity.

**MATERIAL INVESTIGATION**
Deconstructing beauty through modelling an abject condition and representing it as beauty.

**MEDIOCRE**
The initial design response exposes mechanics of factory in a polished representation. I struggled to find an evocative approach using structure as architecture. The design wasn't evocative of the ambivalent relationship between waste and public urban space.

**MATERIAL INVESTIGATION**
Iterative models of Linearity, repetition and humanistic scale.

**ITERATIVE MODELS**
Linearity, repetition and humanistic scale.

**MONUMENTAL ARCHITECTURE**
Articulated through mass and detail.

**MATERIAL INVESTIGATION**
Investigating psychoanalyst modes of design that question how beauty can be inverted through unusual materiality.
The design forms a new urban axis between the lake and hills providing a vibrant main street within the waste infrastructure. The design integrates with surrounding landscape features and urban fabric. The manure loam structure uses dribbles and construction detailing to express the architectural intention and material beauty.

Upon reflection, dribbles could be too literal. A different approach could investigate weathering and natural decay of earth architecture to express natural material qualities. The future development of this building could also become organic and a product of grass roots architecture.

A major constraint in the project was the inability to build a full scale wall and fully resolve the design due to the scale of the project. Time and money were limited and much of the focus was on resolving the macro structure and the micro detail to develop the strongest arguments. Glimpses of middle ground spaces build an understanding between the macro and micro.

The linear form prompted an investigation of arcade typologies. Reconsidering the arcade as an alleyway of back alley activity introduced unique tensions between the conflicting aesthetics.

The proposition that the abject nature of dairy waste and sewage could potentially be understood as beautiful ‘unlocked’ the design.

Although the projected population for Levin is declining, it has been assumed new industry will provide jobs and encourage people to live in Levin, prompting population growth and validating the ‘megastructure’.

AESTHETICS
Psychological tensions were created through juxtaposition of abject materiality and beautiful architecture of luxury quality. Architectural elements were fragmented and repeated to create visual complexity.
Research Questions

ABJECT BEAUTY
We tend to have accepted ideas of what beauty is, but we need to explore new ideas of beauty to make development more sustainable in the twenty-first century. This thesis looks at;
- How abject materiality can be understood as beautiful
- How architecture can challenge the public attitude toward covert industry and abject materials
- How traditional principles of beauty can assist in making a beautiful abject condition

COMPACT SPRAWL
Compactness is antithetical to the rural landscape, yet urban sprawl is a wasteful way of using land and resources. This thesis questions;
- How densification can be a practical solution towards land conservation in rural areas
- How urban sprawl can be controlled to reduce negative impacts on regional ecology
- How regional town centres can become vibrant without losing touch with rural landscapes

MEGASTRUCTURE
‘Big box’ architecture goes up where there is cheap land, usually in rural towns, with a mono-functional programme, often in stark contrast to smaller rural built form. This thesis questions;
- How the megastructure can relate to a smaller scale of architecture that exists in regional settlements
- How the megastructure can adapt to a changing population, either rural decline or urban growth
- How the megastructure can support multiple infrastructural requirements in an integrated way
- How the megastructure concept can be considered beautiful in regional landscapes

ARCHITECTURE AS INFRASTRUCTURE
Architecture and infrastructure tend to be thought of as separate entities in an urban condition, which leads to a sense that infrastructure is necessary but needs to be hidden. This thesis looks at;
- How the troubled relationship between industry and the environment can be reconciled through architecture
- How covert industry practices and infrastructure can be reimagined through architecture

An unfolding of ideas

The design process begun as a linear line of investigation, unfolding as exploratory design upon realising the core significance of the project. The design-led nature of this process meant a lot of what I was doing seemed arbitrary and didn’t inform my design in a productive way. This was time consuming and frustrating often leading to dead ends. I tested many design ideas and only later discovered that they were significant moves in different intellectual contexts. The realisation of my design occurred upon reading psychoanalyst theory, changing the way I understood both context and materiality. Beyond this point the design became much more exploratory, investigating different design methods inspired by psychoanalyst theory. Reflective thinking and theoretical repositioning further enabled me to discover the full potential of the conditions I had set up.
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Abject
1. (of something bad) experienced or present to the maximum degree
2. (of a situation or condition) extremely unpleasant and degrading

Tendencies
1. an inclination towards a particular characteristic or type of behaviour
FIG. 5 < Diagram of thesis structure
Sediments carried down the rivers suffocate the lake. The deepest part of the lake is now two metres causing high fluctuations of temperature, and optimal conditions for toxic algae bloom (Manawatu-Wanganui Regional Council 5).

Increased nutrients from sewage discharged to the lake (1952-1987) and dairy run-off cause rapid weed growth (Manawatu-Wanganui Regional Council 12). The lake is overrun with vegetation which rots in the summer.

The culturally significant waters of Lake Horowhenua are tainted by pollution. Toxic algae bloom marks the edges of the lake producing foul odours.
The absence of human activity at Lake Horowhenua left the large reserve grounds bare and open. Such a large public space felt poorly underutilised and stripped back. The remnants of abandoned rowing and sailing clubs vandalised and dilapidated, echo the neglect felt in the landscape. The lake could be a great amenity for Levin’s residents. There are picnic areas, a modest playground, club rooms and ample space to run and play. The lake’s pollution and poor quality became a primary driver for the thesis.

The lack of wetland vegetation holding the soil together has led to eroding landscapes. A thin, patchy line of vegetation partially filters storm water runoff before entering the lake. Grassy picnic areas are worn down to mud and covered in bird Manure.

FIG. 6 ^ Photo of Lake Horowhenua taken March 2015

Lake Horowhenua
FIG. 7 Pre-European Landscape

Coast: hardy native grassland and shrubs

Dune Lakes: Swampy forest with broad leaf plants below filtering water entering the lake (Greater Wellington Regional Council 34).

Alluvial Terraces: Canopy trees with an understorey of small leaved plants (22).

Coast: Livestock grazing, coastal settlement

Dune Lakes: Livestock grazing, recreation, stormwater runoff sink.

Alluvial Terraces: SH1 / Levin Town Centre

FIG. 8 Current Landscape
Land of the Great Landslide

Levin sits at the base of the stunning Tararua Ranges, on the edge of the dune lakes Horowhenua and Papaitonga, 5km inland from the western coastline. The western coastline was once an extensive wetland system supporting many different ecological processes. Rivers flow down the ranges washing nutrient rich soil across the low lying plains producing fertile, highly productive landscapes. Dunes forming a sweeping belt between Foxton and Paekakariki, caused by constant movements of river sediments, coastal wind patterns and rhythmic wave actions (McFadgen 8). Sculpted dunes protect delicate wetland environments on their lee side where vegetation and natural habitation occurs (Buxton). Recreation, deforestation and settlement patterns threatening these impressive landscapes, eroding and degrading soils built up over time (Buxton). Lakes surrounded in protective wetland planting occupy lowlands beyond the sheltering dunes. Like a sponge, wetland vegetation absorbs surface waters, slowing water flow, filtering nutrients and sediments carried across the land. Stripping of the land allows water to cut through weakened earth, scouring the land and progressively eroding waterways to large earthen channels. No longer do grand Kahikatea wetland forests cloak the low lands providing a forest floor of diverse flora, fauna and beauty. Nor do small Raupo huts sit humbly around the lake with people feasting on an abundance of Kaimoana and harvested foods. Manufactured landscapes of concrete culverts, streets, manicured gardens, paddocks of pasteurised lands and crops, and dwellings of human occupation have reformed the entire landscape.
Historically, agriculture and horticulture have always been primary activities in Levin. According to Anthony Dreaver, the local Muaupoko Iwi have resided in the Horowhenua district for 250 years, primarily settled around the Lake (3). He states that, “the Muaupoko occupation of Horowhenua was complex, extensive and technologically advanced compared with earlier people, exploiting a wide range of resources” (9). This included food-rich wetlands and forest edge. Keepa (The Muaupoko Iwi Leader) sold subdivision lot 2 (the current town site) to meet outstanding legal debts. He set criteria for development of the block as a town supportive and useful for his kinsmen (22). John Ballance, Minister of Land, put his faith in small business men and farmers to create a good community. The vision lay in developing a practical farming town to be the transport and market centre for goods and services supplied to or produced by the surrounding land (11). Keepa’s ideal town would have a marketplace as the centre, with public open space and a marae. Instead, the town was named Levin after the railway company, with industry and transport connections central to the town (22).

