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This thesis represents 20% of the possible grade for this project, the design represents 80%
TAI TIMU TAI PARI: THE EBB, THE FLOW

INVESTIGATIONS OF THE ARCHITECTURAL RELATIONSHIPS WITHIN THE LITTORAL THRESHOLDS OF THE MANUKAU HARBOUR, NEW ZEALAND

ANDREA LAWRENCE

[ 4 6 1 6 2 3 2 ]

THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE MASTERS OF ARCHITECTURE (PROFESSIONAL) DEGREE

THE UNIVERSITY OF AUCKLAND

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CONTENTS

6 ACKNOWLEDGEMENTS
8 ABSTRACT
10 INTRODUCTION

DOCUMENTARY RESEARCH

HISTORICAL CONTEXT OF MANUKAU HARBOUR
20 MAORI OCCUPATION
26 EUROPEAN 19TH CENTURY SETTLEMENT
28 NAVIGATING THE MANUKAU HARBOUR
32 INFRASTRUCTURE DEVELOPMENT IN THE WIDER HARBOUR
36 TRANSPORT ON + AROUND THE HARBOUR

42 ARCHITECTURE QUESTION

44 FORMULATING THE PROJECT
46 CONTEXTUALISING THE SITE
48 ONEHUNGA WHARF PHYSICAL + HISTORICAL CONTEXT
50 ONEHUNGA WHARF SITE

RECENT CONTEXT

52 DESIGN PROGRAMMATIC PARAMETERS OF ONEHUNGA SITE PROJECT
56 KEY DESIGN ISSUES + INTENTIONS
58 TAI TIMU TAI PARI: PROGRAMME
60 PROJECT DEVELOPMENT
## FORMAL DESIGN

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>EXPLORATION OF THE ELONGATED SITE THRESHOLD ARCHITECTURE</td>
</tr>
<tr>
<td>66</td>
<td>CORE SAMPLES</td>
</tr>
<tr>
<td>68</td>
<td>MATERIAL STUDIES</td>
</tr>
<tr>
<td>70</td>
<td>ENGAGING WITH SITE</td>
</tr>
</tbody>
</table>

### FORMAL SITE PROPOSALS + SPECULATIONS

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>ARTSCAPES</td>
</tr>
<tr>
<td>84</td>
<td>MAPPING</td>
</tr>
</tbody>
</table>

### FILM

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>DEVELOPMENT OF ARCHITECTURE</td>
</tr>
</tbody>
</table>

### CONCLUSION

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>114</td>
<td>CONCLUSION</td>
</tr>
<tr>
<td>116</td>
<td>REFERENCES</td>
</tr>
<tr>
<td>118</td>
<td>BIBLIOGRAPHY</td>
</tr>
</tbody>
</table>

### APPENDICES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>PRECEDENTS</td>
</tr>
</tbody>
</table>
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I would like to thank my extraordinary family, especially my parents, Beverley and Murray Lawrence to whom I am deeply indebted. Without their guidance and support this thesis would not have come to fruition.

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Huge gratitude to my architecture friends and friends abroad for believing in me.

I would also like to thank the University of Auckland and the support of all the lecturers and workshop staff who over the past five years have encouraged and enlightened me from day one of my studies.
This thesis addresses the deteriorating relationship between the community and landscape of the Manukau Harbour, Auckland.

This thesis proposes to reattach the Manukau harbour with the Auckland landscape through an extension of relationships between land, sea and boat by means of the landscape processes, social processes and an appropriation of part of the existing Mangere bridge causeway.

The harbour is generated by substantial tidal change and it is the uniqueness of this landscape which drives this thesis to interrogate the vast elongated nature of the site. Both Māori and Europeans have settled on the fringes of the harbour and these settlements have been inescapably attached to the ocean through agricultural, industrial and transportation networks.

The proposal is for a structure in the Onehunga/ Mangere Channel to restore the democratic dimension and legitimise the social activities which have found expression on this important site. It is not about displacing these activities, rather providing a place of operation and further opportunity.
INTRODUCTION

New Zealand is a landscape of distinct and diverse terrains bounded by a sinuously projecting and enfolding shoreline. The presence of the sea confines the land in which there is no place which is not within close proximity of the ocean.

In John Ralph’s article, ‘Where City Meets Sea’, he describes how New Zealanders have come to ‘live in a land that has very strong physical and cultural connections to the sea.’¹ He talks about how the coastal edge is ‘…where the lands slip beneath the salty water; constantly moving ephemeral space that continues to provide the site of significant design responses to the New Zealand landscape.’²

Funnelling into the land from the Tasman Sea, the Manukau is the second largest harbour in New Zealand. The complex intersection of the Manukau harbour with its foreshore and its accompanying rich history provides a site for new thinking – a site in which a series of variable thresholds have formed between the land and sea in a complicated and continuous exchange of materials and tidal levels. The physical flux of water and sediment that is the harbour gradually became the background environment to social life; first to Māori and later to Europeans. So far as these cultures brought change and sometimes catastrophe to the harbour, so too were they drawn into its watery rhythms and rivulets which provided both food and water for their navigations.

The Manukau is both a vast fluid field and thin surface on which all its processes and journeys become apparent. In this sense the changing landscape of the Manukau harbour has long been visibly affected by a variety of environmental, social and cultural factors.

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¹ Johns, Ralph 2007 Where City Meets Sea Topos Magazine: City Strategies Vol. 58. 20
² Johns, Ralph 2007 Where City Meets Sea Topos Magazine: City Strategies Vol. 58. 18
The harbour is composed of three main arms: firstly, the Mangere Inlet situated near the Auckland central city and the inner suburbs of Onehunga, which the Mangere Bridge crosses over. Secondly, further southwest lies the inlet known as the Waiuku River, which drains down toward the township of Waiuku and thirdly to the South East is the Papakura Channel which extends into the Papakura township. Also noted is the Auckland International Airport, which is located on the harbour’s eastern side below Ihumatao.

The Manukau harbour, located in the south west of the Auckland Isthmus, presents a broad, complex and diverse physical environment extending out toward a bending horizon on the Tasman Sea. The transitional nature surrounding the foreshore of the Manukau harbour reveals extreme tidal variations. Reputed to be the greatest ebb and flow of any harbour in New Zealand, continuous sediment excavation, as well as fissuring aquifers through the Onehunga lava flows, seep on to the sand and mud flats.

In the book *Onehunga, A brief History*, Janice Mogford tells us that when Captain John Logan Campbell first advanced to the Manukau, he described it as resembling ‘a great inland lake’. The harbour extends a vast 375 square kilometres with more than 520 kilometres in length of coastline. Over time, the small rivers and streams have left deposited sediment forming the shallow harbour we know today. The harbour has been important to the Māori community because its shallow nature provides an abundant seafood resource. During low tide, extending mud flats and moving sandbars are revealed, spread with tapering channels draining out to the sea.

