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Architecture demands a certain responsibility to the changing environments of today’s world and the sustainable practices that can support it. Overtime, this responsibility has only become more important as habitat loss, pollution, over-exploitation, and species introduction are increasingly affecting the diversity of landscapes and resources of today’s world.

How can a research facility on an off shore island in New Zealand educate and promote change for ecological significance and biodiversity? How can architects and designers ‘design for diversity’ while taking into account cultural context and the unique environments that surround them?

This research project aims to explore the architecture and planning of an educational facility that is deeply rooted in the cultural ties of the land, and the island solutions that support it. In the end, the project develops a design proposal that compasses indigenous knowledge, values, and understandings in conjunction with western science practices and research.
AIMS AND OBJECTIVES

As an exchange student in New Zealand, this project is inspired by the cultural experience and unique creative endeavor in a new time and place. Traveling here from the United States, New Zealand's scenic landscape and interesting position within the design community sparked my interest to understand a new and exciting part of the world. In order to accomplish this, I have focused this research project to incorporate cultural environments, unique landscapes, and controversial design issues relevant to Auckland, New Zealand. This has allowed me to completely engage with all aspects of Aotearoa and grasp the past, present, and future of culture and design.

The aim of this project is to not only explore a new part of the world, but to understand how responsive design is appropriately formulated. My goal within the project is to grasp a further knowledge of design principals, vernacular architecture, and the many different cultural aspects that affect the world we live in today. In the end, this project will showcase the cultural issues in a specific time and place and how unique design solutions are formulated and defended through research.

RESEARCH QUESTION

How can a research facility on an off shore island in New Zealand educate and promote change for ecological significance and biodiversity?

BACKGROUND

“Design for Diversity” is a research project that aims to understand design tactics and methods of sustainable practices that preserve endangered species and landscapes. It is a project that aims to promote education for cultural heritage and ecology and identify unique design solutions in the context of today’s environmental issues.

Focusing the program within the educational realm, this facility will give a specialized area for scientist, student groups, and visitors alike to understand the flora and fauna of the island. From bird banding, tracking, and monitoring to wildlife rehabilitation and management, the biodiversity of the island can be showcased as an intact ecosystem. It showcases an ecosystem whose patterns and methodologies for conservation can be understood and applied to other environments around the world.

The following research project looks into history to understand the trends of human population growth and increased rate of exploration in wildlife today. Some of these explorations have become detrimental to certain environments and are quickly becoming a global issue. It was declared by the United Nations that 2010 would be the ‘International Year of Biodiversity’ emphasizing the vital importance of conservation of biodiversity to today’s resources.\(^1\) As architects, we have a responsibility to these changing environment and the sustainable practices that can support it.

Everyday, architects are faced with the challenges concerning the built environment versus the natural environment. As climates change, species are extinct, and carbon emissions are at an all time high, there is great attention to be paid to the interactions we have with our surrounding environments.

Island sanctuaries, such as Little Barrier Island, pose fundamental issues concerning the delicate interaction between natural and built environment. Due to the fragile and untouched nature of the site, aspects such as the footprint, construction method, and architectural impact of the facility becomes a driving force for design. The ultimate aim of the project is to highlight the unique ecology of the island through low impact construction methods, renewable materials, and sustainable practices. The architectural solution will support a structure that carefully touches the ground while leaving a limited carbon footprint.

Most importantly, the ecological significance of the area is rooted in the cultural heritage of the Maori people and their emphasis on guardianship of land within New Zealand. As stated by the Department of Conservation,

*Places managed under conservation legislation contain a rich historical and cultural heritage for all New Zealanders – places of exploration, settlement, natural resource use and protection, warfare, communication, and ongoing spiritual and cultural associations. Such places provide a link between the present and the past and with the culture of those who came before.*

This research project incorporates a rich understanding of Maori design principals as well as the wider cultural connections of the governing iwi, Ngati Manuhiri. Issues such as treaty based relationships, naming, environmental health, and creative endeavor need to be explored and developed to inform strategies for design. These strategies will be used to determine the cultural experience of the project, while re-establish the connection to the natural flora and fauna of the sacred land.

In the end, the project will highlight a true ‘Design for Diversity’ that raises awareness for the study of ecology and sustainable practices and illustrates a reconnection to land for the Maori culture and people as a whole.

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3 Auckland City Council, Auckland as a unique Place- Te Aranga Maori Design Principles http://aucklanddesignmanual.co.nz/design-for-auckland/auckland-as-a-unique-place (accessed April 1, 2014).
BIODIVERSITY

Biological diversity, or biodiversity, is a fundamental building block for life on earth, as we know it today. Defined as the “variability and diversity of living organisms on the planet”, biodiversity provides essential resources for humans and organism around the world. These resources contribute to the food, materials, and everyday supply of goods that keeps the human population alive and healthy. In addition, aspects such as medical discoveries are made possible due to research in plant and animal biological make up. Biodiversity is a key factor in providing simple things, such as clean water, oxygen, and absorption of harmful chemicals. Understanding some of the relationships within biological diversity and the environments that surround them have become some of the most challenging and difficult realms in science.

Today, biodiversity faces major issues concerning population growth, species extinction, and the environmental changes that are depleting essential resources. Specifically, throughout history the expansion in human population, along with technological advancement in transportation and communication, has indicated an increased rate of exploration in wildlife. Some of these explorations have become detrimental to certain environments and are quickly becoming a global issue. In particular, the human population jumped from 1 billion in 1800 to 2 billion in 1930, 4 billion in 1975, and today stands at over 7 billion and counting. The Center for Biological Diversity indicates that this increase has caused forty percent of the planet’s land to be devoted to food production, up from 7 percent in 1700. Figure 1 demonstrates this rise in population over time that is directly correlated with the extinction rates of today’s world. If this growth continues and the population keeps up the current consumption patterns, major threats concerning extinction and appropriate resource stability will pose serious problems.

EXTINCTION

In particular, the process of extinction has become extremely accelerated in the past 100 years as the world population has reached an all time high. The Center for Biological Diversity indicates that worldwide, “12 percent of mammals, 31 percent of reptiles, 30 percent of amphibians, and 37 percent of fish are threatened with extinction”. In addition, the organization indicates that with current population growth trends, “the number of threatened species will increase by another 7 percent over the next 20 years and 14 percent by 2050”. Extinction is an irreversible process that leads to unsustainable environments, depleted resources, and a long road for endangered species today. As extinction is a natural process of life, it has occurred through out millions of years without the intervention of humans. However, as technology has become more widespread, there is an increase rate of man-made habitat loss, pollution, over-exploitation, and species introduction.

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5 Ibid.
8 Ibid.
9 Ibid.
10 Ibid.
Today, we now face the greatest extinction since the dinosaurs were wiped out 65 million years ago.\(^\text{11}\) This man-induced rate of extinction far exceeds previous extinction rates and data shows that it is still increasing further.

In the past, massive extinctions and die-offs were caused by things such as “asteroid strikes, volcanic eruptions, and natural climate shifts, the current crisis is most entirely cause by us – humans”\(^\text{12}\). Today, human activity is driving habitat loss, species introduction, and global warming and contributing to over 90 percent of the current endangered species issues.\(^\text{13}\) Due to the fact that these species depend on each other and support biodiversity as a whole, numbers of extinction will only increase further in the coming years and completely deplete the ecosystems of vital material.

In order to preserve the natural diversity of environments today, something must be done to maintain the rapidly diminishing resources.


\(^\text{12}\) Ibid.