The Great Sewage Debate of the 1950s was an infrastructural issue that gave rise to the towns biggest political upset (Dreaver 239). Rapid post-war growth in the area saw a large increase in development and industrial activity, and the council was unable to provide adequate services at the time (242). Storm water management proved an ongoing issue and sewage would often flood into the lake. A lack of town planning made council management considerably more difficult. Overtime the lake became degraded and neglected by resource management. The most recent sewage pond overflow in 2008 proves current infrastructure is ineffective (Fig.11).
Lake of Discontent

Desolation captured in Phil Taueki’s eyes is telling of conflict that has arisen due to the condition of Lake Horowhenua. It is Maori belief that the life essence of all people, objects and resources inter-relate and are bound to the spiritual gods (HDC 15). The lake was a large part of the Muaupoko Iwi’s culture, providing a rich source of food and materials for crafting shelter, clothing and tools. Lake Horowhenua was also the site of a significant battle between Te Rauparaha and the Muaupoko Iwi in 1824. Many Muaupoko ancestors lie in the depths of Lake Horowhenua and the battle site is considered Tapu (sacred). Phil Taueki of the Muaupoko tribe considers himself ‘ guardian of the Lake’ in present day (Fresne). He also believes the Lake should be respected and preserved in its natural state (Fresne). Taueki is passionate about protecting the lake, driving people off his land, abusing police and fighting many court battles against boating and illegal storm water discharge consents (Fresne). His 10 year occupation of the lake has helped gain necessary attention in the form of a NIWA report conducted by freshwater scientist Max Gibbs in 2011, which brought to light the extent of toxicity of the lake and its poor condition. The Ministry for the Environment ranks Lake Horowhenua a meagre 107th out of 114 New Zealand Lakes due to its condition (13).
Gordon Sue, of B.S. Young Ltd Taking a break on the farm.

More than 100 tomato growers visited Levin’s Horticulture Research Centre to learn new growing technologies and research, 1968

loading apples at the Big Apple fruit orchard

Chicken Cargo - Loading up at Tegel Foods

Scientist working at Horticulture Research Centre, Levin 1984
Industrial development in the region, resulting in a push towards technologically advanced systems. Textiles, trades and manufacturing grew in the town providing innovative products to the global market (Dreaver). By the 1950s Levin had developed into an economically sustainable town with diversity of business, retail and urban amenity. However, the town faltered upon climax and since the recession of the late 1980s it has not recovered (341). Urbanisation has meant demographic ‘gaps’ in the regions (fig.13). In 1975 the Levin dairy factory closed as transport technology favoured much larger catchment areas for tanker fed factories and changing land uses affected dairy supply across the region (342). The Closer Economic Relations Agreement with Australia (1983) reduced protections from imports and affected large areas of manufacturing. This was followed by the impact of free trade in new and used cars leading to collapse of the New Zealand car assembly industry (342). The Final demise was abolition of subsidies stripping spending power from farmers and growers which marked the beginning of subdividing productive land (344). Subdivisions have greatly contributed to urban sprawl spreading across the entire district, reducing landscape quality and the economic base that relied on productive land activity. There is opportunity to redevelop the remnants of these industries and engage young professionals to return to the area through technical and skilled employment opportunities and business endeavours.

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**Productive Industries**

Industrial development in the region, resulting in a push towards technologically advanced systems. Textiles, trades and manufacturing grew in the town providing innovative products to the global market (Dreaver). By the 1950s Levin had developed into an economically sustainable town with diversity of business, retail and urban amenity. However, the town faltered upon climax and since the recession of the late 1980s it has not recovered (341). Urbanisation has meant demographic ‘gaps’ in the regions (fig.13). In 1975 the Levin dairy factory closed as transport technology favoured much larger catchment areas for tanker fed factories and changing land uses affected dairy supply across the region (342). The Closer Economic Relations Agreement with Australia (1983) reduced protections from imports and affected large areas of manufacturing. This was followed by the impact of free trade in new and used cars leading to collapse of the New Zealand car assembly industry (342). The Final demise was abolition of subsidies stripping spending power from farmers and growers which marked the beginning of subdividing productive land (344). Subdivisions have greatly contributed to urban sprawl spreading across the entire district, reducing landscape quality and the economic base that relied on productive land activity. There is opportunity to redevelop the remnants of these industries and engage young professionals to return to the area through technical and skilled employment opportunities and business endeavours.
Levin suffers from population decline as a result of current urban planning strategies. The town has tended to grow in a linear pattern along the transport corridor containing the railway and SH1. Peripheral development forms a grid around the linear centre. Rural zoning at the extents of the grid create informal development limits. However, urban sprawl beyond the town block encroaches within the rural setting, deterring from this structured urban planning. Rather than creating strong urban connections between the hills and lake, the town clings to vital transport connections between Wellington and Auckland, feeding off passing traffic. Proposed changes by NZTA to create a SH1 bypass west of Levin will negatively affect the town's commercial base (Kiwi Rail); eventually resulting in the town shrinking, as projected population estimates anticipate (fig.17).

The once bustling central Levin Mall, has become a relic of the 70’s. Malls were said to be the way of the future bringing economic ventures that catered to all nearby regions with access to a vast range of products (Williams). However, Levin mall suffers from under crowding, loss of business and investors and a tension between the busy main street and surrounding sleepy town. The mall itself is a testament to the history of hard working, community orientated residents who pushed many important developments in the region despite its size. But the aged buildings with redundant signage and empty tenancies depict a larger issue of regional decline and urbanisation that affects small towns Worldwide.
Design Concept

Beau-ti-ful
1. pleasing the senses or mind aesthetically

Waste
1. (of a material, substance, or by-product) eliminated or discarded as no longer useful or required after the completion of a process.
FIG. 18 < Diagram of thesis structure
Something Flawed, Something Beautiful
In effort to clean the lake through cost effective means I investigated developing a new waste management infrastructure that could potentially use dairy waste and human waste.

Taking dairy waste from the shed processing it through technology developed by Bill Gates, called the Omniprocessor.

Sewage and storm water are mixed with dairy waste.

Omniprocessor outputs are electricity, fly ash and clean potable water (Janicki Bioenergy). Integrate technology of a biogas digester which allows methane to collect and transform into thermal energy, leaving dry sludge which can be mixed with fly ash to produce fertilizer (Culhane). Dry sludge becomes a building material in a manure loam composite.
The integrated systems produce drinkable water, electricity, fly-ash for cement and roadbed, fertilizer and building material. These resources are able to power the infrastructure and support the town.