---

According to geologists, 20,000–30,000 years ago when Maungakeikei (One Tree Hill) erupted, lava flowed down the slopes and spread westwards until it covered the future European settlements of Onehunga- ‘giving the particular part of the isthmus its distinctive configuration.’

In recent times, factors such as Watercare Service’s sewerage plant and effluent disposal system, the region’s low population density, its history of foreshore reclamation, industrial pollution, the Onehunga motorway extension and the anticipated restoration of the Onehunga foreshore have all contributed to the foreshore remaining a site of fluid but competing interests.

In keeping with both the formal and historic nature of the Manukau Harbour, this thesis proposes a project that emerges from the elongated ebb and flow of tides and history, a project that interacts with the very watery and changeable nature of the harbour and its landscapes. Specifically, the project anticipates a foreshore structure that will have less the finality of a terminal but more of the flux and fluidity of a ferry/interchange network.

The project programme proposes a multi-modal network interface to operate in the harbour. The design will be influenced by the historical harbour infrastructure, architecture and the ebb and flow of the harbour itself. The design project will develop specifically as a response to the harbour foreshore thresholds and their intersection with the existing mobile social context of the Manukau foreshore.

---

As an example; the transport function of the former Mangere road bridge has, in recent years, mutated into a complex social infrastructure variously and simultaneously operating as a promenade, fishing site and general thoroughfare for pedestrians and a convenient route for cyclists. In light of the intended demolition of the old bridge, this project will seek to reincorporate the diverse and overlapping social programmes into a new structure.

The unusual elongated and horizontal nature of the harbour and its flatness provides both a site and a model from which the design process can be developed. As a result of vigorous readings and mappings of the site and its history and programatics, it has become possible to engage with site phenomena that impose strategies through which to shape a habitable ground. This project seeks to recover, revitalise and regenerate the Manukau harbour by drawing on these site phenomena as mobile mechanisms for new forms and programs.

This thesis will be informed by two categories of research: documentary research and formal research.

The documentary research draws from geographical, topographical, planning and historical documents concerning the Manukau Harbour. In the wider context of the Manukau Harbour, the documentary nature of this research can be summarised by history in relation to navigation on the harbour, its history in relation to the colonial and farming period, and its relationship with the development of industrial foreshore processes.

In the contemporary context: on one hand we have a public requirement for foreshore renewal and regeneration projects, and on the other hand, we have increased pressure for further transport networks to the wider Auckland nodes. Drawing from all the documentary analysis to date, the question emerges: What now?
The formal research in this thesis has involved explorations into the vertical and horizontal dimensions of the Manukau Harbour. A series of investigatory sectional foreshore models were constructed, examining the shallow and elongated nature of the water/land intersection. The layered and material nature of this site was further investigated when core samples were taken from the foreshore/mudscape. These began to inform material development strategies within the project and in this design, the formal architecture of accumulation, was made visible in sections.

A sequence of abstracted composite landscape drawings and elongated site models were produced looking to investigate and align with the ‘needs’ of the sites as per the documentary context of the harbour.

The formal design research has embodied the qualities of site, which have come out of the vast flat and changing nature of exchange of the water, mud, sediment and tide. These sites could inform the development of an architectural hierarchy through which this extended formal research could then start to suggest proto-architectural development.
In order to get a sense of the human occupation of the harbour and to see how humans engaged with the formal process we consider the different occupations of the harbour.

The Great Migration canoe is said to have sailed up the Tamaki River and was drawn across the portage from Otahuhu to the Manukau Harbour. Wakas were carried back and forth through these portages, bringing produce from hunting, fishing and cultivating the land before returning with their goods to the villages for the winter months. Māori settlements occupied the eastern shores and land area encompassing the Manukau Harbour, in places such as the sacred Otautau Stonefields of Ihumatao where the Waihoua tribe still reside today, Mangere Mountain and the Island of Puketutu. Settlements shifted with the seasonal food changes determined by the fish stocks, soils and the native calendar (Maramataka).

The story behind the journey to the Manukau Harbour speaks about Hape, an ancestor from Hawaiki and his desire to find a new homeland. ‘Tangaroa, the God of the Sea answered Hape’s prayers and sent the stingray, named Kaiwhare, which brought Hape to Puketapapa.’ The Stingray, Kaiwhare, is the guardian of the Manukau Harbour.


The Manukau harbour was a significant waterway for local Māori in pre-European days, presenting Māori settlements with portages to and from the Waitemata Harbour to East Tamaki, the Waikato River and the Pacific Ocean.

The portages reduced the distance between the East and the West Coast providing new exchanges and fluctuations of settlements to and from the water. According to Dr Malcolm Patterson, ‘the short distance between the east and the west coast was also attractive as resources could be obtained easily from both coasts.’

Various Māori Pās and villages clustered around the lava cones of Auckland as a form of defence as Māori land wars battled across from Maungakiekie (One Tree Hill) to Mangere Mountain, up to Kaipara Harbour and down through to the Waikato. Land between Maungakiekie and Mangere Mountain was vital as a food resource but also as a strategic thoroughfare to the Waitemata and the Gulf. Searle believes that the Māori formed their fighting pas on the ‘volcanic peaks of the narrow neck of land where two seas almost meet, and where north-south routes converge.’ Volcanic mounds were terraced, palisades were erected for protection and, because of the fertile soils and rich fishing grounds, the land was in great demand.

To the Māori, the waters of the sea and river are as much roads and gardens as roads and gardens on land. The harbour was as much owned and apportioned to the care and use of different tribes as the land was. To the local tribes the Manukau was their garden of the sea.


A short waka crossing connected the two halves of the Onehunga and Mangere channel but at that time movement between them by foot was also possible. ‘Māori camped at the water's edge until low tide and made the journey more or less on foot. In those days, a long bar of basalt rock stretched across the mudflats from near where the present undulating bridge meets Mangere. They walked across the bar to where the low-tide stream trickled, a few yards wide and seldom deeper than chest level. Early traders exploited this peaceful to-ing and fro-ing when they used dynamite to widen the channel for heavier shipping in 1858.'

Following European acquisition of the land surrounding the Manukau Harbour, its character progressively altered due to the deforestation, draining, and reclamation. Europeans settled on the ridges between the mountains and like the Māori, another maritime people, they too modified the land to improve their needs. Foreshores were reclaimed, swamps were drained and the hills were levelled.

