

# Active Coastlines

Implementing a sustainable transport scheme for  
Evans Bay, Wellington





Active Coastlines: Implementing a sustainable transport scheme for  
Evans Bay, Wellington.

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# Abstract

With the rise of popularity in cars and the decrease of public open space in our urban centres, there is an increasing pressure to find alternative modes of transportation. Human powered transport in New Zealand is becoming more popular over the last decade, however it is often let down by the isolation and functionality of the existing infrastructure. Active transport can be understood as an alternative mode that is strictly human powered - whether it be cycling, walking, jogging, scootering or other modes allowing for a more sustainable network. The current infrastructure development is evolved around vehicular transport and other modes are considered secondary, further highlighting our cultural reliance on the motor vehicle.

This research aims to reconfigure how sustainable transport is considered, in order to promote and implement active transport into our cities. Creating a sustainable link with the exclusion of cars, offers the opportunity to establish a unique sequence of spaces that is responsive to the human scale and environment. Landscape Architecture has the ability to adapt and restore natural systems in conjunction with public spaces to build healthier and environmentally conscious communities.

The proposed site for this research is Evans Bay, located in the centre of the harbour in Wellington, New Zealand. The public spaces following the bay suffer intense degradation to the natural ecologies, due to urban development and weather conditions. The current cycleway is a disconnected and unsafe path for local commuters to travel through. The research aims to re-develop the Evans Bay esplanade into a diverse active highway, offering all active modes a safer path. The design will be responsive and inclusive to ecological and communal factors producing a multitude of spaces for Wellington's sustainable network.



# Acknowledgments

The last five years has been the most impacting and life changing experience yet and I could not have completed it without the help of many people. I would like to thank all those who helped throughout the process.

To my supervisor, Bruno Marques, the advice and guidance given over the past year has truly been invaluable. You have given me the support and structure needed to successfully complete this year. You stayed positive and encouraging even when times were less than encouraging.

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Finally to my parents, John and Margot, for supporting the initial move to Wellington and continuing to support me throughout the years. Words cannot describe how important your advice and guidance has been to my success and growth as a person. I hope that one day I can return the favour to you both.



Figure. 1 The current cycle-path on Cobham Drive, Evans Bay.



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# 1.0 Introduction

## 1.1 The Situation

There is an increasing demand to implement sustainable transport into the infrastructure of cities around the world. With the increase of green house gasses in our atmosphere, the demand for vehicles needs to rapidly decrease. The world's dependence on the motor vehicle has dominated infrastructural development, with enormous amounts of land dedicated to roading and parking; reducing and polluting our natural ecologies. Sustainable technologies have been implemented into cities to reduce carbon emissions such as electric run transport. However, the space utilised by these systems is not reduced.

The bicycle, although not a new invention, is a transport system that does not use fossil fuels, but requires significantly less space during use and parking. The bicycle is an efficient form of transport that promotes active movement and exposes people to their natural environment. Cities such as Copenhagen, have adapted to using the bicycle over other forms of transport and therefore this has become ingrained into their culture. Despite physical proof and research showing the effectiveness of the bicycle, very few cities have integrated suitable infrastructure to enable its use.

Wellington is not exempt from the severe demand for the motor vehicle, with the housing demand rapidly growing, this means that the urban sprawl is also expanding. The topographical distribution of Wellington's suburbs pushes residential development further from the city centre. This has created a problematic matrix of roadways, which priorities vehicular transport over that of commuter pedestrians and cyclists. With the sprawl of urban centres; the increase in commuting distances and the unsustainable transport options, the densification of vehicular infrastructure has led to high congestion, carbon emissions, social exclusion and natural degradation. The once 'clean, green' image of New Zealand is becoming more unrealistic as our natural landscapes are being developed for larger, more efficient roading infrastructure.

Modern trends of eco-friendly and sustainable methods of public transportation have seen Wellington develop a bus and train network connecting people to the city. Within this development, there is a prominent desire to introduce alternative forms of transport that can contribute to healthier, urban lifestyles. However the current infrastructure implemented for cyclists and other active modes is poorly designed with insufficient planning, resulting in inadequate use.

The investigation examines the re-design and manipulation of how public spaces can be integrated with sustainable transport, in order to promote active modes and consolidate the diverse communities of Wellington. The integration and establishment of diverse public spaces and sustainable transport can create a public hub that is connectable and accessible to the urban matrix. The research will explore and test systems to foster human comfort, balance aesthetics and produce modern links that allow everyday commuters to travel between suburbs safely and efficiently.