Manure-loam bricks are the product of dry sludge mixed with loam composite. They can be used in masonry construction and rammed earth construction. The material, when mixed correctly, has a high bonding strength and compression strength.

By-products could potentially be sold and used to service the town in a circular economy making the project economically viable for Levin, an economically struggling town.
Building with Beautiful Waste

It is of key importance that the waste-earth hybrid is constructed beautifully in an effort to ‘raise the abject’ and challenge existing attitudes towards waste. Not only does waste provide a cost effective and renewable opportunity for construction but it provides political opportunity that could spark new discussions around current practices of a covert waste management process. The material has the potential to capture and engage observers under conditions of beauty before pronouncing itself, creating internal conflict and tension within our intellectual space. The architecture becomes the showroom of waste, celebrating rich material qualities, testing limits of structural capability and investigating different construction techniques that enhance the architectural potential of waste.
The Beautiful Abject

The material imperfections become an architectural detail through the way in which the building will weather, age and adapt to its occupancy. Earthy tones discoulour, stain and streak upon drying and expansion, leaving lines of imperfection. Layers of material compacted in rammed earth-manure hybrid walls leave a layering of colours based on different clay composites and samples of waste. The imperfections of waste build a portrait of colour, movement, texture, and consistency expressing material aesthetics. My approach to design is an exploration exposing these organic qualities in attempt to prove that something flawed can be something beautiful.
The research proposed a megastructure that would create a dense and proximate alternative to urban sprawl. Approaching the megastructure it would seem that the architecture resembles a picturesque winery sitting in its landscape. Its roof sits elegantly above the structure forming a crisp clean line against the backdrop of the Tararua Ranges. The vertical structure contrasts against the horizontal form creating rhythm that meets the uneven ground. The earthy tones of the building become an extension of the landscape, grounding the architecture in its local context and becoming a monument to the landscape.

The urban link between the mountains and lake forms a new focus for Levin. This axis of urban activity has the potential to strengthen urban character through a legible approach of linear development. This mode of compact sprawl allows increased density of mixed use towards an active central spine. Public access to natural amenities becomes a key feature of the design, integrating the urban context with the grand landscape features.
South of the building, shaded by the large form, a Harakeke garden covers the edge of the lake creating a wide vegetation buffer. The garden filters storm water and provides economic resource for the cultural community. Maori practices of harvesting Harakeke is sensitive to the plant and environment, only taking what is needed leaving the heart of the plant to grow (Swarbrick).

North of the building, flooded in warm northern sunlight, a meandering public park surrounds the resurfaced waterways. This park offers public amenity and vibrant community space connecting people to the landscape.
Services are located to the south, while public and residential spaces are located to the north. Services run the length of the building inside the central southern wall.

Shear walls are 1 metre constructed of waste loam to support the 8 metre height of the structure. To reduce mass at the top of the walls they are tapered.

The loading zone for material deposit and pickup is located at the intersection between the structure and transport corridor reducing effects of transport fumes in the internal shared space. The street is dedicated to energy efficient transportation with low carbon emissions.
The roof structure sits on portal frames and is constructed from two linear panels of manure loam tied to bracing elements. A 500mm separation gap allows sunlight into the space while the roof provides adequate shade to reduce high temperature fluctuation.

Wall heights allow sufficient daylight into the internal public street using clerestory windows.

Building length is broken down into a six metre structural grid. Wall panels span between columns where industrial activity adjoins the space. Walls change in density between open public space and enclosed productive space providing diversity along the street.

I used a manure wet mix to create dribbles layered orthogonally along the wall. This artistic finish emphasizes the tensions between a waste management facility at the town heart and beautiful material application in public architecture.

Drawing closer to the structure its imminent scale towers above with heaviness; the roof mass weighing down upon long lines of structure. The mass of the shear walls and roof is contrasted with intricate bamboo structure tied together to form portal frames, cross bracing and warren trusses. These elements complement each other filtering light and movement through the space in a controlled manner. The walls initially seem polished and formal, yet they possess a worn quality that exposes materiality. Artful cracks, texture, orthogonal dribbles and bumps bring the organic structure to life. Colouration and tone suggests the abject material nature of the building.

FIG. 25 < (Left) Looking East from Queen Street at the front of the structure
FIG. 26 ^ (Above) 1:2000 structural model
FIG. 27 V (Following Page) The existing Site condition
Existing Condition

Fertiliser and manure leach into the lake from surrounding farms and market gardens—a problem exacerbated, according to Gibbs, by intensified dairy farming and storm water discharged from the unsightly Queen Street drain that runs east-west across Levin (Population 20,000). Furthermore, the lake front is subject to urban sprawl with suburban developments meandering towards the lake edge with limited planning policies controlling the quality or spatial layout of this sprawl.
Extending the primary east-west streets activates the space around the lake. Smaller streets running parallel to this could improve street structure connecting the urban fabric while conserving a wide vegetation buffer around the lake. Native planting such as toi toi, flax and harakeke will reinstate pre-European swampy forest. Reintroducing harakeke enables local iwi to re-establish their harvesting and cultural manufacturing practices of the plant, providing economic benefits to the landscaping. Public access in the form of natural reserves, Public Park and walkways allow people to enjoy amenity value of native wetlands. It is of critical importance that lake inlets are resurfaced as riparian corridors with ample planting to sufficiently filter water and reduce nutrients and sediments entering the lake.
FIG. 28 The Proposed Site Plan
FIG. 29 Intersection of living, production, manufacturing, ecology and recreation.
“Design is not just what it looks like and feels like. Design is how it works.”

-Steve Jobs
FIG. 30 < Diagram of thesis structure

1.0 CONTEXT
2.0 DESIGN
3.0 MAKING
3.1 ARCHITECTURE AS INFRASTRUCTURE
3.2 ARCHITECTURE AS MEGASTRUCTURE
3.3 AESTHETICS OF SCALE
3.4 BEAUTY OF THE OBJECT
4.0 DISCUSSION
61341 COWS IN HOROWHENUA

467418 KG MANURE DAILY
FIG. 31 The pragmatics of poo (Statistics New Zealand)

40 MANURE PROCESSORS

9200 M² FLOOR AREA
3.1 ARCHITECTURE AS INFRASTRUCTURE
3.1 Architecture As Infrastructure

1.0 CONTEXT
2.0 DESIGN
3.0 MAKING
3.1 ARCHITECTURE AS INFRASTRUCTURE
3.2 ARCHITECTURE AS MEGASTRUCTURE
3.3 AESTHETICS OF SCALE
3.4 BEAUTY OF THE ASPECT
4.0 DISCUSSION

FIG. 32 < Diagram of thesis structure
Existing Vegetation

Lake Catchment

Proposed Public Park

Proposed Vegetation
Inlets
Water courses feeding into the lake have been converted into concrete drains or travel through deforested farmland carrying high levels of nutrients and sediments. It is of critical importance that these inlets are resurfaced as riparian corridors with ample planting to sufficiently filter the water and negate degradation of the lake.