Europeans too utilised the crucial harbour portages in the progressive commercial transformation of the landscape. John Logan Campbell tells how he and his partner William Brown portaged trade goods from the Tamaki River across to the Manukau and then by canoe down to Onehunga. Onehunga’s first commercial venture was transacted. 10

With the spread of European settlement across the harbour, A.E. Tonson explains that the first valid European settlement of the Manukau district was in 1847 as a defence outpost during the Māori wars. European immigrant farmers made the journey down from Auckland to pursue the highly productive soils in the surrounding isthmus. 11


NAVIGATING THE MANUKAU HARBOUR

With the development of steamship technology, the Manukau Harbour and specifically Onehunga became a significant anchorage, and a crucial link between Auckland and the conflicts of Taranaki and Waikato.

From the earliest days of European settlement, the harbour continued to be a significant communications link. Mogford tells us that the early settlers of Onehunga looked to the harbour as their ‘door to the outside world, more so than to the city of Auckland.’ 

During this period, the roads to Auckland were rough and it was nearly a day’s travel away. Canoes, cutter, schooners and other small craft traded in and out of Onehunga and even as far as New Plymouth. Again, we see strong transitional links and the Harbour took on vast networks of exchange. This was all about to change with the advances of the railway.

Today the Onehunga Port sustains only a minor shipping service compared with Auckland’s east coast port on the Waitemata Harbour, despite the fact that in the nineteenth century it provided the fastest shipping route to Wellington from Auckland and Australia. However, the shifting sandbar of the mouth of the harbour was a significant hazard to shipping. In 1863 the HMS Orpheus foundered on the bar killing up to 189 people, only one of many wrecks.

After this tragedy, a harbour master, Captain Thomas Wing was appointed to monitor the shifting sand bar and guide ships to safety into the harbour. He protected the shipping industry for thirty years from potential dangers by learning the land and tidal variations. A signal station at South Head connected to the telegraph system was one of many major developments to the harbour at the time allowing safer courses of transitioning boats and steamers within the channels of the harbour and out through the Manukau Heads.

The bar occurs because of the flushing nature of the harbour when the mix of outgoing harbour, incoming sea, and the accumulation of sediments of these forces are resolved. You can always see the water breaking miles away out at the bar. From this map you begin to read the treacherous nature of the channel off Whatipu.
Our streams and beaches play a large part in our history, culture and social identity and it is crucial that we acknowledge that what happens on the land can directly affect the quality of the water entering our streams, estuaries and beaches. The area around Onehunga and across to Mangere and Ihumatao is in a dense industrial zone and consequently there has been a high level of contamination in the harbour.

Dense forested hills surrounded the Waitakere Ranges in Manukau Harbour in the 19th century providing an abundance of timbers. Kauri (Agathis Australis), was shipped from various surrounding harbour settlements to the Port of Onehunga and on to the various growing settlements of Auckland and abroad.

One milling settlement Te Huia (The Huia), now known as Huia, was the main source of employment in the 19th century and the settlement produced timber from its mill barged up to Onehunga. The removal of trees led to extensive deforestation and silting of the harbour and the clearance of land for the agricultural industries.

The Manukau Harbour became a vessel of contamination for industrial waste and sewerage run off late in the 20th century. Watercare services review of the harbour describes the harbour as ‘huge industrial development around the North – East area of the Manukau made the mudflats lavender coloured with bacteria and foul odours.’ It is only in the past twenty years that the harbour has been returned to a safer level.

Southern suburban development turned the North Eastern side of the Manukau into an industrial wasteland. The waste from the Meatworks at Otahuhu was flushed with the red of blood into the harbour. As the tide went out the remnants were left behind on the mudflat. Toxic waste was excreted from the freezing works and the fertiliser factory resulting in extreme biological

change to marine life and greatly affecting the Waihoua people at Ihumatao. The industries around the harbour edge treated the harbour like a drain.

By 1966, the transfer of sewage from the Waitemata harbour to the Manukau meant the opening of a WasteWater Treatment plant. As a consequence of the constant changing Manukau Harbour, the midges and contamination meant that swimming was banned and the marine life became debilitated.

Sewerage works transformed the formal and biological nature of the harbour; from a regular ecologically and uncontaminated condition of tidal flow to a highly toxic and contaminated sludge. The pollution trickled down to the water’s edge and was flushed out with the tides across the vast surface of the Manukau.

Under new laws and regulations (1991), the Wastewater Treatment Plant underwent a series of changes to restore the coastline and seabed, and to regenerate the harbour water quality. The oxidation ponds and sludge lagoons were removed and the area is returning to a natural harbour and foreshore condition. According to John Fitzmaurice, an environmental engineer, “Manukau harbour water quality, particularly in bacteriological terms and the foreshore area previously used by the ponds has been returned to recreational use.” 14

The crucial point is that the South Auckland and the Manukau harbour have been neglected and both natural and social cycles of the harbour have been exploited by local authority and industries. Only recently have we begun to see a regeneration and remediation of the harbour through walkways, cycle ways, beaches, plantings, and migrating bird roosts. There is a consciousness about the harbour today, yet the extraordinary thing is that up until now there has been no architectural consideration on the harbour.

-----------------------------------------

The first half of the 1870s generated substantial shipping activity in the Manukau Harbour although, with the advent of the railroad, a vast transport potential almost entirely overtook the use of coastal trading ports in New Zealand. The year 1873 brought the Auckland-Onehunga railway connection, yet these major transportation advantages were not fully considered until later in 1878, when the railroad was augmented upon the Onehunga wharf. This meant a clash between land and water transport and an unknown future for the wharf. According to T.R Byrne, ‘a new chapter in the Port of Onehunga’s history began from that time.’

The first timber bridge opened in Mangere in 1875 and was greatly beneficial to the farmers of Mangere and Onehunga by providing a new threshold to transport their goods. A second larger concrete bridge (currently the Mangere Footbridge) erected in 1912 replaced the initial bridge as it began to deteriorate. According to A.E. Tonson, there were proposals for a canal to link the Manukau and Waitemata Harbours, however this never eventuated.

During this time, the Port of Onehunga was the main transport link between Auckland and towns further south. The introduction of the railway provided an efficient method of transportation to the early settlers, allowing the farming and timber industries to transport their goods to the wider network. An early example of the threshold condition in the harbour was the role in which the waters of the Manukau played in transporting people. One would catch the tram from Auckland to Onehunga, after which one would then board a Steamer to New Plymouth and coach to Wellington.

In the 1970s, another road bridge was added to State Highway 20 rendering the initial Mangere Bridge as purely pedestrian. The new highway provided a faster route to the Auckland International airport and Manukau City.

In 2011, a new four-lane northbound harbour crossing was connected to State Highway 20 with proposals for a clip-on train connection and a new pedestrian footbridge replacing the former footbridge.