\(^\text{13}\) Ibid.
Where species went extinct
761 species have gone extinct in recent times*

Click on the circles to see their picture and more information

*Red list count began in 1996 but includes extinctions going back to 1500

Figure 3: Where Species went Extinct
GLOBAL THREAT

Across the world, there are extinct, endangered, and threatened species that are quickly becoming a global issue. As New Zealand sits on the more affected areas of this map (Figure 2), its risk for habitat loss and depleted resources are much greater. As the land mass of New Zealand has been developing for 80 million years now, and as human interaction and exploration have become more widespread the county is in more and more danger.

Accessed over a 3 year period, the New Zealand Threat Classification System List identifies endangered species and their threat of extinction in New Zealand today. Each group including birds, plants, reptiles, etc, list the number of species for each category, the number of species under active management, and the demographics of specific populations that have been managed as case studies. In addition, the Department of Conservation uses a specific threat classification system and ranking to identify the long term threats of this native flora and fauna (Figure 3). With over 2800 threatened species determined as threatened today, there is a further 3000 that are believed to be endangered but cannot be classified due to lack of research and resources. It is only through the education of today population that some of these species can be further understood and steps can be taken to save their habitats.


15 Ibid.

<table>
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<th>Population trend*</th>
<th>&lt; 250</th>
<th>250–1000</th>
<th>1000–5000</th>
<th>5000–20000</th>
<th>20000–100000</th>
<th>&gt;100000</th>
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<tr>
<td>&gt; 10% increase</td>
<td>NV/NU</td>
<td>NU/Rec</td>
<td>NU/Rec</td>
<td>NT/NU_RR/Rel</td>
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<tr>
<td>Stable (±10%)</td>
<td>NE/NU</td>
<td>NV/NU</td>
<td>NU/Rel</td>
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<td>10–30% decline</td>
<td>NE</td>
<td>NV</td>
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<td>30–50% decline</td>
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<td>NC</td>
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</tbody>
</table>

Dec = Declining
NC = Nationally Critical
NE = Nationally Endangered
NT = Not Threatened
NU = Naturally Uncommon
NV = Nationally Vulnerable
Rec = Recovering
Rel = Relict
RR = Range Restricted

Figure 5: Table with Numerical Values for at risk and Endangered Species
EDUCATION

The CITIES treaty was drawn up in 1973 in order to identify some feasible first steps to address this biodiversity issue in today’s world. The treaty was initially drafted in order to protect the exploitation, illegal trade, and regulation of invasive and/or endangered species across international boarders. Its aim has always remained to conserve and protect wildlife, their environments, and the precious resources that support it. In particular, the CITIES treaty states that through the identification and documentation of species, ecosystems and landscapes, and the threats that face them, education becomes a resource to prevent global extinction. Education becomes a driving force for the purpose of this research project and the change for biodiversity that it can facilitate. From figure 4 we can start to see some of the research and methods for classification that drive the threatened species prevention in New Zealand today. Taken from the Department of Conservation, this simple data graph can help educate and further understand the true threats that face our biodiversity and what can be done to stop it.

In particular, this educational facility must have a plethora of information, landscapes, and diverse species in order to conduct appropriate research. Due to the unique nature of many islands off of the coast of New Zealand, these island sanctuaries are prime locations for the study of landscapes, species, their unique biodiversity. With almost 600 near shore islands off the coast of New Zealand, these areas become a paradise for field research in botany, ornithology, etc. The focus of this education should expand to the indigenous animal populations, sustainable practices, and cultural traditions, and specifically how they are properly integrated and preserved. Through this exploration of architectural design, the research question at hand will highlight this indigenous culture and ecological significance of the area.

18 Ibid, 32.
Figure 6.1: Primitive Maori Village

Figure 6.2: Fortifications on Primitive Maori Village
MAORI ARCHITECTURE AND TRADITIONS

The Māori art form of architecture can be traditionally traced back to the primitive term kāinga, a Māori settlement or village.\textsuperscript{20} Varying anywhere from three to five hundred houses, these settlements were some of the first documented architectural structures found throughout Cook’s first voyage in the 1770’s in New Zealand.\textsuperscript{21} However, looking back to pre-European times, the construction methods, materials, and typology of Māori built structures were developed and morphed overtime. Through the challenges of natural, spiritual, political and colonial environments, the design of kāinga has been constantly changing and rebuilt and ultimately has come to represent the importance of Māori art and culture in the built environment today.

During pre-European times, the traditional kāinga associated with Māori were similar in design to early houses found in eastern Polynesia. Techniques for these built structures included lashing wooden pieces with chisels and cord that were secured by wooden pegs.\textsuperscript{22} Māori construction at this time did not include the use of nails but instead adapted natural materials and plants to reinforce structure and shelter. Plants such as raupo reed, toetoe, timber of the totara, mānuka, and pakatea trees were utilized and most commonly used to create semi-permanent structures for this nomadic society.\textsuperscript{23} “Hunting, gathering, and travel often necessitated the construction of temporary buildings”\textsuperscript{24} that were typically, “clad in a variety of materials, such as branches, leaves, and bark”.\textsuperscript{25} The wharepuni or sleeping house was considered the main dwelling or architectural typology for each kāinga, which housed assemblies and accommodation rooms. However, as seasons changed, the other semi-permanent structures around the kāinga were used for sleeping quarters, as techniques such as excavation were implemented in order to protect from the elements.

\begin{footnotes}
\item[21] Ibid.
\item[22] Ibid, 32.
\item[23] Ibid.
\item[25] Ibid.
\end{footnotes}
MAORI ARCHITECTURE AND TRADITIONS

It isn’t until the 18th century that changes in environment and social activity began to morph this traditional kāinga into a fortified village. Sparked by the acquisition of European weapons in the 1830’s, Māori saw dramatic changes in the strategies of warfare and power. By this time period, warfare became the most prominent feature in Māori culture as the building of fortifications for the pā became very widespread. Typically situated on a hill or ridge, the villages began to be protected by a series of ramparts and terraces called pā korokoro. Not only were they used to protect dwellings, the fences began to separate domestic units from kitchen, food stores, and other areas. These fortifications allowed for more substantial and permanent rectangular buildings to be maintained throughout the 18th century as the flimsy semi-permanent dwellings became less prominent.

26 Julie Paama-Pengelly, Maori Art and Design: Weaving painting, carving, and architecture (Auckland: New Holland Publisher, 2010), 35.
27 Ibid.
In addition, the Māori warfare society developed specific structures for the storage and protection of tribal relics during this period. Specifically, each tribe built waka or canoes that were highly prized for processional purposes within the village.

At the ground level of a typical fortified kāinga, a wharau was constructed in order to properly store these 30 meter long canoes. The wharau typically had a steep pitched roof that was thatched with layers of raupo reeds and secured with other natural materials such as the mangemange vines.

This change in typology for built structures throughout the early 19th century identified yet another reason why more secure settlement patterns were prominent overtime. As the tribes became more communal with building, fortifying, and protecting their settlements, more permanent structures began to dominate the design and architectural values for the kāinga.
MAORI ARCHITECTURE AND TRADITIONS

By the late 19th century, changes in the spiritual environment brought about different typologies and design strategies for the built environment of a kāinga. Once Māori had developed a stable lifestyle around the permanent kāinga and pā settlement, a new building typology was introduced that focused on a communal ceremonial space. This new typology was a direct product of the aftermath of the New Zealand Wars and raised awareness for the spiritual influence and preservation within Māori society. Stemming from the waka koiti, or burial structures, the importance of carved monuments to tribal chiefs of the past was a long-standing tradition of Māori settlements. This new typology drew upon this tradition by centering the village around a marae atea, or open space, that was focused on a sacred carved house. This house, known as whare whakairo, was considered to be the single most important spiritual element of a settlement. During this time period, the whare whakairo, “rose to prominence as symbols of tribal mana and expressions of belief systems”. Evolving from the smaller communal building of the chief’s dwelling, the entire community would be invested in the construction, carving, and resurrection of this intricate structure. Its influence and spiritual meaning is deeply rooted in the ancestral narrative and origin of the past that draws a link to the chief, tribe, and spirit of the future.