Land Ownership
The lake bed and a small strip of surrounding land is currently owned by local Iwi and considered Tapu. The surface waters are owned by the Crown and the legal property definition is “recreational” and “reserve” land. These two property definitions create conflict among the user groups and have to be reconciled through aligning the values of each party addressing landscape renewal.
Eco-industrialism embraces the concept of spatially-concentrated and inter-connected industrial activities collectively eco-efficient in their use of resources (Wells 1). A circular economy is developed between industries, minimising waste while increasing productivity and goods. Kalundborg Symbiosis is an eco-industrial park in Denmark that is a precedent of sustainable industry. The industrial park produces numerous valuable products through recycling waste such as renewable energy, fertilizers, pharmaceutical products, gypsum, water, and salt. This model provides a positive future direction for industrial development that boosts economic profitability and challenges the problematic relationship between industry and environment.
The manure-factoring process uses an eco-industrial concept producing value-added products from dairy waste and sewage. There are 61,341 cows in the Horowhenua District (Statistics New Zealand). This is a huge renewable resource that could be utilized. To process this quantity of manure, 40 Omniprocessors would be required with a floor area of 9200m².

Manure-factoring

3.1 | Architecture As Infrastructure
Reconfiguring the omniprocessor into larger component groups allowed an upscale of production. The initial design concept spanned 800 metres between the urban fringe and lake provoking an interrogation of scale. The building overshadowed existing single storey dwellings struggling to integrate with its context, unable to be considered an economic and viable infrastructure for Levin.

The structural grid supports gantry systems and hanging green labs while fragmenting form.

The existing watercourse integrates with water management infrastructural systems. Any excess clean water produced is discharged to the lake.

Large storage tanks for waste and fresh water consume much of the factory floor. Manure-factoring and storage occupies most of the building length.

Industrial scale loading zones support offload of raw products and collection of goods.

Reconfiguring the omniprocessor into larger component groups allowed an upscale of production. The initial design concept spanned 800 metres between the urban fringe and lake provoking an interrogation of scale. The building overshadowed existing single storey dwellings struggling to integrate with its context, unable to be considered an economic and viable infrastructure for Levin.
Reducing structural complexity and building footprint reduces cost and simplifies form. However, overlapping programmes directly exposes the waste production process to the public.

The western building adjoins the lake where proposed harakeke harvesting and production facilities are located. Other cultural facilities in this part of the building will relate to the lakes history and significance.

The road discontinues transforming into a public promenade leading to the water’s edge.
Open space allows activities such as farmers markets.

The omniprocessor uses 75% of the floor area. Retail and residential occupy volumes of space around the plant.

Building 2:
Area 3726m²
Form is broken into three building volumes creating large public courtyards with access to northern sun and views across the lake.

Waste Processing:
1. Waste Storage Tanks
2. Vaporisation
3. Water Storage Tanks
4. Furnace
5. Fertilizer Mixing Tables
6. Steam Engine
7. Electrical Generator
8. Electrical Recharge Station

Electric Car Recharge Station (Avda). Water could also be used from the plant to power hydro cars.

Building 1: Area 3114m²
Product pick-up and deposit stations located at the SH1 transport links reducing heavy traffic through the building and minimising traffic pollution.

The infrastructure lies along Queen Street making use of the existing road. The linear form of the building lends itself to the linear production line taking raw material in at one end and depositing produce progressively along the line.

FIG. 42 Production Layout Plan 1:300 with key transport infrastructure noted.
Components are grouped together to maximise space planning. These groups are placed in response to desired public exposure, daylight access, and connectivity with transport links or the landscape.

Plumbing connects each component in the larger system to the production lines which can be expanded over time.

Tying landscape and urban infrastructure together is key to designing a holistic system. Manure-facturing infrastructure becomes architecture supportive of urban activity through an integrated approach. Occupying space within and around the infrastructure becomes an architectural spatial planning challenge.
3.2 ARCHITECTURE AS MEGASTRUCTURE
FIG. 45 < Diagram of thesis structure
Extending and densifying the east-west axis formed a strong connection between the Tararua Ranges, urban centre and lake. However, access to the lake is limited reducing development in relation to the waterfront.

An urban sub-centre integrates built form within the landscape by creating wetland courtyards and direct public access to the lake. Medium-high density development would conserve the landscape, activate the waterfront and maximise daylight and viewpoints.
Combining the concept of sub-centre with an urban connection across the lake provides an opportunity to develop a strong and unique architectural relationship to the landscape. However, it would encroach onto a sacred Maori site, and may interfere with the ecosystem.

Alternatively, a network of buildings around the lake could work as components in a larger system of production. The fragmentation of the system breaks down the building scale introducing a culturally sensitive approach to the design of a new micro-industry.

FIG. 46 < Iterative studies of conceptual form and layout
At 1.2m high the building overshadows surrounding development.

Research facilities and industrial programmes border Queen Street utilizing the transport infrastructure. The building facade doesn't create a barren streetscape, but allows pedestrian activity to flow through the structure.

The landscape has the ability to move in and around the building integrating with productive systems.

Extending and densifying the east-west link is the strongest line of architectural investigation. Designing a megastructure that deals directly with the issue of scale provides an alternative to bland and imposing ‘big box retail’ development in small towns.

Medium density housing occupies the site around the Queen Street drain and lake front. The gantry structure allows easy transportation of housing units and adaption of the site.
Form is fragmented through superimposition on the site, proportionally relating the design to landscape. Property lines, rivers and streets become reference lines for voids. Varying levels of enclosed space further break down the mass of the building. Repeating structural elements bridge the negative space in a reiterated formal gesture, introducing a unit of human scale. The compositional balance of building volume relates the form to its and its surrounding context.

FIG. 49 < (Top) Conceptual model form imposed on landscape
FIG. 50 < (Bottom) Conceptual Model fragmenting form
To better understand relative scale, I analysed the current town precinct. The centre stretches along the central north-south axis of the town grid along SH1. Low-medium density retail and light industrial form linear blocks around the rail corridor. Big box retail such as The Warehouse, supermarkets, Mitre 10 Mega and the mall have developed close to the transport corridor. Central buildings do not exceed three storeys and streets are 3-4 lanes wide. This density is typical of most New Zealand ‘strip towns’.
Medium-density retail lines the SH1 traffic corridor projecting an active streetscape.

Despite significant traffic flows many of the buildings are unoccupied and shops see little pedestrian activity.

Excessively wide streets with minimal pedestrian activity, shops or traffic flow create dead urban space. The proportion of street to building height/density is overbearing.

The large parking space behind the mall, west of SH1, is rarely full to capacity.
Large developments bring new life to the town in attempt to reinvigorate the urban centre. However, the buildings are authoritarian and a departure from the intimate, small community orientated buildings of the past.

Big box retail dominates the urban fabric creating endless flat facades negatively impacting on the street scape. The urban centre consists of poorly articulated buildings and barren concrete landscapes.

Comparing the quantity of car parking and street scape (fig. 54) with the commercial building footprints (fig. 55) exposes a clear issue common to regional towns. Levin is a small town with good urban connectivity and proximity. Yet, cars are the focus with large streets and excessive parking space. Urban activity is diluted in the expanse of concrete surrounding each building, rather than concentrated in a dense urban setting.

FIG. 54 < (Left) Street Surface including pavements
FIG. 55 < (Right) Commercial Building Footprints
Suburbs have been developed as cul-de-sacs, crescents, drives and dead-end streets. Peripheral streets don’t acknowledge the lake stopping short with dead-end streets.