Transport is an important theme in the changing nature of development/transformation of the harbour. The thresholds between tram to steam, road to bridge and road to boat. We see how the dominance of road based networks and the bridges across the Manukau set up a period of isolation of great pollution and the end of the ferry service. As you cross over State Highway 20, it appears that the harbour suddenly ceases to become a central locality. There is a sense of isolation and a loss of interaction, allowing you to avoid the Manukau Harbour, resulting in the fate of becoming worthless.

According to Dr Malcolm Patternson, in his report for the State Highway 20; Transit Manukau Harbour Crossing: ‘Onehunga and its surrounding land and water ways cannot be seen in isolation but as one township’/resource hub in a Tamaki cityscape of often connected kainga and use sites.  

Ferry/steam services originally ran on the harbour quite regularly in the days before vehicles and roads because this was how people and freight were transported. Nonetheless, cars and road conditions improved to the peripheral towns, and the function of domestic ferry services were no longer required. The Waitemata harbour also offered much easier docking for ships and so the Onehunga Wharf was downgraded to regional status.

It is also important to take into consideration the problems that have occurred since the automobile. Traffic jams have proven to be somewhat an issue each morning and evening for the region’s workers, therefore rendering the harbour transportation a potentially faster and more economical way of commuting to and from the city. With oil prices increasing globally, in the name of sustainability and cost effectiveness alternative forms of transport should be given priority of council funding.

Geoff Williams and his wife, locals to the area, ran Manukau Harbour Cruises from 2006 – 2009. His charter offered mainly sight-seeing trips on the harbour, however, due to the recession and reluctance by council, despite many proposals being put forward to develop any infrastructure on the harbour to maintain this service, the charters discontinued in 2009. As he sees it, ‘... in reality all ferry services on the Auckland Harbour are subsidised by the council and that is not going to happen on the Manukau any time soon. You also need good infrastructure to support any such service.’

We see a continuous layering of transport interchanges as the pressure of modern day transport follows the needs of the people. There are also the connections such as rail, cycle and pedestrian nodes put in place to ease the use of the car to transform the Manukau Harbour back to public and recreational importance.

The old Mangere bridge stretches over the incoming and outpouring tides, so do the people of these communities who walk, cycle, and drive in a parallel social flux above the mud flats, mangroves and currents that comprise the harbour.

18 Williams, Geoff. Email message to former Harbour cruise owner. 24th April 2011.
ARCHITECTURE QUESTION

Research into the wider context of the Manukau harbour has shown that the social use of the harbour and its edge has developed in close relationship with the topographical processes and their effects on the harbour.

This thesis asks the question: Can an architecture be formulated that can be understood as an extension of the relationship between topographical form and social use and contribute to the restoration of the harbour foreshore?
FORMULATING THE PROJECT

An obvious example of the topographical processes entwined with social activities is the proposal for a ferry network, which would include Onehunga, Huia, Waiuku and Cornwallis. This network proposal becomes the main theme and programme in developing the landscape and architectural extension that this harbour needs. This particular project identifies and works on the Onehunga site which has direct connections to the landscape and social processes occurring on the neck of the harbour. It would deal with the flow and flux of people, sediment, and extreme tidal conditions, ultimately re-mediating and reinvigorating the existing social connections, and therefore strengthening the thoroughfare to the north.

We draw parallels from James Corner’s essays, when he writes about ‘landscape development: first, the apparent recovery of landscape, or its reappearance in the cultural sphere after years of relative neglect and indifference; and, second, the revisions of the very nature of landscape itself, rethinking what landscape actually is- or might yet become- as both idea and artefact’. 19

It was proposed to enhance the activities already occurring at the site such as the cycle way and pedestrian thoroughfare but also using this window of opportunity to extend the programme activities to the site such as a ferry interchange, fish market, waka storage and restaurant. These new functions could be significant to the regeneration of the surrounding communities. Although the project focuses primarily on the Onehunga site, the project still takes into consideration these principles which could be applied to the other sites around the harbour network in the near future.

---

CONTEXTUALISING THE SITE
ONEHUNGA / MANGERE CHANNEL

Right in the nexus of the narrowing Onehunga arm, the design proposition is to take up and extend the existing processes to both landscape processes and social processes, to build and interface between the two. The old Mangere Bridge which is sited at the narrowest neck of the harbour is an ideal site for this project. There is already an existing causeway connected to the old bridge allowing all forms of transport to access the site which has meant that the bridge has a high use thoroughfare to the north and south of Auckland. It is also in close proximity to the Onehunga Wharf and the State Highway 20, which have strong connections to the harbour and the centre city of Auckland as well as providing a recreational hub for fisherman, waka, and launching boats. The characteristics of this site provide practical areas for boats and wakas to calmly and safely approach the building as well as a strong current to resume the journey back out to the harbour.

Walking along the causeway at present from the Mangere precinct, you are exposed to the strong southwesterly winds forcing the waves against the rocky banks. Rats forage about the inorganic material scattered within the mangrove fields fringing at the edge of the foreshore. Due to the Manukau Heads being in such reach of each other, the inundation of the tide is extreme as it fills the vast Manukau basin. The current surges through the footbridge at an immense speed as it fills the Mangere Inlet, and as six hours pass again it drains just as fast as it fills when it recedes. At the turn of the tide, the footbridge fills with the masses of keen fisherman out to catch their dinner and children on bicycles followed by runners crossing this threshold to the other side of the channel of Onehunga.
The recent Council proposals concerning the Onehunga and the wider Manukau Harbour context bring a seriousness to the project. Not only are they a reference to what is trying to be achieved socially, culturally and economically, but also they help to enforce a need for such an infrastructure to be built.

Jim Jackson, the Chairman of The Onehunga Enhancement Society (TOES) is fighting, along with the Onehunga community, to propose a new large-scale shoreline reclaimed to the west of the motorway. It would have connections to downtown Onehunga with new pedestrian/cycle bridges, all tide boat ramps and a marina/ferry terminal therefore reclaiming 11ha of new foreshore and headland landscape. At present, there are many proposals on the table.

TOES are also suggesting a series of jetties to the outer Manukau Harbour enhancing the link back to Onehunga as well as replacing the Old Mangere Bridge with a new pedestrian bridge at a clearance height for recreational boats to pass through.