## 1.2 Problem Statement

The invention of the motorised vehicle led to many changes in terms of social structure and built infrastructure throughout communities. Cities have been constructed with and built around the infrastructure needed for the car and unfortunately this has created significant congestion, degradation of existing ecologies and spaces that are undesirable for humans. Wellington is no exception to the devotion the car has been given, with its city being formed around highway construction. Although Wellington has one of the higher uses of public and active transport in New Zealand, as seen in figure 2, with 32% of people using public transport, cycling, jogging or walking to work, compared to New Zealand's 13% (Statistics NZ). Development of a sustainable network can continue to increase the percentage of sustainable commuters.

In Wellington, an average of 44,000 people travel into the city by car daily; most of these commuters travel alone (Ara). Not only does this use a significant amount of space in the city to hold the parked cars, but it also leads to social exclusion within our communities. With the lack of proper functioning public transport amenities, people who do not have a car, are restricted in terms of everyday necessities such as education, work, health care and other things such as shopping, sports clubs etc (Sean Creighton). This exclusion has adverse effects to the functioning and value of our communities and will not be solved as long as the vehicle is given priority throughout our public realm. Although there is accessible public transport, research shows this often does not allow people the same efficiency - whether it is the frequency of the bus or the distance to bike (Rose, Witten and McCreanor 191-203). Wellington holds a unique opportunity to reduce social exclusion through active transport, as its compact city grid means that travel distances are relatively low. The use of active transport prevents people from being blocked off inside their personal cars. The use of a bike, walking, skateboarding, and scootering, exposes users to their surroundings and can promote interaction with other people. Human exposure to nature and green spaces has been a thoroughly researched concept since the industrial revolution, however significant studies show that exposure to nature significantly improves human health and wellbeing (Bowler, Diana E). Despite Wellington's abundant natural landscapes - from the rugged coast of the south, to the green belt encasing the city - we do utilise the environment to its full potential.

The bicycle is a comparatively cheaper transport option to the vehicle and requires notably less development to create efficient links. With modern trends promoting the use of the bicycle, tax-free systems have been implemented in areas such as the United Kingdom (Cycle To Work Guidance). Tax-free systems in conjunctions with effective infrastructure will create an accessible transport option for all spectrums of social class.

The bicycle has a multitude of beneficial elements from health to space reduction for our communities, however the appropriate infrastructure and systems need to be implemented to fully utilise its potential. Wellington's current cycleways are disconnected



and dangerous; often forcing people to come into harms way. Cyclists, along with other active modes need to be given priority within our cities to lower car dependence and develop sustainable communities.

Bicycles require significantly less space when not in use; a contested issue with vehicles in Wellington's dense city grid. As seen in figure 2, at least ten bicycles can fit into the standard car park of 12m<sup>2</sup>. Space reduction within cities offers opportunities to increase the public realm, enhancing the liveability on the human scale.