FIG. 56 ^ Reducing the width of the street creates an intimate streetscape with concentrated urban activity appropriate for a small regional town.
3.2 | Architecture As Megastructure

Urban Structure

FIG. 57 < (Opposite Top) Existing Street Structure (Google Earth 40° 37' 00.98" S 175° 16' 30.76" E)

FIG. 58 < (Opposite Bottom) Proposed Street Structure

FIG. 59 < (Top Left) Existing Urban Density: 190/km² (Statistics New Zealand)

FIG. 60 < (Bottom Left) Desired Urban Density: 50-100/km² (based on Lyall Bay, Wellington urban Density 44/km²)
Secondary alleyways provide alternative access to housing and intimate courtyards that are semi-private.

Staggering tenancies improves privacy and viewpoints across the street. Recesses and alleyways break up the long walls with interesting spaces transitioning from public to private.

Entrance to Linear Factory Line.

Transport Spine Internal Street.

Public Square
3.2 | Architecture As Megastructure

Dense and Proximate

The megastructure provides a framework for development, activating the urban centre. It creates direct access to surrounding landscape, restricting development encroaching on important ecosystems. Realigning Levin provides better connectivity in a proximate and dense urban footprint. The structure has a similar size footprint to the existing cbd achieving higher density based on development constraints.

FIG. 61 ^ (Above) Sketches of the potential site connectivity / viewpoints and the proposed building footprint

FIG. 62 < (Left) Sketch of the internal public street exploring occupation of the street
Barrel roofs are common icons of the arcade type, letting daylight flood the urban corridor.

Hierarchy of detail transitions from intricate lower levels to quiet ceiling space above.

Intricate detail also draws attention to shop front displays creating an engaging wall of extrusion, recess, pattern, texture and colour.

Openings and form are articulated in a Human Scale

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**Queen Street Arcade?**

Reframing the street as an arcade provoked an interrogation of scale at a micro level, relating the human directly to the street, rather than the vehicle. To entice people to walk the entire length of the building to the lake required a higher level of detail, vibrancy and intimacy along the promenade. The Galeries Royales Saint-Hubert in Brussels set an arcade precedent that creates social interaction within the public corridor, blurring the threshold of shopping/social activity and circulation. The promenade detailing at ground level and regular column spacing relates building volume to human scale, creating visual complexity and engagement with ground level programmes.
Community/public facilities - direct viewpoints towards the lake

Harakeke Drying and storage - access to Northern sun
Public Courtyard

Housing units with regular openings to the internal street (Entry L1-Unit L2)

Plant (south side of building)
Residential units and retail units are spaced at regular intervals for consistency in street front Openings. The industrial programmes are located near the outer walls to avoid long featureless walls inside the building. However, locating these programmes on the northern side reduces access to northern sun and public gardens. As an alternative to the strict repetition of openings, the openings could transition along the length responding to different programmatic requirements creating changing conditions down the street.
FIG. 64 < North Elevation showing porosity of facade to allow pedestrian connections to the public park and access to northern sun. Model Scale 1:2000

FIG. 65 < South Elevation showing enclosed industrial areas and open public courtyards. The transition along the facade eliminates the long unchanging facade typical of big box retail. Model Scale 1:2000
FIG. 66 View of megastructure from Lake Horowhenua showing clear structural grid.
3.3 AESTHETICS OF SCALE
FIG. 67 < Diagram of thesis structure
The scale and proportion of the form is derived from geometric techniques in an abstract application. Figure 71 (left) uses the golden rectangle and circle to draw out proportional relationships through lines of projection and intersection points. Figure 71 (Right) uses gothic proportions used in the Milan Cathedral to construct aesthetically pleasing formal composition (Cesariano). The realisation that I was designing a 'cathedral of poo' in the second drawing enforced the idea of an architecture that celebrated waste, challenging current attitudes towards it. I emphasised the length of the building through four simple, vertical elements. The close spacing of the walls heightens the sense of scale. The simplicity demonstrated in the model (Fig. 72) provides a clear architectural language emphasizing scale.
A balance between mass and void is achieved through materiality and detailing. Lines of sight are controlled through linear landscape elements creating a focal point.

The construction detail on the concrete walls don’t draw attention away from form and scale.

Verticality—simplicity in form
A series of large vertical shear walls are staggered along the edge of the courtyard creating fragmented form.

Form draws attention to the sky through positioning of linear elements wrapped around edges of courtyard.

Lines of sight are controlled through linear landscape elements creating a focal point.

Construction joints run parallel to linear features creating consistent detail across the landscape.
Monumental Effect

3.3 | Aesthetics Of Scale

The walls rise from the earth becoming the focal point, drawing attention to the building rather than the landscape.

The manure walls create an earthy aesthetic amplified through large mass and scale.

The linearity of the building draws the eye through the internal street towards the horizon.

Landscape becomes an extension of the building through a continuation of lines of sight and materiality.

Verticality- simplicity in form
Vertical openings in long shear walls follow a rhythmic pattern breaking down length.

Interiority created through mass and void.
FIG. 72 Formal development of the central 'arcade' and adjacent spaces.

FIG. 73 Designing the ends: exposing mass and void

FIG. 74 Daylight study in the internal public street
Monumental affect was preserved through the use of transparent facades on the end elevation. However, formal proportions needed to be altered to accommodate the programmes adjacent to the street. The barrel roof heightened the central space allowing daylight into the corridor. Yet the 12m high shear walls reduce access to sunlight in the narrow space, creating a cold and dark atmosphere down the long street.
To improve sunlight access the central walls were divided into smaller modules with vertical openings. This greatly improved sunlight access and humanised the massive 12m high, 1m thick walls.

Repeating penetrations helped create consistency along the length of the wall while introducing rhythm to the design.
The curved canopy related too closely to the arcade type becoming a too literal symbol of architecture.
The primary school in Burkina Faso uses similar aesthetic principles to this project. The earth structure incorporates repeating vertical elements and openings to fragment form. However, the roof structure becomes a separate entity through a distinct change in materiality, and the use of a lightweight structural system creating a void between the two forms. The contrast of architectural language between the orthogonal earth structure and curved steel roofing creates a distinct relationship of building elements.
Simple post and beam configuration replaces the literal arcade barrel roof. Wall heights altered to allow maximum sunlight from the north.

A glass canopy supported on bamboo post and beam structure brings sunlight into the long street.
Structural Analysis (Appx.1) revealed the length of the building would need to be tied together in the transverse direction by either shear walls, portal frames or cross bracing. Bamboo portal frames were the most practical option as they don’t interrupt interior space.

To maximise height on the southern industrial side I glazed the top of the truss as opposed to the public northern side where glass sits below the truss. This adds to the composition of form in a positive way balancing the different wall heights.

The glass canopy could have a negative effect on the internal street as the glasshouse effect would mean frequent overheating or overcooling. The earth roof structure and glazed clerestory windows allow northern sunlight, filtering heat of the midday sun.
Portal frame aesthetically balances the walls dormant mass providing elegant features that break-up the monotony of the space. The bamboo gives richness in detail integrating with the earth structure and allowing the building to ‘sing’ with light and shadow through penetrations.

Aesthetics of scale became more resolved through contrast of form, mass and detail element. The four shear walls are monumental in scale and at one metre thick and twelve metres high they rise out of the ground egotistically, while light bamboo suspends the heavy roof structure.
In the longitudinal direction the portal frame uses k-bracing for lateral support. K-braces contribute to the aesthetic detailing of the bamboo structure branching out from the column into three points of connection with the canopy. They provide a refreshing departure from the orthogonal structural elements.