Currently, parts of these proposals have been accepted and the New Zealand Transport Agency and Auckland City Council have committed themselves to the restoration of the foreshore, which is expected to be completed by mid 2014. (Jim Jackson 2011)
ONEHUNGA WHARF PHYSICAL + HISTORICAL CONTEXT

The Onehunga arm of the harbour appears to be seen as the threshold between Auckland and South Auckland, between the lower socio-economic classes of the South and the upper socio-economic classes to the North. There is also the divide between the white sands of the East Coast, Pacific Ocean (Tamaki, Waitemata, North Shore) and the black sands of the West Coast, Tasman Sea (Mangere, Huia, Whatipu, Waitakere). As the design proposal takes shape, it starts to inform axial elements in reference to a strong nexus of the wider context to the Auckland Isthmus and Manukau Harbour.

The Onehunga Wharf, originally an old timber jetty, was upgraded and replaced with concrete piles. The wharf was established on reclaimed land embedded on the fringe of an extinct shallow volcanic crater known as Te Hopua, with a tidal lagoon opening to the southwest. This was also reclaimed from the sea and was used as a Council Rubbish tip, now in-filled, and currently known as Gloucester Park Reserve.

In the 1970s, Onehunga’s direct waterfront access was lost on the southwestern side, near the Mangere Harbour, when the Southwest Motorway was built. At present, only a tidal inlet remains on the city side, and the harbour is generally deserted and neglected.

The wide reaches of the Manukau Harbour momentarily narrow between Onehunga and Mangere. It is a natural constriction through which the tide ebbs and flows bringing with it the fish, sediment, and flotsam that circulate in the vast bowl that is the harbour.

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DESIGN PROGRAMMATIC PARAMETERS OF ONEHUNGA SITE PROJECT

THIS DESIGN WILL REINVIGORATE AND REINVEST IN THE PROCESSES THAT HAVE CHARACTERISED THE HISTORICAL SITE. THESE INCLUDE:

FERRY SERVICE: NETWORK OF HARBOUR SITE

Daily/weekly/seasonal use—controlled by tide and weather.

REESTABLISH SITE AS THOROUGHFARE

North/South crossing-threshold continues tradition of harbour portages.

PLACE FOR RECEIVING PRODUCE (NODE)

Continues 19th Century tradition of being on the route for producer, also site of sale.

SOCIAL CONNECTION. ONEHUNGA/MANGERE

Social flux, resources, recreation and commuting.

NEW PROGRAMMES

Restaurant, fish market, and dedicated waka storage to provide for community.
THE DESIGN PROJECT WILL BE DEVELOPED THEMATICALLY AND FORMALLY AS AN EXTENSION OF THE LANDSCAPE PROCESSES THAT DEFINE THE SITE.

The project can be seen as a complex interface in which water provides another threshold within the building. Exchange becomes an important theme within the organisation of the building strata, from the minor exchanges to the major exchanges such as the changes in material to the way in which the building provides a rhythm of structure for people to follow to the other side of the channel.

The programme becomes complex and geometrical and the emerging interface becomes halfway between the land and boat as functions filter between the land’s edge and the water. The natural and mechanical processes are in unison. When the tide rushes in, the architecture negotiates with the flowing water. It begins to shape the direction of the form and create the condition of a habitable ground and a manifesting structure. There is also the notion of a double threshold, because it is not only the wharf, it is the cycle path, the bridge and the fishing site. It is not about trying to invent a programme rather, designing an interface for programmes that already happen.

The foreshore complex has qualities of detachment, qualities of machine and qualities of architecture and landscape, but are all separate from each other. The structure is always a threshold condition to people, to boats, to water, to pedestrians. The change in angle brings different circulatory routes throughout this interface, allowing deviation and changes in activity, and allowing separation and connection between people and their activities. The foreshore complex provides a social form for the accumulation of people to wind through the building and meander or cast their lines.
KEY DESIGN ISSUES + INTENTIONS

• Multiple threshold and thoroughfare.

• The public connection between Onehunga and Mangere needs to be re-established and the shoreline reactivated. The programme will provide a multi-modal hub infrastructure to house domestic ferries and create new nodes of transport and recreation linking the rest of the harbour to the city through water transport, cycling, walking, produce and rail.

• A programmatic interface which also references the historical and cultural context.

• Incoming and outgoing boats/ferries, fishermen, cyclists, pedestrians, rail are reinvigorated and reinvented to enhance the site that has been so long neglected.

• Setting up cultural and social zones of importance, for haircutting ceremonies, and as a social hub for the surrounding communities.

• The structure will reveal large open and elongated spaces/platforms, fluidity of circulation, views and vistas. The materiality of building will invoke a consciousness of weathering and its materials and colour effects.
TAI TIMU TAI PARI: PROGRAMME

• Ferry terminal facilities and infrastructure
• Restaurant
• Fish market and kitchen facilities
• Recreational boat docks
• Refuelling facilities
• Waka Storage
• Newstand/coffee kiosks
• Toilets
• Bike stations
• Water fountains
• Link/pedestrian walkway to rail terminus
• Fishing platforms
• Boat ramps
• Pedestrian bridges/access
• Vehicle access/parking end of causeway
• Tidal turbines beneath structure
• Storage
PROJECT DEVELOPMENT

As a result of exploring the transitional qualities of the Manukau Harbour, notions of transitions, transformation and translation are being explored in this thesis as a way to read into the landscape, such as the relationships between the land and water, the land and air, and the ebb and flow of tide. Studies of the land lead to an abstraction of the structure and functionality of the project. The physical qualities and elongated nature of the harbour provide an extreme environment for this architecture.

In the book Landscrapers, Aaron Betsky considers our historical concern with identifying with the land through building. His notion of ‘geotecture’ explores ways in which to ‘respond to, become a part of, and yet remain distinctive within our natural landscape.’ Similar to the thinking process of this thesis project, Betsky believes that buildings should ‘seek to restore the land...and unfold the land rather than hiding it.’

This project looks at drawing from the historical context informed by the formal geographical conditions and the dynamic nature of those landscape conditions through a programmatic approach. Conflicts of this major site lead to an exploration of the formal processes of layered exchange and transfer.

Through landscape architect, James Corner’s work we see that the concept of understanding landscape as a process, or an activity, rather than as an object, offers a unique perspective to landscape architecture. As we cannot control these landscape conditions, the landscape architecture and architecture in landscape is implicitly affected by landscape process and patterns.

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This perspective additionally foregrounds the temporal, social and habitual processes that not only affect, but are a part of the landscape. Too often landscape is seen not only as object, but as objective, something which exists apart from the individual and something which is larger than the individual, the aerial eye.

The project concerns a multi-modal/interchange interface related to the industry of tourism, recreation and transport. Through investigation of the transitional nature of the Manukau Harbour’s topography, relationships are identified through a process of production of translational and transformational models and drawings.

Given the redundancy of the old Mangere bridge as it lost its transport component, the social activity has flourished in an unprogrammed response. It is used to fish, as a cycle way and promenade, to launch boats and outrigger canoes, haircutting ceremonies and it acts as a thoroughfare to the north.