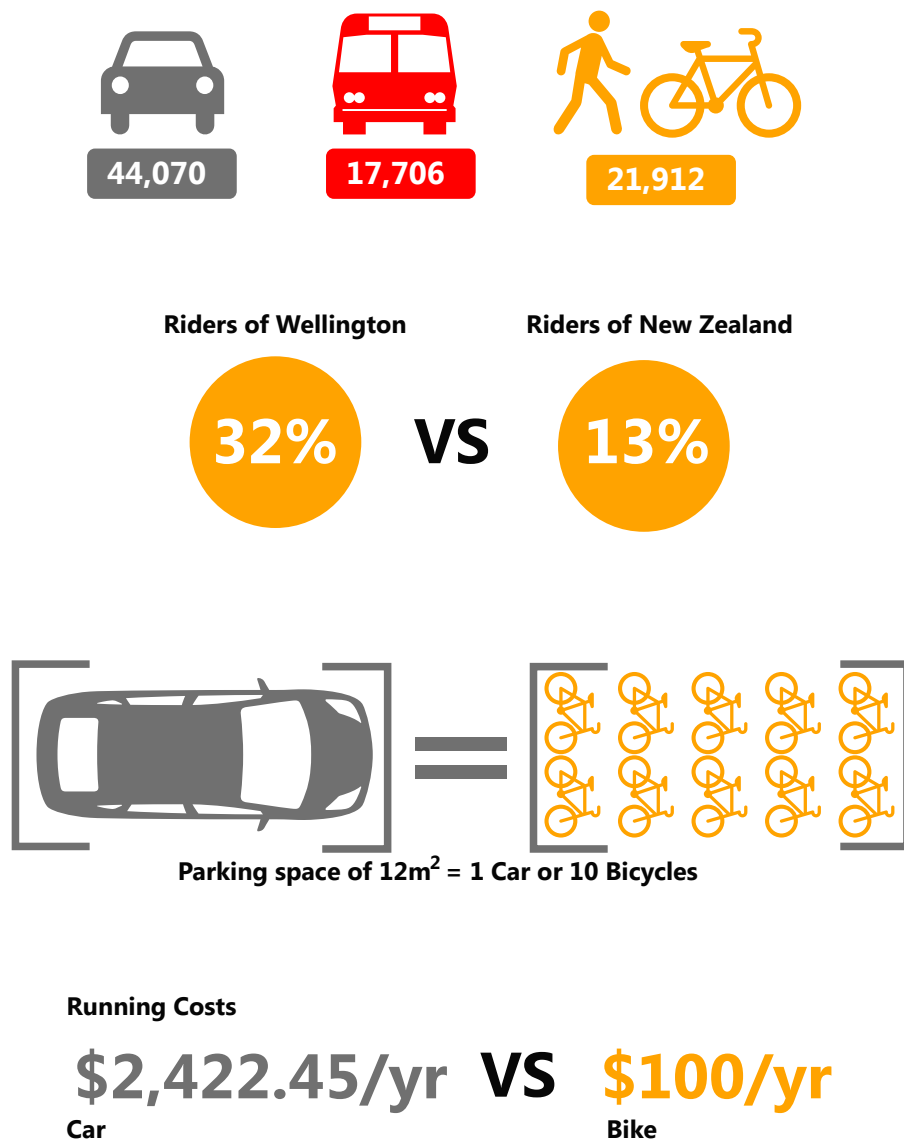


figure 2: Assessment of the current use and cost of a bicycle compared to other modes. (Data from Statistics NZ)

## 1.3 Scope

This research investigates the issues with the current use of cycleways and how the use of alternative sustainable commuting methods can be promoted. This design aims to develop a potential precedent for future cycleways, in order to increase the use of active transport and lower the dependence of cars. The research uses Evans Bay, Wellington, situated at the lower end of the North Island, New Zealand (figure 3), as a case site to research potential solutions.

Evans Bay is popular thoroughfare for the eastern suburbs of Wellington and a vital link from Wellington's airport to the central district. The coastal section of Evans Bay currently has a cycleway. However, it is heavily degraded by being exposed to the harsh winds, making it unsafe for users. The area was previously redesigned to add an aesthetical value for people travelling through the site, but due to the conditions, vegetation and walk-ways have not maintained its aesthetical value.

This thesis does not follow the usual infrastructural model, where function is the soul driver. Although function is a vital component, it will be intertwined with aesthetics, ecological systems, community needs and site specific narratives. The combination of these factors will revitalise the area of Evans Bay into a communal thoroughfare and provide a precedent for sustainable links.