Figure 8: Traditional Marae structure becomes the center of the Community
The main construction of a whare began with rear and front supports called pou tuarongo and pou tāhu. These supports were first made by halved tree trunks of a tāhuhu tree and placed at four corners of the dwelling as the main structure. These supports came to represent ancestors Tāne Mahuta in front, representing the forests and birds, and Hine-nui-te-po in back, receiver of the souls of the dead. The ridgepole was then set into place, another large tāhuhu timber that ran the length of the roof, which connected the two existing supports and their respective spirit. Rangi and Papa, the earth mother and sky father, from whom all Māori tradition can be linked, are typically represented upon this ridgepole as it faces the front façade of the dwelling. From this ridgepole, the heke or ribs of the roof were put in place in order to link the genealogical relationships important to the tribe, chief, and culture as a whole. On the interior, one or two poukokomanawa or columns are attached to the ridgepole giving extra support for the roof. Finally, sidewalls called pakitara are incorporated through the art of carving to give more support for the base. All along the way, the meeting house is adorned with carvings, weavings, and sculpture such as these that come to symbolize a certain link to ancestors important to their tribe. This allowed uniqueness to each whare and a true narrative that is rooted in Māori tradition.

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28 Julie Paama-Pengelly, Maori Art and Design: Weaving painting, carving, and architecture (Auckland: New Holland Publisher, 2010), 43.
29 Deidre Brown, Maori Architecture: From Fale to Warenui and Beyond (Auckland: Penguin Group, 2009), 12.
30 Ibid.
31 Julie Paama-Pengelly, Maori Art and Design: Weaving painting, carving, and architecture (Auckland: New Holland Publisher, 2010), 51.
32 Ibid.
33 Ibid.
Figure 10: Modern Marae, Unitec Institute of Technology Campus, New Zealand

Figure 10: Modern Marae, Unitec Institute of Technology Campus, New Zealand
MAORI ARCHITECTURE AND TRADITIONS

Later in the 19th century, changes in construction methods, material quality, and building complexity further developed this meeting house typology and allowed Māori structure to reach its highest potential. With the introduction of European technologies, construction of the kāinga and specifically the meeting house were changed forever. For example, the innovation of copper nails used within construction began to replace the traditional cord and lashing technique.\(^{34}\) This allowed structures to be built larger, longer, and faster, with wall heights beginning to be based on Western standards and practices. Along with this innovation of joinery, wood shaping tools developed by the Europeans allowed timber to be manipulated and utilized to its best ability.\(^{35}\) However, one of the largest architectural changes that the Western building system and material implemented was the separation of the artistic elements from the fundamental structure of the dwelling. This basic separation allowed the solid building system to be constructed properly while carvings, weavings, and other aesthetics qualities were adorned around the structure. This building technique was most important for the changing climate and conditioned nature of the interior spaces and begins to emphasize the true importance of construction strategies during this time period.

Today, the marae and meeting house typology remain a vital architectural art form for the natural, spiritual, and political culture of Māori society. Remaining the centerpiece for many tribes and communities today, its’ continued relevance is apparent in numerous art forms and design fields. The importance of ancestors, community, and tradition can be traced back to pre-European times, but demonstrate the continued influence that culture has taken upon this art form. In the end, the changes in construction, symbolism, and functionality have challenged the built structures of Māori society and the view of kāinga as a whole. However, it is important to consider how, when, and where culture will continue to transform the art form of architecture. As technology, structure, and methods of construction are enhanced, what does the future hold for this spiritually and traditionally grounded culture called Māori. I hope to explore this notion further in my architectural design project, while preserving the history and important traditions that make Māori the culture it is today.

\(^{34}\) Julie Paama-Pengelly, Maori Art and Design: Weaving painting, carving, and architecture (Auckland: New Holland Publisher, 2010), 43.
\(^{35}\) Ibid.
TE ARANGA MAORI DESIGN PRINCIPALS

MANA
Treaty based relationships
The term mana recognizes the signing of The Treaty of Waitangi in 1840 and the working relationships that have developed between the indigenous Maori society and the colonizing New Zealand/Europeans. Mana whenua, defined as “authority over land and natural resource”36, is recognized and respected by both Maori affiliated and New Zealand/European affiliated parties and allows visual identity to be appropriately expressed within a design project or issue. Mana is considered a fundamental building block for the remaining Te Aranga principals.37 Within this project, the local iwi called Ngati Manuhiri is engaged in a land settlement agreement with the Department of Conservation. This settlement sets aside a certain amount of land on the iwi’s jurisdiction that is devoted to cultural knowledge and tikanga, or the act of interpreting and practicing Maori knowledge. This agreement is honored throughout the design process and continuously reflected on concerning working relationship status. In any given project, these mana whenua groups must be identified and included in any development or design approach processes.

WHAKAPAPA
Names/naming
The term whakapapa encompasses the names and/or naming process within any design project or development. This principal recognizes the ancestors of the specific mana whenua groups and celebrates their significance in today’s world.38 Typically, a meeting house will be separate from surrounding dining and restroom facilities. Each of these structures will be named according to ancestral background and importance. This process of naming allows the mana whenua to enhance their sense of place and truly reconnect the land back to the people. As well, the naming process allows an outside designer to correctly inform the past present and future of a given iwi and the appropriate design processes.

37 Ibid.
38 Ibid.
TOHU

The wider cultural landscape

This design principal is focused on the sacred sites and cultural landmarks that are recognized by the local iwi and/or mana whenua. Whether it indicates an orientation, origin of the people, sacred marking, or an enhanced sense of place, tohu highlights the wider cultural landscape. Elements such as mountains, springs, or food gathering areas are used to inform design and the true cultural heritage of the site. It allows the design response to connect significant sites and incorporate appropriate building forms and spatial planning. Within this project specifically, an existing landmark was indicated within the Ngati Manuhiri settlement area. This wooden peg was placed within the site to signify the start of a whare. Taking this landmark into consideration is vital to the spatial planning and building placement throughout the complex.

TAIAO

Natural Environments

This design principal aims to “protect, restore and/or enhance” the natural environment of a place. It focuses on rehabilitation of biodiversity, respect of the local flora and fauna, and implementation of sustainable practices to protect the landscape. It allows the importance of nature to resonate through all design processes and decisions. Within this project, aspects such as touching the ground lightly and avoiding touching or destroying the bush line are implemented in order to honor this principal and celebrate the existing natural environment. As well, site repair is an important aspect of taiao that enhances the preexisting conditions of a landscape. The building placement and spatial planning of this project aims to improve the worst areas of the site and highlight the flora and fauna of the island.