The project attempts to reinstate the facilities and opportunities for these kinds of activities to take place. It attempts to restore the democratic dimension and legitimise the activities which have found expression on this important site and bridge. It is not about displacing these activities, rather providing a place of operation and further opportunity.

The harbour foreshore already retains an existing cycle way which is a significant resource and, with ever-growing petrol prices, the cycle way has become a popular alternative of transport. If parts of the foreshore were regenerated to emerge as recreational destinations, this in turn could revive and recover a long neglected gem.
FORMAL DESIGN:

EXPLORATION OF THE ELONGATED SITE THRESHOLD
ARCHITECTURE

We have identified the vast flattened and elongated nature of the harbour and the consequence of this is that we find that any architecture must engage with this elongated threshold. The harbour presents an exhaustive elongated nature which has become a key element in suggesting radical propositions to the site.

Due to the exaggerated flatness of the Manukau Harbour, we are introduced to huge distances of empty sprawling mud flats, which create the harbour’s own horizon of mud. When the tide is in, it fills the whole basin and the water must travel extremely vast distances, resonating within a six hourly inundation. Its elongated nature is a consequence of its extreme and exaggerated flatness where issues arise concerning the endless exchange and transformation that exist within the harbour. Working with these responses rather than against it, allows a deeper and more complicated poetic response.

Notions of the transient and the cyclic resonate in the harbour in which the tidal, biological and topographical elements escape across the landscape as a layering of irregular exchange.

Such exchanges existing in the harbour vary from the incoming and outgoing boats, the fish, the seasonal birds, the prominent South Westerly wind, and the ebb and flow of tidal waters. From observation, the harbour becomes transformed into alternative terrains when water advances and retreats. Commanding currents through the Onehunga and Mangere channel provide an accumulation of mangroves on the cusps of inlets, filled with organic and inorganic debris and white shore mollusc banks, followed closely by the silts carried down through the aquifers filtering into the draining channels. The harbour is always in a state of flux.

There is also a psychological/fear factor of extremities between the apparent calmness and the power of the torrent that forces its way through the heads. Fisherman talk of it with great respect and wariness.
Core samples were taken from the mud flats of the Manukau Harbour. Mud and silts are exposed and layers are revealed. The layering of the land begins to inform the layers of circulatory routes which pass through the Onehunga site. These meticulous studies of the land were used to understand the sectional manner and could therefore inform material relationships later on in the project.
The material studies were done with saltwater taken from the Manukau Harbour in order to monitor the different reactions and textures over time to the related sites. The colours and textures explored were useful in informing a material language toward the project. These studies provided some insight into the weathering of materials and how they could engage with the watery site which this project is proposed to be anchored.
The initial part of the formal investigations examined the site in a series of abstract models in order to fully understand the interrelationships of the site and its sectional transitions, eventuating on to inform scale, structure and encasement. The project at this stage questioned how architecture can correlate with this complex site. It was not the architecture which informed the site; rather the site which informed the architecture.

The high tide and low tide allowed a point of stillness that these structures could respond to in different situations such as ferries approaching areas at high tide and areas at low tide.

From the experimenting with casting plaster and latex negative and positives of potential sites around the harbour, the casts began to develop imperfections, having parallels with the change of the land from the past. The notion that there could also be some kind of trailing arm structure which could use the strong current to counteract, and integrate a resistance with another element to counterweight it, was considered.

Moving from one side to the other these structures were not assumed to obstruct, rather they would work on the basis of a small angle to move, sitting neutrally, and starting to inform other functions. They began to inform relationships between the shallows of the mud flats to the deep channels through which wharf structures would align themselves with the current. Investigation of a structure that rather than only resisting lateral forces like tides and winds might look to balance those forces by deflections. However, due to so many variables of extreme conditions of current forces, wind and practicality to contend with, these ideas of a mobile structure were abandoned.
The question which preoccupied the aesthetic of these models preoccupied the elongated site and the idea that a mechanism has some kind of exactness. The models presented an idea of something that is exact using strategies like insert and embedment and precision operations, putting those into relationships of a geographical nature and scale.

These models significantly contributed to the notion that the relationship with ground is formally important. It was not just about creating one object, but a system and a network, setting up an arrangement of complicated relationships. What came out of these works was that it was not about becoming focused on the object nature of these works, rather the relationship between them and the land.
The project then generated a comprehensive series of drawings that have investigated the relationships between the transitional elements of the Manukau Harbour and identified the issues that haunt the harbour’s neglect. The issues identified in the documentary research were explored in a subsequent iteration of artworks interrogating the landscape and social processes of the harbour.

The narratives of the artscapes initiated thinking and making to provoke a new material design response to the continuous and changing landscape of the Manukau Harbour. Interrogations of the elongated nature of the Manukau Harbour sought to find a relational nature to site rather than objectional to inform architecture. High tide lines and low tide lines form a patternation, which produces the hierarchal lines of contours as the sea graduates up against the land sorting the flotsam.

It was important to be exhaustive and critical in the making process of the artscapes to produce a kind of proto-architectural translation. The intention was to interrogate the elements already presenting a common lineage with one another and to question the nature of each of these relationships.

The artscape drawings have investigated a series of architectural landscape relationships between the land and sea of the Manuaku harbour, and it is these relationships, which form an underlying basis for this thesis proposal. These strategies and explorations engage and propose new proto-architectural relationships.

OPPOSITE PAGE:

The embedded nature of this work interrogates the foreign objects washing ashore in the Manukau, whether it be the driftwood and flotsam or the remnants of the meatworks or the shipwrecks which were swallowed by the sandbar gateway. Interlocking became another theme to this work, the notion that there could be something that is discontinuous from land but is potentially connected by a type of structure.

The shifting edge condition of the lines evoke the basaltic hardness of the harbour, and the surrounding grittiness of the roads. The architecture is informed and driven by shifting from the documentary research through to an analysis and then on to the form.
ARTSCAPES

These works became a really crucial way of understanding the nature of the harbour looking along an elongated horizon and what the formal mechanisms were that could be transposed into an architectural language. The artscapes began to interpret some of the physical processes that operate on the harbour’s edge as well as advising compositional insights.

We also read these works as a possibility of the trace and anticipation of, or the loss of architecture. These issues extend more specifically to the speculation of loose plans, that are cut into the ground, and anticipate a new architecture. It was then questioned how one might take these operations more seriously by bringing the architecture out of the landscape, working off the shoreline, surgically cutting into the latex and graphite lines.