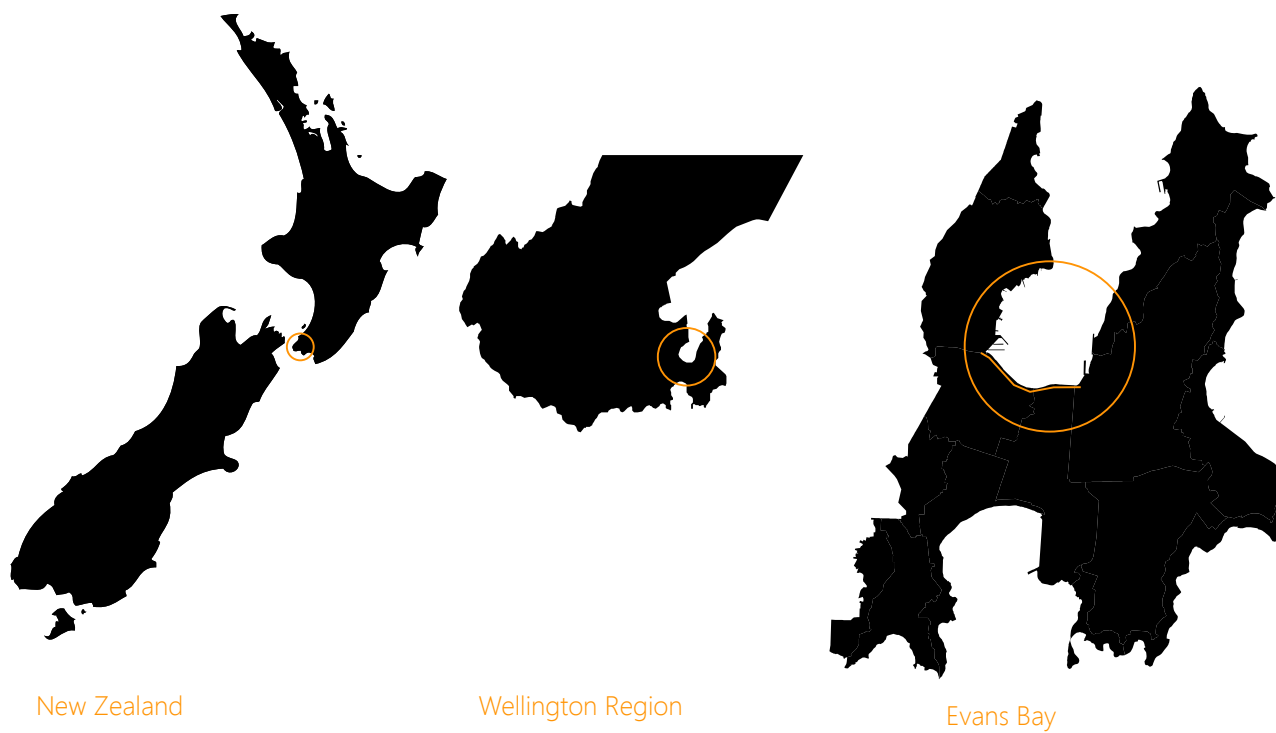


figure 3: Location of the research in Wellington, New Zealand.

## 1.4 Methodology

This design led research follows an iterative methodology, to evolve design issues into potential solutions. The design will be driven by site-specific details at various scales and tested against multimodal requirements outlined by appropriate sources. Through critical assessment and analysis, the design will refine and develop potential usability issues. The research will use theoretical and physical precedents to aid the advancement of components as well as the overall design. (Cobb et al. 10)