40 Ibid.
Treaty based relationships

Names/naming

Whakapapa

Mana

Ahi Ka

Mahi Toi

Creative Endeavour

Mauri Tu

Environmental health

The wider cultural landscape

Tohu

Taiao

Natural environments

Visibility/living presence
MAURI TU
Environmental Health
In a similar way to taiao, mauri tu helps to protect, maintain and/or enhance the environmental health and overall well being of a site. This principal is more focused on the sustainable practices such as daylighting, rain water collection, grey-water recycling systems, locally sourced material systems, solar panels etc. These systems promote a community well being as well as an environmental health that is a fundamental belief of the Maori culture and society. All species today rely on the earth to sustain a healthy life. The Maori society see this connection as essential and should be honored accordingly. By implementing sustainable practices into this project, mauri tu improves the quality of environment and human life on such a unique and precious site.

MAHI TOI
Creative Endeavour
This design principal aims to take narratives of the iwi and capture the essence of the tribe in a creative and appropriate way. The idea is to rejuvenate traditions into the architecture, interior design, and art of a design project. By understanding the history of Ngati Manuhiri, aspects such as the use of a fire pit can be reintroduced as spaces for a creative endeavor.

AHI KA
Visibility/living presence
The final design principal called ahi ka ensures that the occupational rights of the iwi are alive and well. This principal is in place to order to honor the local iwi and their presence within the community. Within this project, the site on Little Barrier Island is being rekindled within the Maori community as the cultural heritage is brought to the forefront.

Figure 11: Topography and Locality of Little Barrier Island
Located in the Hauraki Gulf, Little Barrier Island is home to one of the richest bird populations still thriving in New Zealand. Also known within the Maori language as Hauturu-o-Toi, the island’s nick name is known as “The Wind’s Resting Post” as it is most often found cloud capped. The island is one of the few remaining places in New Zealand that can give an accurate impression of what the country was like before human interaction. It is considered “the most intact ecosystem in New Zealand” and truly “an invaluable refuge for rare and endangered plants, birds, and animals whose mainland habitats have been destroyed”.

Having an area of about 7,544 acres, Little Barrier Island is a volcanic cone in origin, dating back to 200-400,000 years ago. With the highest point at the summit of Mt Hauturu reaching 2,370 ft, the topography of the island ranges from pebble beach and shore line to deep gorges and ravines. Almost completely covered with vegetation and bush, deep streams carry water between ravines creating a steep boulder like geography. Due to erosion, the only flat land on the island is the Te Maraeroa on the south-west side of the island. No more than 2,000 years old, Te Maraeroa is about 66 acres and is set apart by the surround boulder banks of the island. Te Maraeroa is where the only built structures on the island are currently located and is ideal for future development of facilities for an educational center.

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42 W. M. Hamilton, Little Barrier Island (Hauturu) (Wellington: Department of Scientific and Industrial Research, 1961), 5.
44 Ibid.
45 W. M. Hamilton, Little Barrier Island (Hauturu) (Wellington: Department of Scientific and Industrial Research, 1961), 17.
SITE LOCATION

Located in the southern hemisphere, New Zealand is country made up of a series of islands in the Pacific Ocean. Comprised of two large islands, North and South, and numerous smaller island, it is one of the most remote land masses in the world. With more than 600 off shore island located off the main land of the country, the country has many varied topographies and landscapes. Within the Hauraki Gulf, these islands are ideal places for a research and educational center location. As shown below, Little Barrier Island is the only true nature reserve in the gulf and contains the appropriate biodiversity and landscape integrity that a research facility requires.

LITTLE BARRIER ISLAND

![Map of Marine Reserves and islands in the Hauraki Gulf](image_url)

Figure 13: Off Shore Island Map of Marine Reserves and islands in the Hauraki Gulf
The island was originally occupied by the Maori tribe Ngati Wai dating as far back as the 1150’s. For centuries before European invasion, the island was governed by this iwi under the ancestor Toi as settlements were established on Te Maraeora. With pas located on the cliff tops, the island was well defended by the deep trenches on the narrow cliff tops. It wasn’t until the 17th century that the island under went a multitude of attempted invasions and eventually was conquered by rival iwi Ngati Wahtua. Although Ngati Wai was forced to retreat to the interior of the island, the iwi was never completely forced to abandon Hauturu and still claims important ancestry to the island today. Eventually, a series of marriages between the conflicting iwi began to link the groups and give ownership to both tribes.

The crown first sought after the purchase of the island in 1881 in order to establish a bird sanctuary. According to the Land Court, a series of misunderstandings led to a ten-year long dispute of the sale of the island. Unfortunately, by 1891 when an agreement was finally reached between the Maori owners and the government, conflicting agendas let the agreement to fall through. It was at this point that one of the Maori owners took matters into his own hands and pushed for the sale of all kauri tree material off of the island. However, without kauri trees a bird sanctuary or wildlife reserve of any kind would be unable to be maintained. The government passed an injunction in order to preserve the landscape and stop timber merchants from destroying the island.
At this point, the government began to purchase shares of the island off of individual Maori stakeholders to further preserve the land. It wasn't until 1894 that the *Little Barrier Purchase Act* was passed and forced the sale of the remaining shares at the price of 3000 pounds and all Ngati Wai owners were evicted. Since this act, a ranger has been present on the island to enforce the ban against kauri timber harvesting and preserve this nature reserve. Te Maraeroa remains the base on the island for all ranger operations. Little Barrier Island continues to play a huge role in the efforts to protect native flora and fauna of New Zealand.

Today, Ngati Manuhiri hold mana whenua over Hauturu, a sub tribe of Ngati Wai. The land settlement treaty that now stands between the government, Department of Conservation, and Ngati Manuhiri allocates specific land to the iwi. This land holds cultural and spiritual significance to burial areas, archaeological sites, and historical landing spots within Maori history. The ongoing connection to the island remains an important principal for iwi as they play an active role in the management alongside the Department of Conservation.

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49 Ibid.
50 Ibid.
CLIMATE

Due to its location within the Hauraki Gulf, Little Barrier Island typically has a warm and temperate climate with few extremes. The temperatures never fall below freezing and rarely reach above 85 degrees Fahrenheit in the heat of summer. The prevailing west and southwesterly winds keep the low-lying areas, such as Te Maraetoa, cool by the sea breeze. Some of these winds can tend to become severe as storms and/or rainfall reach the island. As the typical rainfall is estimated around 56.7 inches per year, the winter months always tend to be wetter. The island is most frequently seen cloud capped and indicates an increase of precipitation as your reach higher elevations. Hamilton describes how at the top of Mt Hauturu a 26.6 percent increase in annual rainfall can be attributed to the bush thickness and vegetation above 1,800 ft.  