The artscapes invoke various operative processes of shaping spaces derived from transitional qualities of the site. The artscapes do not seek to provide a shelter, nor do they suggest some form of inhabitation. They try instead to uncover productive relationships between landscape processes, materiality and architecture through site-specific narratives and a translation of site. However, like all translations, they change the site by emphasising certain processes and exaggerating others. They intertwine together as a collection of dissimilar relationships: technological/natural, objective/subjective, degenerative/regenerative.

OPPOSITE PAGE:

This artscape interrogates the relationship between land and sea dealing with the translucent and transient nature of the Manukau through different mediums and a build up of individual lines. It presents us with the idea of different types of layers overdrawing and overlaying in relationship to the washing in and out of accumulation.

The channelling nature of this piece explores the enfolding land in a response to the volcanic landscape of Auckland forming the distinct nature of the harbour, contracting the fractured nature of the land to the fluid nature of the water. There is a stage whereby the historic basaltic lines can be read as indications of previous fluidity when lava flowed down and the water washed in and out.
This *artscape* investigates the watery rhythms of the ebb and flow of tide setting up layers of transparency and opaqueness in relationship to littoral edge condition that is so extreme in the Manukau harbour. The cotton lines explore the transitional qualities of the foreshore when the water resonates within such a long distance of mudflats. These works became useful in the way that they reinforced the extension of the flow and flux of tides and could then provide new strategies for the project. The aquifers which carve through the land and seep out on to the mud represent architectural implications of the voids, becoming part of a narrative of architecture. This work proposes the idea of a proto-architecture washing up and accumulating around an edge condition.

These works question what is the architecture that lives on this long elongated site with the accumulation, withdrawing of water, mud and exploration of the previously fluid scoria. The suggestion is that this is not an architecture but a proposition about the relationship between the topography and proto-architecture and an analysis of the elongated conditions of the harbour. As a whole, these works evoke a sense of the fluid translucency, boundary and moments of accumulation.
The warfare of boundary lines of the land are used to provoke the bloodshed between the Māori and Europeans. As Māori lived off the land nomadically, the Europeans imposed their boundaries upon the edge of the harbour. This work therefore provided a level of cultural and social importance to the project as it is important to always refer to the multi-cultural city that is Auckland.
Contamination and carving away of the land became significant themes throughout this piece, signifying the abuse that the harbour retained by human occupation and interrogating the way in which the land was ruined and repaired over time. The accumulation, embedment, and erosion of sediment proposes a way through which to anticipate the architecture. It questions whether the architecture requires a sectional and clean condition and whether the architecture is part of an excavation floating with ungrounded lines.

The different angles and orientation could be imagined so that as the flow increased they could be slightly rotated and moved. The work suddenly portrays the idea of an architecture which is washed up but with the potential to be washed out, and more or less grounded by its sectional condition.
The beautiful figured maps throughout this text point us to the day to day ephemeral nature of the harbour, allowing us for one moment to see a clear overview of the harbour we can never understand in one individual place at one time. As an extension of this idea, a time lapse of the primary Onehunga/Mangere site and its surrounds were filmed over a series of days and nights to find and to localise the material and to stand back to appreciate a wider sense of the site one would not normally see.

SEE TIMELAPSE DISC IN BACK.

Similar to Corner, maps of the site have served an important part of reading into the landscape to ‘consider the role of maps, for example, which, like aerial photographs or paintings, are documents that are not remotely like the land itself: they are flat, un-dimensional, and densely coded with all sorts of signs and hieroglyphs….maps make visible what would otherwise be invisible.’

OPPOSITE PAGE:


According to the Watercare website, almost 40 percent of Auckland city sits on cooled basaltic lava and other volcanic flows formed by earlier volcanic eruptions. Aquifers formed by cooling lava creating fractures, joints and caves and allowing rainwater to fissure through the joints.

The aquifers are significant because they supply the reservoirs, which are tapped for consumption by the people of Auckland. One such case is the Captain Street Springs, which supplies the Onehunga community with most of its water needs.

The lowlands of the Manukau harbour are dominated by soft pumiceous clay silts of the Pleistocene age.

New Haven: Yale University Press. 18
Mapping of the harbour became useful in revealing just how vast this harbour is and showing the networks that the ferries could utilise for water transport in order to provide to the wider nodes of Auckland.

Map: Andrea Lawrence
This thesis is concerned with the fluidity and exchange of the elongated nature of the sectional condition of the edge of the land to the beginning of the sea.

The formal investigations have been made to create architectural relationships with the site through which they become drivers for the programmatic of the cycle ways merging through the building, adjacent to the water flowing in and out below the structure. The design materials and formal arrangement have been brought together using material and formal compositional processes which both programatically and structurally engage with each other. Concentrated elements are all tied together programatically. While this foreshore structure is a lot about movement, there is also a secondary nature of cultural, standing, fishing and viewing.

Parallel to Allen Smout’s investigations, he explains that ‘the building explores the natural cycles and processes that are present in the surrounding landscape and apparent in the ambient and latent qualities of the site. Diurnal light, tidal flow, texture, colour, etc...are highlighted and accentuated.’

Working at an operative level, the structure is instrumentally set up and independent from the land, creating an intermediary space. Secondary transitions are applied to approach the structure, although instead of resting on top of the land it sits away from it, creating another threshold condition between the complex and the land and, between the boat and the interface, like a foreign object washing ashore, always in a state of flux.

Bike lanes and pathways wind throughout the platforms creating a world where everything intersects and programatically applies the elongation of folded lines.

O P P O S I T E  P A G E: Initial studies into the structure and circulation of the interface proposal.
The harbour has a strong steering south westerly, so the ferries approach the wharf through a gateway and around into a sheltered terminal. As the ferries enter the structure, people disembark moving from the mobile harbour condition to the pedestrian, and the fishing boats unload their fish to the market and then on to the restaurant.

Structural exchanges such as the timber structure, rest on concrete piers and roofs become folded and hung from timber angled trusses like driftwood embedded in a shell bank. Concrete fins are driven into the seabed which slightly change in angle at they allow for displacement of the current to provide calm spaces for boats and ferries to come to dock. The changes in angle of the structure allows various routes throughout this complex, allowing deviation and changes in activity, and allowing for separation and connection between people and their activities.

The project accepts and is driven by all the layers of change and materials, where staining occurs in the building, accepting the weather and exposed nature of the site, layers of material take on the ebb and flow character of the landscape, as well as the rhythm of the structure which shifts alongside the current.