### Regional Issues

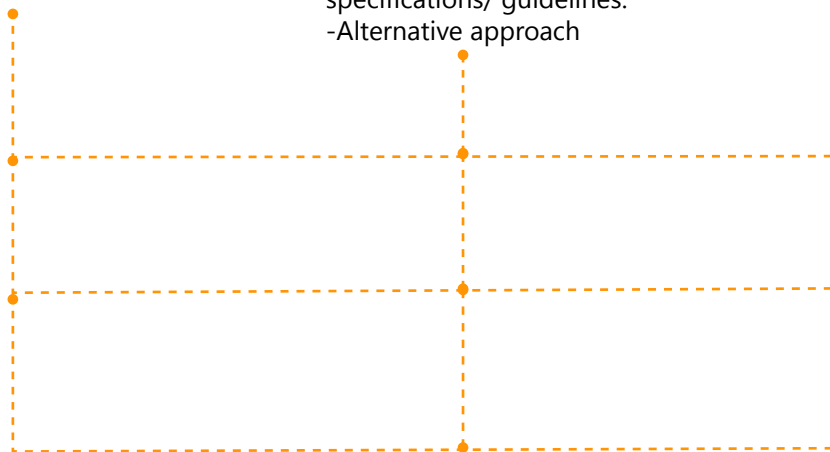
- Problematic Areas

### Site Exploration

- Problematic Areas
- On-site evaluation

### Theoretical and Precedent Analysis

- Key design specifications/ guidelines.
- Alternative approach



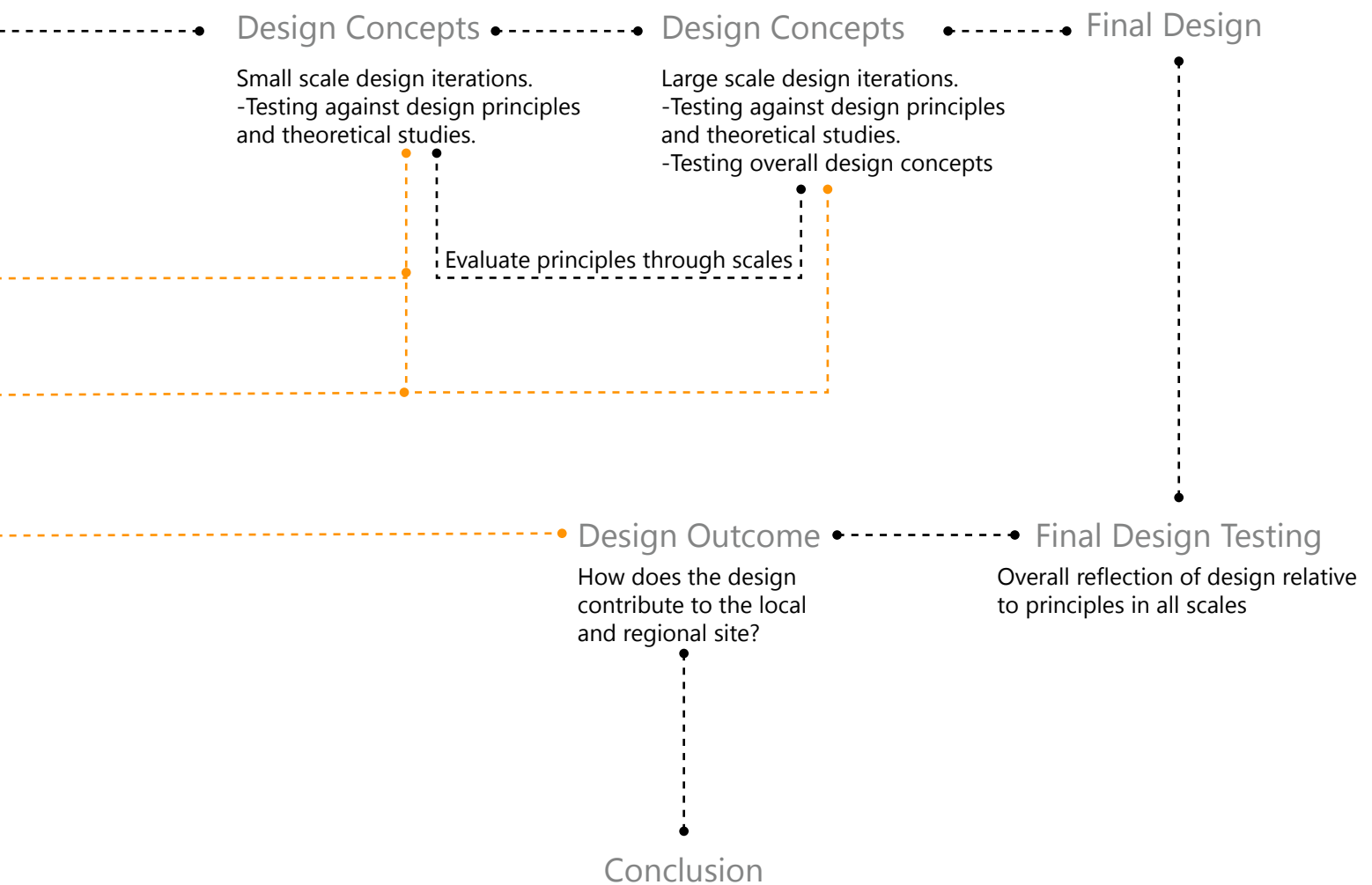


Figure 4: Methodology structure









## 2.0 Site Analysis

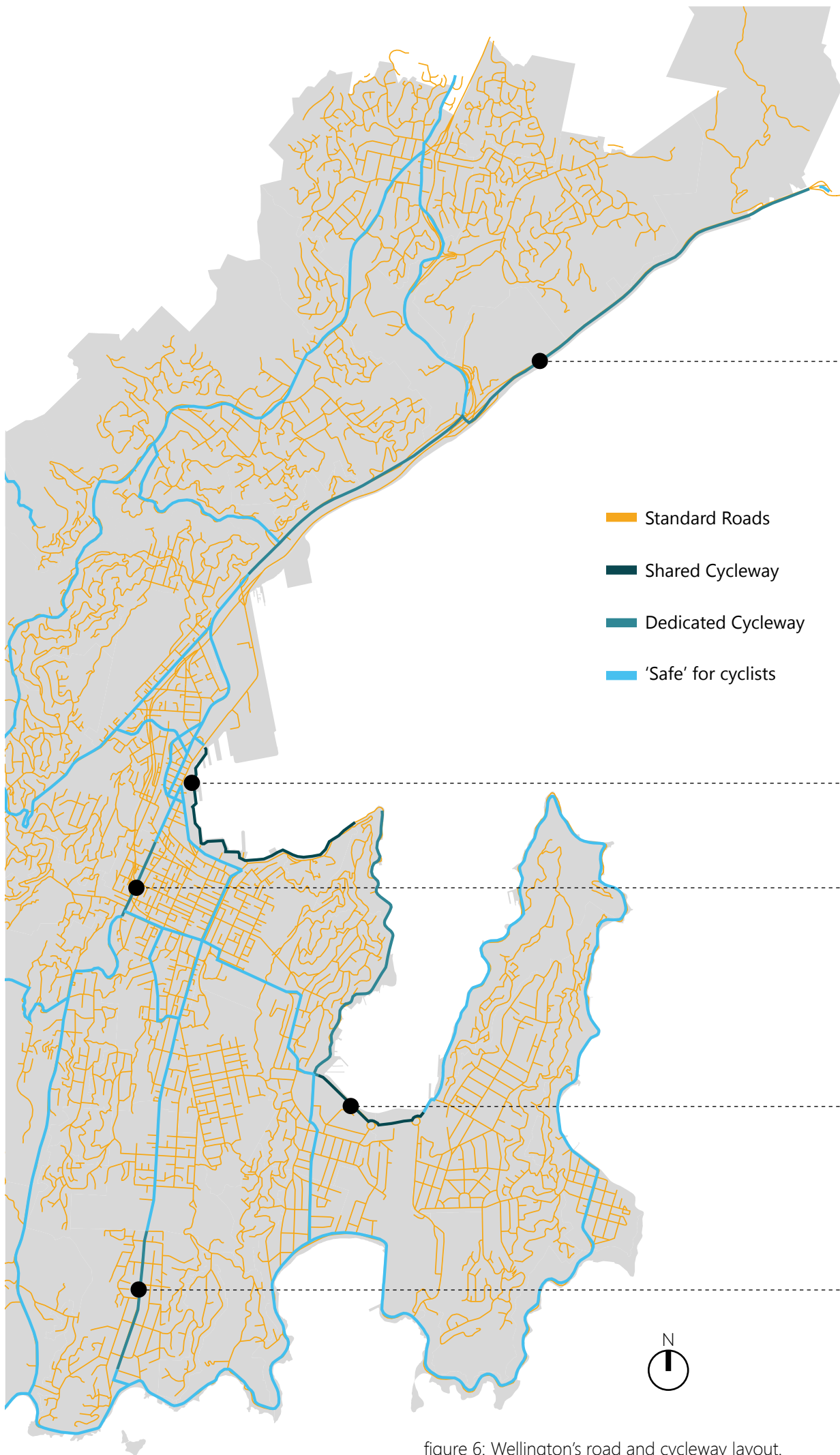


figure 6: Wellington's road and cycleway layout.

## 2.1 Wellington's Cycleway Network

### Seatoun Cycleway

Wellington's current cycleway network is extremely disconnected, making efficient and safe commuting difficult. As shown in figure 7, the dedicated cycleways are isolated and only joined by standard vehicle roads. When the cycleways end, generally users have to share main roads with vehicular traffic with no visibly marked lanes to separate modes. Currently the only separated cycleways are the Island Bay Cycleway and the Victoria Street Cycleway, which combined are 2.3km in length. Wellington waterfront, Oriental Parade, and Evans Bay are considered cycleways, however are shared with many different modes and do not have the infrastructure to deal with the congestion.

### Wellington Waterfront

### Victoria Street Cycleway

### Evans Bay Cycleway

### Island Bay Cycleway

#### Cycle-way Dedication

**Wellington's Roads**

**17.8% are Cycle-Safe**

**32% are Seperate lanes**

**45.9% are Shared with Pedestrians**

**2.5%** of Wellington's road network is dedicated to bicycle only lanes.

figure 7: Statistics of current issues with cycleways in Wellington.

## Current Cycleways

New Zealand cycleways are often very basic designs attached to roading networks. Road signals and markings are used to indicate to users where the dedicated areas are and occasionally barriers are implemented for safety (figures 8-9). The simplistic design can be functional, however is undesirable for the cyclist due to the close proximity to vehicular traffic. Other cycleway designs, as seen in figure, use a planted barrier to create a more significant divide between modes. Ensuring user safety is a key concept for promoting cycleway use (Beetham, J, 78).



Figure 8. : The basic road side cycleway.

This is the simplest form of a cycleway and is relatively common within New Zealand. The lane is clearly marked with bright green road markings and road signs indicate where the lanes start and end. This however is not separate from traffic, which can be intimidating to users and does not provide a protective barrier between cyclist and vehicles.