NATURAL FLORA

Little Barrier Island stands today as one of the only sites in New Zealand that is pest free and completely free any browsing animals today. The island's flora gives an accurate rendition of primeval New Zealand and the environments that natural occurred. With the majority of the island covered by bush, the different layers of forest cover can be described and categorized in terms of elevation. These areas are defined as vegetation zones that grow intermittently within cliffs, ridges, valleys, and even shoreline of the island. On the lowest level, pohutukawa forest covers the outer fringe of the coastline and boulders along the steeper shores of the island. Pohutukawa can be seen up to 1,000 ft above sea level in places with cliff formations (Figure 16.1). On the shallower coastline areas, land is rapidly eroding and can only support shrubby pohutukawa plants. Tree species such as coastal kohekohe, puriri, taraire, and kauri make up this low altitude zone of vegetation. In the mid-altitude zone, northern rata and tawaroa are populated throughout valleys, while ridges are more commonly seen with hard beech trees. At the highest altitudes, the forest is dominated by tawheowheo, tawari, and southern rata. Due to the frequent cloud cover and precipitation as these altitudes, the moist environment allows filmy ferns, mosses, and liverworts to survive. The ecology of these vegetation zones allows more than 400 native species to thrive within the environment, most of which are no longer found on the mainland of New Zealand.
Little Barrier Island, “supports the most diverse assemblage of native fauna of any island in the country” and according to the Department of Conservation it is, “considered to be one of the most important reserves of its kind in the world”\(^5\). Following a series of eradication campaigns from 1980-2006, the island is now home to over 40 species of birds, two bat species, and 14 reptile species\(^5\). These campaigns eliminated invasive species such as feral cats and kiore (Polynesian rats) that have contributed tremendously to the recovery and repopulation of numerous threatened species. These threatened species include the wetapunga, or giant weta, that is New Zealand's largest insect and the saddleback, or tieke, a bird that is extinct on the mainland of New Zealand. In addition, the hihi, or stitchbird, is believed to be extinct anywhere else in the world besides Little Barrier Island as it has thrived on the island for over 100 years now. Other native birds that inhabit the island today include kiwis, tuis, both red and yellow crowned parakeets, brown teal, rifleman, the grey warbler, the blue penguin, and the pied shag. These species are just a small selection of the rich biodiversity that thrive on the island today and make it an ideal location for a research and educational facility. Today, animal rehabilitation efforts are already taking place on the island as reptiles called tuatara are being cultivated. Starting out as small amphibians, the adult species grow quite large in size. The adults are known to confuse the younger animals as food and accidentally eat their offspring. In order to repopulate the species, rangers on the island hold these reptiles in captivity, caring for them and feeding them, until they are large enough to be released. This effort has created a large self-sustaining population over the years as it continues to be a campaign for endangered species and their repopulation.

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\(^5\) W. M. Hamilton, Little Barrier Island (Hauturu) (Wellington: Department of Scientific and Industrial Research, 1961) 24-25.
\(^5\) Ibid.
NGATI MANUHIRI SETTLEMENT

Of the 7,544 acres available on Little Barrier Island, the settlement of Ngati Manuhiri has been allocated 3,055 acres for development. As outlined specifically in the following documents, the land distribution, easements, and conservation areas are specifically laid out. In agreement with the Department of Conservation and Ngati Manuhiri, this land must be used in accordance with Maori cultural principals, as well as DOC required quarantine and biosecurity processes.

The settlement is located on the Te Maraeroa area previously described. Its defining characteristics include a rocky beach shoreline that is surrounded by flat terrain. All other built structures on the island are located adjacent to this settlement, as Te Maraeroa remains the homestead for the rangers and visitors on the island.
Figure 18.3: Ngati Manuhiri Settlement
PRE-DEPARTURE QUARANTINE

Prior to the trip, a permit must be obtained from the Department of Conservation that grants the right for visitors to land on the site. This is due to the fact that Little Barrier Island is a nature reserve and is not a public landing site. Only privately chartered trips under the supervision and transportation of Department of Conservation officials are allowed to visit the island. With only 600 permits granted per year, the process can be long and tedious. In accordance with their conservation principals, DOC will identify the intentions for the visit and if the visitor is appropriate and valid for the setting.

On the morning of the visit, each visitor is required to go through a quarantine inspection in order to eliminate any pests, invasive species, or inappropriate gear that is not allowed on the island. This quarantine process allows all visitors to secure their belongings in a box that is zip tied shut. This zip tie-box method ensures that no pests or unwanted material could possibly be tracked onto the site accidentally. After this initial quarantine is complete, visitors are instructed to meet at the boat ramp in Leigh in order to depart.
LITTLE BARRIER ISLAND

---------VIEW FROM DROP OFF---------DINGY BOAT LANDING METHOD ---------APPROACH TO QUARANTINE ON SITE
**JOURNEY ON THE ISLAND**

The diagram below describes the typical journey of a visitor once successfully landed on the rocky shore of Little Barrier Island. The Department of Conservation requires all visitors to go through an additional quarantine process once the zip-tied boxes are recovered from the boat and moved onto the island. This allows rangers to inspect gear one more time and yet again reduce the risk of invasive species or any pests that may have infiltrated personal belongings. Seen as the first black dot, it is the one of the first built structures that visitors encounter on their walk onto the island.

Once cleared from the quarantine, visitors are free to explore, hike, and experience the island. For the purpose of this research project, visitors to Ngati Manuhiri’s facility would then walk to the settlement area in order to be properly received at the whare. Marked as the second two dots on the right, these are the two potential areas of arrival onto the site.
SITE ANALYSIS

Looking more closely at the Ngati Manuhiri settlement, there are certain site features that limit the buildable area and scope of the project. Diagramed below, the green indicates the existing bush line on the site. In accordance with Department of Conservation and the Te Aranga design principals, this bush line will remain untouched throughout the design and construction process. As it is considered precious and vital to the biodiversity and health of the island, it should remain undisturbed.

In addition, the red diagram below indicates easements that were previously established on the settlement area. Indicating a sewage and waste disposal area and power and water line pathways, these two areas are unable to be built upon for this facility.
A typical visitor to the Ngati Manuhiri settlement area will approach the facility using the highlighted pathways indicated on the right. Indicated as black dashes lines, these pathways show the current circulation patterns around the settlement area. The facility will continue to use these pathways as main access points and circulation methods. This decision even further highlights the idea of leaving the bush line untouched and preserving the existing landscapes.

Ngati Manuhiri indicates important ceremonial markers within the settlement that should be taken into considering when designing the cultural portions of the facility. Indicated as a blue circle, this marker indicates the start of a whare. Set in accordance with Ngati Manuhiri aspirations, this marker is associated with burial areas, archaeological sites, and other historical landing spots within Maori history. The iwi wishes to keep this marker in mind when the planning and spatial sequencing of the design is determined.
SITE IMAGES

Zooming into the specified site on Ngati Manuhiri’s settlement, there comes to be an understanding of the rich tree variety, lush landscape, and precious nature of the area. This first panorama looks at the northern most site and the opportunities for the facility. This cove like formation in the bush is the initial area that has been indicated by Ngati Manuhiri for the start of the whare.
Facing away from this initial site, this next panorama starts to unveil the connection of the bush, land, water, and shore. As you can see sky off in the distance, the end of this site has topography that slopes down to a rocky shoreline.
Moving down into the southern most portion of the site, the topography for the most part is flat. It isn’t until the slope starts down to the shoreline that drastic changes in topography occur. For building purposes, this flat site will be ideal for prefabricated and/or flat packed construction that can lightly touch the ground. As it will be extremely hard to have concrete poured and/or heavy construction methods, this prefabricated panelized system is the least invasive method.
This panorama, taken from an existing pathway through the site, demonstrates a typical view of the facility that a visitor would experience. The facility will be able to frame views to the shore, bush, and water and truly embrace the flora and fauna of the island.
- Whare: 120 square meters
  - Sleeps 30-40

- Kitchen and Dining Facility: 150 square meters
  - Area to spill into outdoor dining spaces
  - Area for fire pit integration

- Sanitary facility: 80 square meters
  - 2 Toilets
  - Shower and sink area for accommodation

- Research Labs/Animal Rehabilitation Center: 350 square meters
  - Educational facility for species cultivation and research
PROGRAM ANALYSIS

In accordance with Ngati Manuhiri aspirations and the Department of Conservation, the program of this facility will contain a mixture of cultural and scientific research facilities. As these two groups have mana whenua over the settlement area, both of their thoughts and aspirations will be considered and incorporated into the planning and construction of the facility.