Emerging at Lake Horowhenua the building transforms into a pier continuing the structural format of the rest of the building. The walls transform into columns at six metre spacing that bury themselves into the bed of the lake.
The columns stop short of the end of the pier accentuating the linearity of the building through the ground plane. Horizontality is expressed through the mass of the roof and the pier.
3.4 Beauty of the Abject
FIG. 85 < Diagram of thesis structure

1.0 CONTEXT
2.0 DESIGN
3.0 MAKING
3.1 ARCHITECTURE AS INFRASTRUCTURE
3.2 ARCHITECTURE AS MEGASTRUCTURE
3.3 AESTHETICS OF SCALE
3.4 BEAUTY OF THE ABJERT
4.0 DISCUSSION
This photo presents a ‘moment’ of ambiguous beauty. Photographed under directional and ambient lighting before digital manipulation to an inverted representation. The model proves abject materiality can be considered beautiful under crafted conditions.
Creating an abject model was an uncontrolled process whereby a range of unusual materials including gloves, pipe cleaners, wire and mesh were scrunched and twisted together with no predetermined form in mind. An interrogation of the abject model revealed how ambiguity can create moments of beauty.
Crafting ‘conditions’ of ambiguous beauty architecturally became an issue of rationalisation. The rationalised systems of control in both architecture and computer modelling restricted organic crafting of architecture. The outcomes of this approach (fig) were unlikely to be cost effective solution for Levin.

The most obvious cost reduction could be achieved through alternative materials and construction details. Locally sourced materials reduce the cost and embodied carbon footprint, creating more meaningful architectural solutions.
FIG. 91 Traces of hand finished surfaces remain as an artistic feature in Martin Rauch’s rammed earth wall (Kapfinger 29)

FIG. 92 Martin Rauch uses horizontal battens of split bricks as weather protection for the raw pisé wall (Kapfinger 22)
Andres Serrano’s artwork inspired much of my design investigation. The image pictured to the left is an image of artistic power. It captures the essence of holy sacrifice and greater forces through the simple application of lighting, saturation, hues and figurative positioning. The structure of the painting is bold placing the object centrally with emphasis at the top of the frame. This placement is egotistic, allowing the viewer to succumb to monumental affect. The colouration is suggestive of blood and provokes reaction to its significance. The image possesses a dark beauty that has a mysterious quality about it. It is not until the viewer steps closer and reads the placard that they discover the medium of the image. Some sites prefer to state ‘Esoteric Medium’, while the title of the photograph renders a clear image ‘Piss Christ’ (1987). Using similar approaches I created architectural operation through the tension between abject materiality and architectural beauty.
Loam is composed of sand, silt and clay. To test the viability of manure-earth construction in the Horowhenua District, materials were sourced locally from the beach, rivers and hills. A few test samples were made using different ratios of sand, silt and clay. The final loam composition is as follows:

25% Clay  
45% Sand  
30% Manure/silt
The sample took three weeks to dry and was able to stand upright due to its designed proportions. However, the material composition was not accurate causing the model to crumble at the edges. Excess water content meant it could not be compressed enough to achieve a fine surface finish.
The artistic application of manure loam was inspired by Bill Hammonds and Klimt’s artwork. Manure dribbles psychologically enhance the abject aesthetic of the space strengthening the architectural operation.

FIG. 95 < (Left) Elevation North 1:200 with dribbles applied to surface

FIG. 96 < (Above right) Greyscale close up of the kiss by Gustav Klimt revealing textural blobs

FIG. 97 < (Below right) Close up of the Fall of Icarus by Bill Hammond showing the controlled artistic dribbles
Using wet loam mix on paper I experimented with dribble techniques. This sample in particular reminded me of a cow pat splatter. Thick textural consistency. Orthogonal lines of dribbles layered upon each other could complement the tapering of the heavy shear walls. This splatter possesses qualities of soft, hard, wet and dry achieved through the vigorous flicking motion of the brush. Klimt's textural dots inspired the layering of blobs. The effect is simple but could be composed beautifully. Brushed plaster applied to the long walls might become a texture rather than an artistic application of material.
This mix was a lot runnier and contained lumps of organic matter contributing to the final aesthetic. The manure greatly changed the colouration of the mix, making it a darker green-brown.

I found it hard to control the dribbles as lumps of manure would fall rather than the mix dribbling down.

Material explorations reveal opportunities and limitations of artistic application. I was captivated by the plaster models because of the smooth, delicate finish and the control of consistency. However, the manure samples were much more tactile and expressive of materiality alluding to the idea of beautiful waste.
Detailing the loam within the building changed the aesthetic of the space significantly. The structured and simple formal techniques that formed a sophisticated promenade transformed into a grungy, back-alley aesthetic. The dribbles and materiality relate the space directly to a covert industrial activity. Approaching the building, the rhythmic and simple architectural gesture of the megastructure does not allude to the manure-facturing activities within. Drawing closer monumental effect overshadows the observer drawing them into the heart of the waste management infrastructure. The promenade allows glimpses of the manure-facturing process, surrounding wetland, public courtyards and Lake Horowhenua beyond.
The surface application of manure loam is a literal approach to achieve the desired architectural operation. Alternatively, the structure itself could be considered an artefact of abject materiality. The weathering, aging and preservation of the manure-loam structural elements would uncover defects overtime. The control and preservation of defects becomes an artistic practice towards a ‘beautiful abject’ that has further potential to be investigated. The design would then become a showroom displaying material qualities, processes of decay and preservation for manure loam.
FIG. 106 < Diagram of thesis structure
Thoughts on Manure-facturing
Often design is intuitive, acting on hunch, designing through problems that arise. It is clear that much of my design occurred as reaction to criticism, questioning and self-deprecation. More often than not hindsight led me to make important decisions. Realising I was designing a waste management facility rather than a lake-front public building was but one of these critical shifts in thinking. Structuring the thesis enabled me to frame the research within relevant architectural discourse. Allowing me to analyse, at a macro and micro scale, what my project set out to achieve. Hence, the following discussion reflects on the project in relation to broader discursive research.
Abject Beauty in Psychoanalyst Theory

Psychoanalyst theory basis itself upon tensions within our mind, causing us to understand art and architecture critically, allowing an interrogation and engagement with factual beauty (Foster, Krauss and Bois 20). “Our actual enjoyment of an imaginative work proceeds from a liberation of tensions in our minds” (Freud 20). Often psychoanalyst artwork takes form as a dreamlike surrealism exploring regressive dreams and erotic fantasy, presenting an artwork of bodily expression or conflicted desire (Freud 16). Feminists of the seventies and eighties also explored sexuality, power imbalances and gender roles through psychoanalyst methods (Foster, Krauss and Bois 21). These ideas progressed into the negative aesthetic attempts to receive reactions of disgust, ordinariness, pain and boredom towards abjection and terror (Macarthur and Stead 131). Psychoanalyst theory has been translated into architecture theory by few, particularly within the creative process (Sperber 123). Aisling Campbell marks the intersection of the disciplines through subjectivity which plays a significant role in our relationships with buildings. The conscious of the analyst and the unconscious of the analysand meet and a tension based on interpretations exists (Campbell). Though architects create through materiality and construction, architecture provokes reaction through affective relationships, controversy and its articulation (Campbell). “Consciousness comes about as a result of repression which creates a sense that there is something “hidden”, something that lies beneath” (Campbell). Constructing egotistic and aesthetically pleasing buildings in waste indulges the conscious, creating intimacy between material and occupant. This intimate relationship is a jarring concept that demands a shift in thinking towards understanding the inverted beauty of raw material. This project challenges the traditional interpretation of beauty suggesting an abject beauty through other types of materiality and their uses in architectural operation; this project specifically uses waste as a building material, constructed artistically to produce tension in our understanding of beauty.
FIG. 109 Existing Landscape