Figure 9: The basic road side cycleway, with added lane barriers.

Similar to the cycleway above, this lane is attached alongside vehicular traffic and is marked by bright green road markings. This lane also has added yellow bollards to provide a barrier between cyclist and vehicles. Although it is not a solid barrier, it provides necessary warning to road users where the cycle-lane is.



Figure 10: A 'New York' styled cycleway with planted barriers

This is a common cycleway in other countries, such as the United States. The planted buffer offers a significant barrier between cyclists and vehicles, making it safer for both users. The solid barrier also prevents cars from pulling into the cycle-lane to park. The added vegetation increases the aesthetics of the cycleway, but can also buffer sound from the nearby traffic.



Figure 11: A 'New York' styled cycleway with planted barriers and two lanes.

This cycleway is similar to the above, with a vegetated barrier, however two lanes are available for cyclists. Having two lanes for both directions of traffic can decrease the impact on the street, as the infrastructure is bound to one side. This style of lane only creates impact on side of the road, leaving the other side for parking or loading locations.

## Current Conflicts

Although Wellington is increasing its cycleway infrastructure and investing in improvements, many people are still dissuaded to commute using the bicycle. (Beetham, J, 78)

Jean Beetham researched the current cycleway network and conducted questionnaires to understand the issue with the implemented infrastructure. According to Beetham's studies, the most common deterrent was the current road and safety issues. 79% of the interviewees specifically stated that separation from vehicles was critical aspect for improved safety. (Beetham, J, 78-79)

Commuter cyclists in Wellington are often confronted with dangerous situations, due to the lack of separation from vehicles. Figures 12-14, demonstrate the common dangers when cycling through Wellington. Current laws do not allow for cyclists to operate on sidewalks; forcing them to compete with the vehicles. ("The Official New Zealand Code For Cyclists - About Cycling")

Figure 12: With no protection barriers, cars often drive over the cycle lane.