As the cultural epicenter and initial greeting point of the facility, the whare becomes the first building that all visitors will be received into. Gathering for song, dance, and a formal greeting from Ngati Manuhiri members, this ceremonial path must be attended by all visitors to the site. Traditionally, the whare is also used for the accommodation quarters, as thirty to forty people are estimated to need space for sleeping at any given time. Diagramed in blue, the initial ‘ceremonial’ pathway describes how groups of people will enter onto the site and into the facility.

Diagramed in yellow, the lower portion of the facility will house the research, animal rehabilitation, and lab space portions of the program. As traditional Maori planning has been described, the separation of facilities is vital to the layout of a complex. This separation honors the Maori aspiration while also giving more opportunity for outside interactions, pathways, and gathering spaces. The yellow curved lines are considered more day-to-day pathways as they are shown more flexible and fluid moving. As the total square footage of the facility is 700 square meters, additional outside seating, gathering space, etc will blend the interior and exterior of the facility and truly connect each visitor back to the environment.
PRECEDE NT STUDY 1

Part of the ‘Living Building Challenge’ in New Zealand, the Tuhoe Center in Taneatua is designed, “to have no environmental impact, be integrated into its surrounding landscape and to give back to the world around it. It will be the most advanced sustainable building in New Zealand”\textsuperscript{54}. Designed by the Kiwi building company and Jasmax, the challenge follows rigorous standards on where materials are sources, how they get transported, and what their respective carbon footprints are. Across seven performance areas: site, water, energy, health, materials, equity, and beauty, the Living Building Challenge follows strict guidelines.\textsuperscript{55} Implemented by the International Living Futures Institute, these guidelines are in place to show a different future where structures support a healthy environment and overall healthy life. The building takes simple concepts such as, “when it was hot, we’d open a window. When it was cold, we’d throw on a jersey. Embracing simple concepts like this are not only good for the environment that surrounds us, it’s good for us too. It reminds us about what’s important about people and our place within the bigger scheme of things”.\textsuperscript{56} In addition, the cultural integrity of the project can be well interpreted and understood by all, making it a strong precedent concerning Maori design and principals.


\textsuperscript{55} Ibid.

\textsuperscript{56} Ibid.
Figure 26.3: Sustainable Strategies of Tuhoe Center
The Hawai'i Wildlife Center designed by Ruhl Walker Architects is a one of a kind facility that is dedicated to the recovery and conservation of the islands' unique wildlife. A non-profit organization and institution devoted to research, the public gains experience from education and training on the rehabilitation and conservation of animals. Studying the vernacular architecture of the area, the architect designed a building that protects from harsh outdoor elements while providing a natural open-air ventilation system. Blurring the lines between inside and outside spaces, the facility has an interior animal treatment facility, an open air teaching pavilion, as well as an exterior garden. The facility implements strategies for sustainable practices through natural ventilation systems, mounted photovoltaics, and water run-off collection tanks. In the end, the facility demonstrates unique ‘island’ design solutions for teaching, learning, and observations alike.
The Vanke Pavilion was designed in 2013 as part of the Tsingdao World Horticulture Exposition. Designed by Slow Architects of Quindao China, the structure demonstrates a timber roof structure under which unconditioned spaces create a free flowing and natural layout. Consisting of a café and break area, integrated table and seating spaces allow the structure to blur the lines between indoor and outdoor conditions. The roofs are supported by a column and beam construction system that highlights the beauty and openness of wood as a material. In addition, this construction allows pre-fabricated assemblies and a low impact on-site construction to leave less impact on the environment. This small café allows people to, “sense the beauty of sustainable wood building while providing them a place to relax.”

ROOF SYSTEMS

The functionality of the roof system for this facility is extremely dependent on the sustainable practices that it employs. In order to achieve a zero carbon footprint, the practices will include rain collection, solar panel integration, natural ventilation, and daylighting strategies. Within this section, the strategies begin to show how systems will be integrated and work together as a cohesive system. Being able to understand these systems and how they are properly integrated will affect the design decisions of the facility in many ways.
SOLAR PANEL INTEGRATION

When mounting solar panels, it is important to determine the angle of installation. This angle will give the ultimate sun capture for solar panels and create the most power for the facility. For any particular location, the latitude of the chosen site determines this angle. For latitudes that are positive (northern hemisphere) the panels should be facing towards the south. For the site on Little Barrier Island, the latitude is negative (southern hemisphere) reading at -36 and will require 36 degree panels that are facing north.

Integrating this into the design will be vital to the roof pitch and overall design of the facility. It changes the look and functionality of the roof system in order to reach the highest potential for sustainable practices and a reduced carbon footprint.

RAINWATER COLLECTION

Rainwater collection systems are important strategies to integrate with these solar panels. In order to create a zero carbon footprint facility, each and every roof structure will be designed to collect and store rainwater. As the island is most commonly seen cloud capped, the annual rainfall provides ample water for the use of this facility. These tanks will feed directly into the restroom, cooking, and research facilities to provide a sustainable solution to water consumption. Designing a proper gutter collection system and indicating where tanks can safely be stored will affect the layout and design of this roof system.
LAB SAFETY AND LAYOUT

In order to understand the layout and requirements for laboratory buildings, information from the Australia/New Zealand Standard for safety in laboratories is as follows. With issues such as counter top layout, seating arrangements, containment line, and surface quality, the guidelines are quite strict. Understanding these principals is important to the layout of the lab spaces within the educational facility of this project. However, since the educational facility will not be a strictly regulated lab space, the lab area on the island will be a variation of these guidelines.

Due to the fact that this site is so unique, unconventional teaching and learning environments drive the layout of the facility. As many of the lab spaces will spill out into outside lab areas, open air and unconditioned dissection tables, and exterior wildlife enclosures with activities such as bird banding, visitors will be able to truly experience the outdoor flora and fauna of the island.

AS/NZS Safety In Laboratories - Part 3: Microbiology safety and containment

PC2 Laboratory Facilities:
Plant and animal research
Specific containment lines (entry/exit)
Appropriate lab support spaces
Ventilation/Containment requirements
Easy to clean surfaces
Separation of write-up and lab space

This diagram identifies specific layouts for small, intermediate, and large lab spaces within a typical laboratory building. With bay areas identified for proper seating arrangements, the lab tables are spaced accordingly depending on the number of seats that need to be filled. As the typical bay area would be 10’ 6” and the width of a lab is 30’, these labs can become quite large in order to accommodate the high tech equipment being used. However, this high tech equipment requires tremendous amounts of power and energy that can be seen as unnecessary for the research that aims to be conducted on the island.

These layouts are a precedent study for the lab set-up for this facility. Understanding these initial principals and spatial relationships will allow smaller lab spaces that are seen as more appropriate for the island to function in the correct ways. Having such large lab spaces on Little Barrier Island would be unnecessary for the number of people visiting the facility at any given time. In order to have a smaller physical footprint as well as a low carbon footprint, the scale of these labs will be diminished.
Due to the location of some of the easements and restrictions of the site, these three schemes on the right indicate the closest relationships that the historic marker of the whare can have to the facility. Marked in yellow, the historic marker tries to physically link the traditions of the past with the facility and vision of the future. With the limited space on the northern most part of the settlement area, my initial reaction was that the more southern site is more ideal. The initial idea was to create a facility that has individual structures for different functions of spaces that are all adjacent to each other and share a common architectural language.