FIG. 110 Proposed Landscape and Urban Development
The Kapiti-Horowhenua landscape possesses complex and beautiful ecosystems that have become neglected through poor settlement patterns and exploitation of natural resources. Levin has the potential to become a regional settlement that embodies sustainable management of its productive landscapes; providing high quality urban space supportive of a strong community which has historically lived off the land. Unprecedented population growth rate has had a resounding effect globally, with two-thirds of the population expected to become urban dwellers by 2050 (United Nations 3). There is need to reconcile urban development and ecological conservation before these growing centres impose on and damage productive ecosystems leaving dysfunctional, manufactured landscapes in their wake (Masashi, Yamaura and Koike 1).

The design reconciled contradictions based on tensions that exist between urban planning and landscape conservation. Proposing a megastructure in Horowhenua would seem counterproductive in an environment riddled with pollution and degraded ecosystems. However, as an alternative to urban sprawl consuming the ambiguous fringes, pushing these boundaries wider upon housing demands, densification provides a positive approach. To further this argument compacting sprawl into a militant urban planning structure forming a dense core along the east-west axis sets out an enforceable development framework that conserves land and maximises urban activity at the centre of a currently sleepy town. The megastructure has the ability to expand along this line, servicing the town in an efficient manner; much like typical New Zealand strip towns that feed off primary services running alongside the main highway. Although the megastructure ultimately connects to the proposed State Highway One bypass west of Levin and existing train line that runs between Auckland and Wellington, it does not align itself to these routes; instead, aligning to the ecosystem, minimising interruptions to natural flows across the land.
FIG. 111 Existing town centre

FIG. 112 Existing fringe Development, Queen Street West.

FIG. 113 Compact Sprawl proposal, Queen Street West.
The compact city pursues a relationship with the environment scaling between land sharing and land sparing (Masashi, Yamaura and Koike 1). The concept is commonly in tension between opponents concerned with health and social benefits, traffic congestion, noise pollution, transport costs, land and ecological conservation, different effects densification have on diversity and numbers of wildlife species. The OECD study on compact city policies summarises key characteristics of compact cities as: dense and proximate development patterns, urban areas linked by public transport systems, and accessibility to local services and jobs (27).

The project exposes tensions within current debate settling in the land sparing camp yet sprawling indefinitely in a controlled manner, rather than intensifying within strictly defined areas. The compact city challenges New Zealand regional architecture, described by Ben Allnatt as “a single-storied concrete carpet that de-saturates a possible paradise into a consumptive, pallid blur most post-war American sprawl than idealized New Zealand hinterland” (69); Introducing a singular, large architectural gesture that promises clear distinction between the built and unbuilt and resolved regional character. Administration of national resource consent processes for subdivision discourages innovation and implementation of alternative designs aimed at achieving sustainability, instead favouring an out of date land development policy (Gibellini 1). This research suggests that a megastructure planning policy would benefit regional settlements through maximising land conservation and creating dense, proximate and vibrant urban spaces.

Public access to the environment is favoured over privatised quarter acre blocks, the ‘kiwi dream’. The environment becomes a productive cultural landscape that reaffirms the need to renew the landscape condition and create moments of beauty to be enjoyed by all. The immediate relationship to the surrounding environment reconnects people to larger ecosystems and accompanying health and social benefits of nature. The megastructure allows the community to live in close proximity to the environment while maintaining the regions ecosystems. It allows linear compact sprawl instead of traditional unrestrained urban sprawl. This is a sustainable approach to settling the regions that reconciles the relationships between urban planning, agriculture, horticulture and the larger ecosystems through land sparing.
Architecture as Infrastructure

With the arrival of driverless cars and the digital age people’s perception of the built environment is becoming less emotional and cities have become airports for a transient population (Treacy 20). We base ourselves around trade centres for an increasingly global market of products. Our relationship with the environment is governed by limitations of exploitation and infrastructure that supports our volatile lifestyle. Time spent in nature is replaced with virtual relationships embedded in manufactured landscapes. Common issues associated with compact cities are based on congestion, noise and pollution resulting from concentrated populations. However, this project eliminates heavy traffic from the internal street, with electric driverless cars providing a future based solution. The design intends to provide facilities for electric car recharge linking manufacturing and production to the rail system which will eventually be electrified (Greater Wellington Regional Council). The linear form supports an infrastructural spine of production, manufacturing, services, and transport; ultimately, improving urban connectivity and maintaining social proximity to enable community engagement and access to jobs and services. The introduction of Waste management facilities into a public urban space changes people’s relationship to the by-products of living creating an immediate understanding of sustainable living that relates larger regional ecosystems.

New models of service infrastructure challenge modernist attempts to zone cities by function and aim to build clean infrastructure integrated within compact cities. New models of high-tech industry provide a platform of sustainable industry that could address issues of space and sustainable efficiencies. Architecture as infrastructure has the opportunity to challenge peoples understanding of production and manufacturing and its consequences. A redefinition of industry is born through architecture as infrastructure changing the existing detrimental relationship to the environment. Thus, eliminating the need to build industry on outlying brown sites and reducing negative social health and wellbeing implications. This project suggests that sewer and other underground surfaces could be redeveloped into clean systems and integrated into an exposed infrastructural architecture that becomes a living and working space for a community. Challenging architectures role as structure, the architecture becomes an infrastructure of the human ecosystem using services and covert waste systems in a beautiful exposed way.
When considering how future expansion and potential grass roots development would occur, I decided the megastructure would be developed as core public infrastructure, providing some housing in addition to the existing housing stock. The project focused on reinvigorating the urban environment and providing sustainable solutions for landscape renewal. Manipulation of the megastructure for future development would be in an organic grass roots manner that built off the main structure. However, this approach felt weak, torn between the perceived public need for a fragmented privatised urban setting and the need for planning control. Committing to the megastructure as a planning policy avoids ambiguous and undefined strategies that restrict the projects resolution. The megastructure is a way to create a singular architectural language providing rural character that can be considered an alternative beauty more appealing than the current ‘concrete carpet’ of housing. The megastructure is a clear master planning strategy allowing for growth and change along an expanding line of densification. The only limitation of linear expansion is the extent of land in both directions. The research suggests a series of megastructures could be developed parallel along the New Zealand coastline, setting up a town model based on productive systems and land conservation (Fig.113). This megastructure network links to the North-South transport line enabling efficient transport and mobility throughout the north island.
The notion of the building functioning as an arcade to improve urban connectivity was considered differently in this project. Typically arcades function as a connection between a main street and secondary street providing a rich network of passages in the city (Garip, Salgamcioglu and Fitnat 2). Yet the megastructure does not link two streets nor does it link two urban subcentres. Instead, it links two distinct landscape features, designed with the functional purpose of providing direct access to the environment for recreation, amenity, health and social wellbeing and access to production materials. The megastructure could be imagined as a production line that transforms raw material at one end to added value sustainable products at the other, where it meets the transport network. In the reverse it receives products transferring these to retail stores on the main street. In this sense the building functions similar to an arcade engaging shoppers to walk through the promenade making choices on which shop they visit and becoming an “interface of exchange” (Sarma 2).