Figure 13: Roads with no marked cycleway force cyclist to ride the narrow section between cars.

Figure 14: Opening car doors is one of the major risks for cyclists.

## Wellington Cycleways

Figure 15: Proposed Petone Cycleway

Figure 16: Built Island Bay Cycleway

Figure 17: Proposed Evans Bay Cycleway



Wellington has had a lot of attention with bicycle infrastructure, in order to improve cycle access into the city from the outer suburbs. The Wellington City Council and New Zealand Transport Agency have collected reports to efficiently connect the Southern, Northern and Eastern suburbs to the city.

#### Petone Cycleway

For the commuters riding from the Northern suburbs, the cycleway consists of a narrow stretch of footpath located in between the motorway and railway, which then blends into a confusing mix of pedestrian and cycleway zones. This area has had a proposal to renew 5.1km of cycleway (figure 15) and given a \$9 million budget. This is a much needed revamp as cyclists are battered by salt spray along the coast and put in danger along the busy roads. This connection will link with the Hutt Valley cycleway proposal in order to create an even better link for northern suburbs. ("Northern | Where - Wellington City Council Cycleways")

#### Island Bay Cycleway

The most recently built cycleway is the Island Bay Cycleway (figure 16) which connects the eastern suburbs with the city. The cycleway was completed in 2015 and is 1.7km long, bordering both sides of the road ("About the Cycleway"). Many studies were done into the feasibility and structure of this cycleway. However, reviews have been split about the final product, some strongly disagreeing with it. People argue that the cycleway was never needed in the first place and it not only puts cyclists in danger but drivers and pedestrians as well (FORBES). People lined the street with signs, started Facebook pages and signed petitions against the cycleway, however the construction went ahead.

#### Evans Bay Cycleway

The current Evans bay cycleway is a 1.5km and around 2m wide, shared with pedestrians. The cycle is majorly degraded and overgrown, making riding or even passing dangerous. The path rapidly ends, forcing cyclists to join roads with vehicles at either end of the bay. This is however one of the major routes for the eastern suburbs to commute into the city, forcing people who choose to ride to use this cycleway or weave the back streets of Kilbirnie. This area, being located in a serene bay of Wellington, holds significant potential to provide an efficient link for pedestrians and cyclists.

#### Evans Bay Cycleway Proposal

The site for this thesis was selected based on the opportunity Evans Bay provided and the lack of attention for development it had at the time. During this research the council revealed a \$7million plan to improve this stretch to create a wider and more accessible cycleway, as shown in figure 17. Although the proposed design begins to address the importance of active transport links, the issue of encouraging sustainable commuting is not conveyed in the design. In order to promote active and sustainable transport, the designs must consider ecological restoration, improved water access and increased community integration.

## 2.2 Evans Bay's Cycleway



Figure 18: The start of Evans Bay cycleway.



Figure 19: The cycleway merges with the pedestrian footpath.



Figure 20: Isolated grass areas are usually unused.



Figure 21: Pedestrians and cyclists are forced to use a 2m wide path.



Figure 22: The path is used by traffic in both directions.



Figure 23: There is no protection barrier between the footpath and vehicles.



Figure 24: Passing pedestrians can be difficult on the narrow path.



Figure 25: The vegetation is overgrown and unmaintained.



Figure 26: Two cyclists wide leaves no extra room on the side-walk.



Figure 27: Several extra path-ways meander along the coastal edge.



Figure 28: Vegetation narrows the path significantly.



Figure 29: The vegetation also prevents users seeing oncoming traffic.



Figure 30: Cyclist and pedestrians are in very close proximity to vehicles.



Figure 31: Areas of degraded vegetation offer very little wind protection.



Figure 32: The winds can be so strong, that boats loose their mooring.



Figure 33: The cycleway ends rapidly and merges into a standard side walk.

## 2.3 Historical Change

Figure 34: Miramar Peninsula prior to the earthquake uplift.

Figure 35: The Kilbirnie dune lands in 1909, prior to housing development.

Similar to much of New Zealand's coastlines, Evans Bay has a rich history that has literally shaped the way it is today. The earliest records are from the Māori oral history, stating that the Evans Bay, Kilbirnie low lands were once under water (figure 34) and Miramar was originally an island. In the 15th Century a large earthquake uplifted this area above sealevel, further uplift continued in 1855 where another large earthquake struck. (Pillans and Huber, 2-3)

The area between Evans Bay and Lyall Bay was lifted by the earthquakes and became one of Wellington's largest dune lands, prior to development around 1909, as seen in figure 35 (Lyall Bay)

After 1909, significant development in Evans Bay was due to the creation of the Wellington Airport seen in figures 36-37. In 1953 construction began on Wellington's Airport and around 3 million cubic metres of earth were moved in the process. The extra earth removed to flatten the runway was pushed into Evans Bay for further housing development. (Hunt)



Figure 36: Evans Bay in 1941.