The orientation and pathway of travel to the whare is most important, as it becomes the gateway to the facility and starting point for all visitors to be received. As indicated by the client, the southwest orientation is desirable for the whare. This is mainly due to the approach to the island, landscape around Te Maraeroa and how traditional defense mechanisms of the Maori culture were developed. The diagrams to the left in red start to show this orientation as well as building mass, framed views, and the circulation scheme for the facility.
Initial concepts for the facility look at organic shapes for inspiration. Understanding the flora and fauna of the island, these organic shapes make a nod to the surrounding landscapes and environmental integrity of the island. However, these shapes pose some fundamental issues concerning construction feasibility. With organic shapes, the flat-packed and pre-fabricated construction method is not realistic. With more orthogonal geometries, construction will be easier and less invasive on the environments of the island. In addition, the cost effective factor for organic versus orthogonal shaped geometries does not give a valid enough reason to proceed with this concept.
SCHEME 1

Moving toward an orthogonal layout, this initial scheme develops the southern most site of the Ngati Manuhiri settlement. In accordance with Maori design, the whare and surrounding accompanying facilities are to be separated. This notion is deeply rooted in the Maori tradition of separate structures for food storage, sleeping, cooking, etc. However, the facility aims to have a cohesive architecture language from structure to structure so it can be read as one unified facility.
WHARE DESIGN STRATEGIES

Reflecting on scheme 1, it becomes vitally important to understanding the process for the whare entrance and arrival. Traditionally, the welcome begins at the whakaeke where a group of visitors will gather together in order to be formally received. Once they are called upon by the Ngati Manuhiri iwi to enter, a ceremonial walk is done across the marae atea. Once all visitors enter into the whare, a formal greeting from the Maori people will occur inside. This completes the formal welcome and visitors are free to use other facilities on site as needed.

When determining the location of this whare, it is important to look closely at this process. Diagramed here is the traditional pathway of a typical visitors to a whare. Adding the southwest orientation of this specific Ngati Manuhiri whare, there is a further understanding of the pathways that should be put in place for this whare.
The two schemes shown below take this pathway system into account in accordance with Maori design strategies and principals. Between the two locations, the northern most location is more appropriate for the whare. Due to the direct pathway on the northern scheme, the southern location becomes a confusing journey to the formal greeting area. As the whare is supposed to be viewed straight ahead when guests are arriving, the pathway system of the northern scheme is more successful. All further schemes will take this whare design principal into account and use the northern scheme as a base for spatial planning and layout.
SCHEME 2

Scheme 2 develops the proper whare location on the northern site, while separating the accommodation, sanitary facility, and dining area from the research branch of the facility. This separation allows more blending of indoor and outdoor space between structures, pathways, and gathering areas. The iterations on the left explore these pathways, building placement, and framed viewports that are vital to the facility.
Looking closely at the easement placement and bush line in the northern site, the whare is located near the historical marker, in accordance with the aspirations of Ngati Mauhiri. With ample amount of room for the open courtyard marae atea, the environment naturally compliments the layout and concept of this design. As the bush line is naturally flowing, spaces for sanitary facility, dining area, and gathering spaces slip in and out of the tree cover. Through the study of this bush line, the small and large areas of available space give enough restrictions to reach a feasible solution to the design.
ENVIRONMENTAL EFFECTS

With the prevailing winds coming from the south and southwest, built structures on the island must be appropriately placed respond to the environmental conditions. For many months of the year these winds can be very strong and unpleasant, therefore it is important for exposed areas to have some kind of method to block these forces. For the northern most site, this is less of a problem as the bush line will block most of these winds. However, the southern site is quite exposed to the shore and raises issues for sheltered spaces. In order to address this, the lab and educational branch of the facility will be situated to blocks these unpleasant winds. Placing buildings down wind from any potential outdoor gathering spaces will create more pleasant and shielded areas from the elements.

As the location of the site is in the southern hemisphere, it is important as well to consider the northern sun exposure on the site. In order to create pleasant outdoor space, the exposure of sun is very important to the efficiency of a space. Within the southern hemisphere, the optimum hours of sunlight exposure are typically seen through a north-facing courtyard. This north-facing courtyard will allow daylighting to occur within the facility while incorporating indoor and outdoor elements. The diagrams below show the design process and transformation of this northern facing courtyard scheme for the research center.
SITE SELECTION

Taking a closer look at the location of the research and lab facility, it is important to touch the ground lightly and have as little environmental impact as possible. In order to accomplish this, I have placed the facility close to the easement area previously identified. As this area is unbuildable, it can be seen as the worst part of the site. In order to repair this unsuccessful site, the facility will be placed adjacent to the easement helping to engage the site with outdoor activity. This helps to turn the unbuildable area into a useable site for teaching and research in a unique place. In addition, the engagement with existing pathways around the site allows the research facility to plug directly into the circulation of the existing area.
ARCHITECTURAL LANGUAGE

This diagram demonstrates the development of the research wing and accompanying facilities. Changes in the layout and 3 dimensional representations have overtime created an architectural language and priority for design. In order to apply sustainable strategies such as water collection, solar panel integration, natural ventilation, and daylighting, the roofs are designed to be high performance roof systems. These roof systems will provide shelter for the conditioned areas of the educational facility, as well as capture water for facility reuse, harness the suns energy for electricity, and ultimately create a low carbon footprint. With pitched roofs that are situated at the ultimate angle, these systems become a driving force for design. Below is the final design iteration that is the appropriate size, roof pitch, and complexity for the needs of the research facility wing.
DESIGN OUTCOME

This plan show the separation of the marae/meeting house and joining facilities from the research wing on site. On the top, the whare is located near the original wooden marker indicated by Ngati Manuhiri. The bottom plan indicates a scheme for the research and educational facility. As well, this 3 dimensional view gives a spatial idea of the facility on site with the existing pathways and bush.
NOA AND TAPU

The line indicated below shows the noa and tapu sides of the facility that separates the spiritual journey from everyday experiences. As well, the circular areas indicate where further gathering spots are created by the layout. With the more important fire pit gathering area near whare, more informal spaces below give protected areas from wind, rain, and other elements.

PATHWAYS

Highlighted in blue (below) is the initial pathway that visitors will experience when approaching the facility. This is a more direct and spiritual journey as groups are received into the whare first. The later pathways highlighted in orange and red are more day-to-day pathways that guests will use for dining, restrooms, and access to the research wing.
WHARE

The series of perspectives shown below indicate the current design proposal for the whare portion of the facility. Highlighted in yellow, the views track a typical journey of a visitor through this branch of the facility. With a north-facing courtyard indicated in plan, the orange arrows demonstrate sun exposure penetrating the open gathering space. This allows for pleasant daylight hours for seating, dining, and gathering all year round. In addition, this northern exposure is being harnessed by mounted solar panels within the roof system. As all roofs are collecting water, a water tank collection system is supporting the needs of the facility.

Red arrows below indicate the ceremonial pathways for the initial greeting ceremony into the whare. Pathways that stem from this structure indicate more day-to-day pathways to be used for dining and restroom needs, highlighted in blue.
RESEARCH WING

The research wing of the facility uses the north-facing courtyard as well as it demonstrates sun exposure and the importance of daylighting from the north. In addition, this north facing courtyard scheme blocks the harsh winds and elements that are typically coming from the south. Indicated in blue, the harsh south and southwesterly winds are prominent on this exposed site. The layout of the lab buildings aims to block these harsh elements and keeps the courtyard, gathering spaces, and educational areas pleasant.

Indicated in red, the circulation paths between lab space, indoor and outdoor, and teaching areas is free flowing and flexible. As well, the red arrows indicate the different framed views that the architecture starts to take advantage of. The perspectives below explore more of these view ports and how one would circulate accordingly around the facility.
In conclusion, ‘Design for Diversity’ explores the importance of threatened biodiversity, the cultural issues in New Zealand that surround it, the steps that can be taken to preserve it, and the complex and controversial architectural solutions that it can support.