OPPOSITE PAGE:
Programme becoming clearer and the layering of circulatory routes are interrogated. Now the structure begins to deal with the contending current. Angled fins direct the water away from the terminal areas and the rhythm of the structure correlates with the ephemeral nature of the site.
OPPOSITE PAGE:

Model of interface in site context approaching from Onehunga side.
OPPOSITE PAGE:

Model of complex in site context approaching from Mangere side.
EXPLDED
AXONOMETRIC
OF
FORESHORE
COMPLEX  1:1000
TO ONEHUNGA
TO MANGERE
RESTAURANT
TICKETING
ADAPTABLE KIOSKS
OFFICES
TOILETS
FISH MARKET
WAKA STORAGE
FISHING AND GATE PLATFORM
ONE HUNGA
CHANNEL SITE
WITH PROPOSED
INTERFACE.
Sectional model through fish market and waka storage pontoon.

Note the concrete fins which ground the structure into the sediment and basalt and the tectonics of how the structure is attached and detached as a series of overlapping layers.
Sectional model slicing through the floating restaurant and the kiosks. The circulation of the pathway running above through the structure. Roofs fold in against the strong south westerly winds and the changing material nature parallels with the transitional site.
This sectional model cuts through the nexus of the bridge where paths tie a knot either taking you to a fishing platform or to carry on across the channel.

From the motorway the bridge pylons appear to be emphasising the gateway of the Manukau heads as it aligns itself with this enclosure of water. Once again the layering of circulation and the exchanging of materials throughout the structure are revealed.
Moving toward the interface from the Mangere side of the channel. Boats and hovercrafts are launched off the edge of the causeway and people are guided up and over or below and through the foreshore complex.
Interior view through the nexus of the structure. Various routes and ramps take you on a journey in and out of the structure in relation to the layering exchanges which occur on the site. Bicycles and pedestrians cross paths as they make their way across the bridge or toward the fishing platforms and ferry stations.
Views and vistas out toward the harbour and the heads are revealed as you pass through the interface. Nodes of the stationary and points of passing cross over each the same way in which the landscape deals with the tide coming in and out over the littoral zone of the land.
The structure anchors itself below the water yet is still able to filter through the structural fins of this interface proposal. The structure becomes directional by way of the strong current displacing it away from parts of the platform in order for the boats to dock safely. The interface is always extending from one platform to another as it reaches across the channel to the north, responding to the extreme tidal levels.
This new architectural foreshore complex proposal has the potential to contribute to Auckland society through the extension of relationships between the landscape processes and social processes of the Manukau harbour, enhancing and reinvigorating the Onehunga/Mangere site. The structure which takes on the landscape characteristics of the ebb and flow of tide, parallels with the social processes which have historically and culturally established this site.

Should this project be undertaken by appropriate authorities, it could fulfil the needs of a community which has in the past received minimal architectural consideration. The research highlights that there is a need to draw the neglected Manukau harbour community together at some focal point in order for the community to regain some sense of belonging. I believe my structure would provide such a focal point to enable this to happen.

The building acts as an extension of the landscape itself contributing to such programmes as the restaurant extension which is an example of the landscape processes in two ways. The restaurant uses the fish caught from the harbour and the dining area engages with the visual aspects of the harbour looking out to the vast flat stretches of the water. The programmatics extend through the building facilitating to the people, the ecology and the modes of transport.

Another outcome of this project is that it could reconnect the thoroughfare from south to the north and vice versa instead of the Manukau harbour being viewed as a separate entity.

In future, the structure might also be used to offer refined modes of transportation between the surrounding areas, such as the use of the hovercraft as a high speed connection to the wider nodes of the Manukau harbour.

To conclude, this project provides a structure and can be used as a mechanism through which to bring together a disconnected community and to also further enhance the networks to the wider area providing a catalyst to continue and extend the social processes that so strongly define the harbour nexus. One might say this project is an artefact of the processes of the harbour, an artefact that like driftwood and other flotsam continues the accumulation and erosion of the land/sea threshold. It is an extension of the landscape itself.
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WEBSITES


APPENDICES

PRECEDENTS

1966 LEÇA SWIMMING POOLS // ALVARO SIZA

Regarded as one of Alvaro Siza’s significant earliest works, La Leça Swimming pools on the coast of Porto, Portugal sets up a language of its own amongst a coastal topography. Something which this thesis takes precedent from is the ability to allow the building to act as ‘an attenuated three dimensional opening, structuring the passage from land to sea’¹. The series of large coastal pools bound by low concrete walls extend into the sea embodied by natural rock formations. Continuity of the pools with the existing topography and the level of the water in the pools appear to be contiguous with the sea, creating the impression of a seamless transition between the man-made and natural.

Elements slice in to the edge between the land and sea, a composition only understood from the perspective of the pools. From the road, the complex appears to carve into the landscape achieving a level of homogeneity between the rough concrete and natural rock formations; disconnected from the holds of the city. Alvaro identifies the natural processes occurring on site to determine the outcome of his design, which essentially becomes an underlying thematic to the program of this thesis.

The sea consumes the concrete ground and timber panels as it flushes through the pools to resume a new cycle of water. The materials appear to dissolve into the pure landscape through juxtaposed weathered copper roofs, fading timber and extending concrete walls. The constant flux of the ocean sets up a strong transitional relationship within the pools’ infrastructure, forming an intentional blurring of the ocean’s edge not only giving the swimmer the sense of a vast expanse but blurring the limits of this man made structure. The nature of the irregularity in Siza’s pools motivates this thesis design to interrogate the structure applied to the building, giving the notion of some foreign object washing up on the beach.

PHOTOS: ANDREA LAWRENCE 2010

¹ Testra, P. (1996) Álvaro Siza: Berlin Berkhäuser. 25
It was in Louis Kahn’s interest that his buildings achieved a sense of the monumental and spiritual quality. He was vigorous in achieving the formal perfection and emotional expression in his buildings and it is for those qualities that he has become such an inspiration.

The commission of the Salk Institute in 1965 became an extremely functional institution building as well as an architectural prodigy. Kahn demonstrated a high regard for natural lighting and imaginative use of space in the Salk Institute through large light wells and refined transitional spaces within the “served” spaces. His use of material throughout the building consisted of concrete, teak, lead, glass and steel. Upon the setting of the concrete, he allowed no further finishes to façade, meaning the concrete was exposed and the timber left to weather naturally.

The building, whilst heavy and monolithic and courtyard, bare and open, reveals a sense of elegance within the tranquil surroundings. The building expresses itself beyond the horizon by means of a narrow travertine channel moving effortlessly down the centre courtyard toward the Pacific Ocean. It is here that Kahn reminds us of our scale compared to the ocean by means of directed views towards the nature of the site. In Marc Treib’s article, he discusses how the building, ‘as a totality, this concrete, stone and wooden construction...effectively supports the endeavours of the biological research institution it serves while offering a fitting conclusion to a continent and a frame for the Pacific Ocean beyond.'

PHOTOS: ANDREA LAWRENCE 2010