The dilemma of scale was a thread that ran the entirety of the project influencing many key decisions. The plant required to manage Horowhenua’s volume of waste required a large building. The buildings footprint would be equivalent to the existing CBD. I struggled to rationalise a project of this size in its context, seeking ways to reduce negative impacts of big architecture that often occur through ‘big box retail’; ultimately, failing due to a weak architectural approach that attempted to hide the buildings enormity. Taking the opposite approach I put the architecture centre stage as a monumental ‘cathedral of waste’, in the heart of Levin. Monumentality was articulated through egotistic form and structural proportion using mass and rhythm. Rather than integrating a small building or a series of small buildings into the urban context, the design introduces a new building scale that redefines the town’s culture and urban development practices.

Although scale was a design catalyst it became a limitation to the project. Throughout the project the design was in a state of flux between the micro and macro scale: landscape/urban renewal and materiality. The issues interweave in an interdependent relationship at opposite extremes of scale. But were large enough propositions to become independent theses, hence, both remain underdeveloped and unresolved in many ways.
Future Directions

Abject beauty and architectural operation remain the strongest theoretical threads in this project that have not yet met their full potential. This theory could be used in an embodied manner through a study of material aging, preservation and construction limitations. A beautiful example of material investigation conducted by Jorge Otero-Pailos, preserves pollution on architecture as an artefact of hygiene, memory and time, rather than preserving and stabilizing the architecture itself (Fig. 116) (96). Otero-Pailos challenges the cultural, political, ethical and aesthetic definitions in architecture through the redefinition of preservation methods (96). Similarly, this project challenges the way in which we experience materiality in architecture. The smell, aesthetic, texture, organic properties and eventual decay create a unique sensory experience that oppose the white, sterile environments that we live and work in. Its earthy properties connect us with nature exposing organic defects that become naturally occurring artistic detail. The control and preservation of these defects becomes an artistic practice towards a beautiful condition of abject nature that has further potential to be investigated.

Using manure-loam as a structural building material provides new opportunities for constructing cost-effective infrastructure in economically struggling regional towns. The material is renewable and easily accessed in the New Zealand context while the rammed earth construction method allows for future growth and expansion. Using an architectural framework and artistic approach in the construction of manure-loam infrastructure has the potential to improve urban character and aesthetics, grounding the architecture in its landscape and urban context.


Hammond, Bill. The Fall of Icarus. Wellington. acrylic emerald paint.


Hoch, Hannah. The Sweet One. Modern Art Final at University of Chicago. photomontage and watercolor.


Klimt, Gustav. The Kiss. Österreichische Galerie Belvedere, Vienna. oil on canvas.


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X-Direction: Bamboo Portal Frames

Y-Direction: Rammed Manure-Earth Shear Walls

6000mm 6000mm 6000mm 6000mm 6000mm 6000mm

Structural Grid layout Plan 1:400
Appendix One: Structural Analysis

Bamboo Cross-bracing forms a ceiling diaphragm resisting lateral forces. Roof Plan 1:400
**Wind and Terrain Information**

- Design code: AS/NZS 1170.2:2002
- Wind Region: A7
- Building design working life: 50 years
- Building Importance: 2
- Terrain category: Open
- Lee effect zone: None
- Site elevation: 100 m

**Regional 3 sec Gust Wind Speed**

The regional 3 second gust speed ($V_R$) depends on the wind region, building design working life, building importance, and the limit state under consideration.

<table>
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<th>Limit State</th>
<th>Ultimate</th>
<th>Serviceability (SLS1)</th>
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</thead>
<tbody>
<tr>
<td>Recurrence interval (yrs)</td>
<td>500</td>
<td>25</td>
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<tr>
<td>Regional 3s gust wind speed, $V_R$ (m/s)</td>
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</tbody>
</table>

**Seismic Information**

- Design code: NZS 1170.5:2004
- Hazard factor (Z): 0.35
- Soil: Medium soil (C)
- Recurrence interval years (ULS): 500
- Return Period factor (ULS): 1.00
- Near Fault factor: 1.00

**Lateral Load Structure, X Direction**

- Type: Reinforced Concrete Moment Frame
- Design method: Limit-state
- Number of frames: 10
- Number of bays: 3
- Bay length: 15m
- Floor width supported by beam: 8.5m
- Column size: Depth: 0.45m, Width: 0.27m
- Beam size: Depth: 0.682m, Width: 0.27m

**Lateral Load Structure, Y Direction**

- Type: Reinforced Concrete Wall
- Design method: Limit-state
- Number of walls: 23
- Wall length: 6.500 m
- Wall thickness: 1000 mm
- Penetrations in structural walls: Penetrations for doors, windows and services up to 30% of the wall length at ground floor, and greater above are allowed.
- Minimum thickness: The minimum thickness to prevent wall buckling is 632 mm.
Analysis Results

Results are percentage of max. allowable: <= 100% is OK; > 100% is Failure

<table>
<thead>
<tr>
<th>X-Direction: Reinforced Concrete Moment Frame</th>
<th>Y-Direction: Reinforced Concrete Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Seismic</td>
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</tr>
<tr>
<td>Drift</td>
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</tr>
<tr>
<td>49% 20%</td>
<td>0% 0%</td>
</tr>
<tr>
<td>Shear</td>
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</tr>
<tr>
<td>10% 16%</td>
<td>0% 1%</td>
</tr>
<tr>
<td>Moment</td>
<td>Moment</td>
</tr>
<tr>
<td>32% 60%</td>
<td>0% 1%</td>
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Wind Vibrations

The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. $H^{1.3}M = 0.355$ (should be less than 1.60; where $H$=building height (m) and $M$=Mass of building per unit height of building (tonnes/m))

Building Construction

<table>
<thead>
<tr>
<th>Building Importance category</th>
<th>Design life</th>
<th>Number of storeys</th>
<th>Total height</th>
<th>Floor plan points</th>
<th>Floor plan properties</th>
<th>Inter-storey height</th>
<th>Floor weight</th>
<th>Interior wall weight</th>
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<tbody>
<tr>
<td>Normal structures</td>
<td>50 years</td>
<td>1</td>
<td>12.5 m</td>
<td>(-16.627, -33.021), (27.419, -33.280), (27.678, 24.109), (-16.627, 24.239)</td>
<td>Area: 2532.3 m², Perimeter length: 203.000 m; Centroid: (5.469, -4.460) m; Bound lengths: (44.305, 57.518) m</td>
<td>12 m</td>
<td>Light, 0.66 kPa, Office (3.00 kPa)</td>
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<td>Medium, 0.5 m, 0.80 kPa</td>
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RESIST(NZ) - Preliminary Lateral Load Design
Architectural Report

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Andrew.Charleson@vuw.ac.nz

RESIST is an application for the simplified evaluation of the structural performance of lateral load-resisting systems in a building under seismic and wind loads. Designed to be used in educational settings as a guide for the sizing of lateral load resisting systems for Architectural and Civil Engineering students, the software should not be used for the final design of a building.

Project: Manure-Facturing
Modeller: roferobe

Wind Vibrations

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Rammed Manure-Earth shear walls reinforced with bamboo

1:50 @ A3