The project acknowledges traditional architectural typologies of the indigenous Maori culture by looking at important patterns of the past. The aim was to understand culture and design in a different time and place and what unique solutions can be achieved. By understanding the issues of Maori layout, building separation, and architectural sensitivity, a new understanding of design is achieved. Further researching the panelized system, lightweight structure, outdoor integration of spaces, and spatial layout of island architecture as a whole will inform further design decisions for the facility. Keeping the Te Aranga principals in mind, the project has and will continue to keep a constant focus on cultural heritage. Achieving one of the main objectives, the facility connects the people of New Zealand back to the rich landscapes of the past, present, and future.

Sustainably, the project develops a highly integrated and functional roof system that supports a low environmental impact. Employing strategies such as daylighting, natural ventilation, rain collection, and mounting solar panels the low carbon footprint is achieved. As a fundamental aspect of preserving biodiversity, it is most important that these strategies are an active part of the facility from day one. In order to further understand these principals, more integration and documentation of these functional systems needs to be done. For the final design, development of these systems will be included.

In the end, the facility gives a successful solution to an educational facility on an off shore island in New Zealand. It begins to raise awareness for the ecological threats that the world is facing today and highlights research as a feasible solution. It gives a starting point for other areas around the world to employ similar principals concerning construction, sustainability, research, and design to support biodiversity in today’s diminishing environments.
Figure 1: Design Initiative Diagram.
Figure 2: Species Extinction and Human Population.

Figure 3: Where species went extinct, World Map.

Figure 4: Diagram and Classification of Species Threatened.

Figure 5: Table with Numerical Values for at risk and Endangered Species.

Figure 6.1: Primitive Maori Village.

Figure 6.2: Fortifications on Primitive Maori Village.

Figure 7.1: Semi-Permanent Dwellings.

Figure 7.2: Fortified Trenches of Maori Village.
Reproduced by http://www.megalithic.co.uk/article.php?sid=31436 ; As seen in the Auckland Mueseum.

Figure 7.3: Canoe/Waka Landings.

Figure 8: Traditional Marae structure becomes the center of the Community.

Figure 9.1: Diagram of Structure of a traditional Marae.

Figure 9.2: Façade of Traditional Marae Building Typology.

Figure 10: Modern Marae, Unitec Institute of Technology Campus, New Zealand.
Reproduced by Te Noho Kotahitanga Marae (Unitec) axonometric perspective diagram modelled in Revit Architecture by S.Hutana 2011.
37 Figure 18.3: Ngati Manuhiri Settlement Area. Reproduced by Title Plan SO 440008 Toitu te whenua: Land Information New Zealand. Surveyer: Be-\text{ca} Infrastructure Ltd.

38 Figure 19.1-19.3: Photos of Journey and Approach to Little Barrier Island.

39 Figure 19.4-19.6: Photos of Journey and Approach to Little Barrier Island.

41 Figure 20: Sketch of Approach to island indicating existing buildings and Settlement Area.

42 Figure 21.1-21.2: Site Documentation and Analysis.

43 Figure 21.3: Site Analysis of Pathways and Historical Markers.

44 Figure 22.1: Photos of Site.

45 Figure 22.2: Photos of Site.

46 Figure 23.1: Photos of Site.

47 Figure 23.2: Photos of Site.

48 Figure 24: Analysis of Program with Ceremonial pathways versus Everyday Pathways.

49 Figure 25: Diagram and Associations of Programmatic Elements.


50 Figure 26.2: Tuhoe Center Images for the “Living Building Challenge”. Reproduced by http://architecturenow.co.nz/articles/surviving-new-zealands-first-living-building/.

51 Figure 26.3: Sustainable Strategies of Tuhoe Center. Reproduced by https://scontent-a-sjc.xx.fbcdn.net/hphotos-xaf1/t31.0-8/474865_433239926772931_670137774_o.jpg.

52 Figure 27.1-27.4: The Hawai‘i Wildlife Center Images. Reproduced by http://www.archdaily.com/159928/the-hawaii-wildlife-center-ruhl-walker-architects/.


54 Figure 29: Sustainable Strategies for Functional Roof Structures. Reproduced by http://www.designshare.com/index.php/projects/islandwood/images@2968.
55 Figure 30.1: Orientation and efficiency for Photovoltaic Installation. Reproduced by http://www.noutilitybills.com/solar/APIInstallationBasics.html.


56 Figure 31: Lab Layout Strategies.

57 Figure 32: Lab Size and Unit Exploration.

58 Figure 33.1-33.4: Orientation and Building Location Drawings.

59 Figure 34: Initial Concept Design Sketch (Organic Shapes).

60 Figure 35.1-35.6: Scheme 1 Concept Design Sketch and Building Layouts.

61 Figure 36.1-36.5: Three Dimensional Representation of Scheme 1 Building Proposal.

62: Figure 37.1-37.2: Diagram of Whare Approach Strategies and Formal Greeting Process.

63 Figure 38.1-38.2: Diagram of Ceremonial Pathways for different Whare Locations.

64 Figure 39.1-39.3: Iterations of Scheme 2 Building Layouts.

65 Figure 40.1-40.3: Exploration of Whare layout with Surrounding Toilet and Dining Facilities.

66 Figure 41: Development of Research Complex Layout.

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68 Figure 43: Architectural Language Development.

69 Figure 44: Final Development of Research Complex Architecture and Layout.

70 Figure 45.1-45.2: Final Design Outcome.

71 Figure 46.1-46.2: Diagrams of Spiritual Pathways and Gathering Spaces.

72: Figure 47.1-47.3: Whare Complex Final Design Concept.

73 Figure 48.1-48.2: Perspectives of Marae Complex.

74 Figure 49.1-49.3: Research Complex Final Design Concept.

75 Figure 50.1-50.2: Perspectives of Research Complex.


Architecture demands a certain responsibility to the changing environments of today's world and the sustainable practices that can support it. Overtime, this responsibility has only become more important as habitat loss, pollution, over-exploitation, and species introduction are increasingly affecting the diversity of landscapes and resources of today's world.

How can a research facility on an off shore island in New Zealand educate and promote change for ecological significance and biodiversity? How can architects and designers ‘design for diversity’ while taking into account cultural context and the unique environments that surround them?

This architectural project aims to explore the architecture and planning of an educational facility that is deeply rooted in the cultural ties of the land, and the island solutions that support it. In the end, the project develops a design proposal that compasses indigenous knowledge, values, and understandings in conjunction with western science practices and research.
Ceremonial and Everyday Pathways

Noa and Tapu gathering spaces

Sustainable practices Plan

Butterfly roof rain collection system
Photovoltaics 42 x 120 watt Panels
(5 kWatt System)
Rain collection tanks for immediate use
(4500 Liters Each)
Rain collection tank 25,000 Liters
(Underground)
Primary tank of a Living Machine system
(Equalization Tank- 30,000 Liters)

Energy Connection Line
Water Collection Tanks (Above ground)
Solar Panel
Living Machine Tanks
Fill and Drain Planters
Water Collection Tanks (Underground)
Battery and Generator Room
Pelton Wheel (Micro-hydroelectric Energy)
View Points for Perspectives
traditional marae building separation from marae access points and circulation central gathering space larger courtyard scheme
dining and toilet facility programmatically separated
northern facing courtyard view points and access clear circulation pathway enclosed central gathering space addition of entry piece programmatic lab areas allocated

Section through marae and fire pit
Marae entry

Marae and dining facility

Outdoor cooking area and courtyard

Night time fire pit gathering