Figure 37: Evans Bay today (2016).



## 2.5 Geology



Figure 38: Geological Structure of Wellington

- Floodplain Gravels
- Beach deposits consisting of marine grael, with sand, mud and beach ridges.



## 2.4 Suburb Population

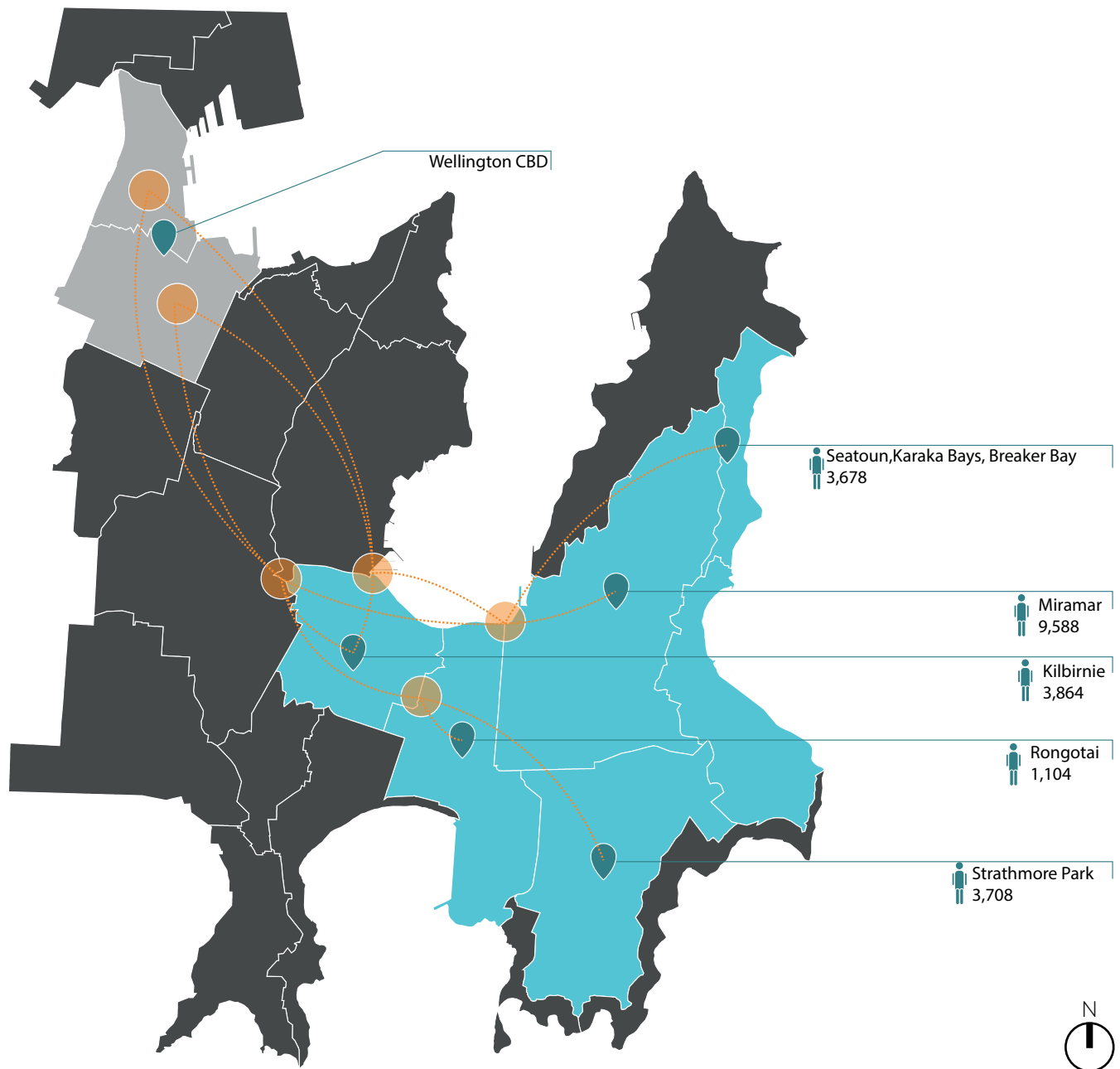


Figure 39: Populations of Wellington Suburbs.

The Wellington regions population is sitting just below 500,000 people and is expected to rapidly increase in the next 30 years ("Population Growth"). This growth has seen the eastern populations increase as the proximity to Wellington CBD and schools is optimal. (VAN DEN BERGH)

The increased population has put severe stress on the roads causing major congestion during peak traffic. However the close proximity of the eastern suburbs, it is the ideal area for sustainable commuting.

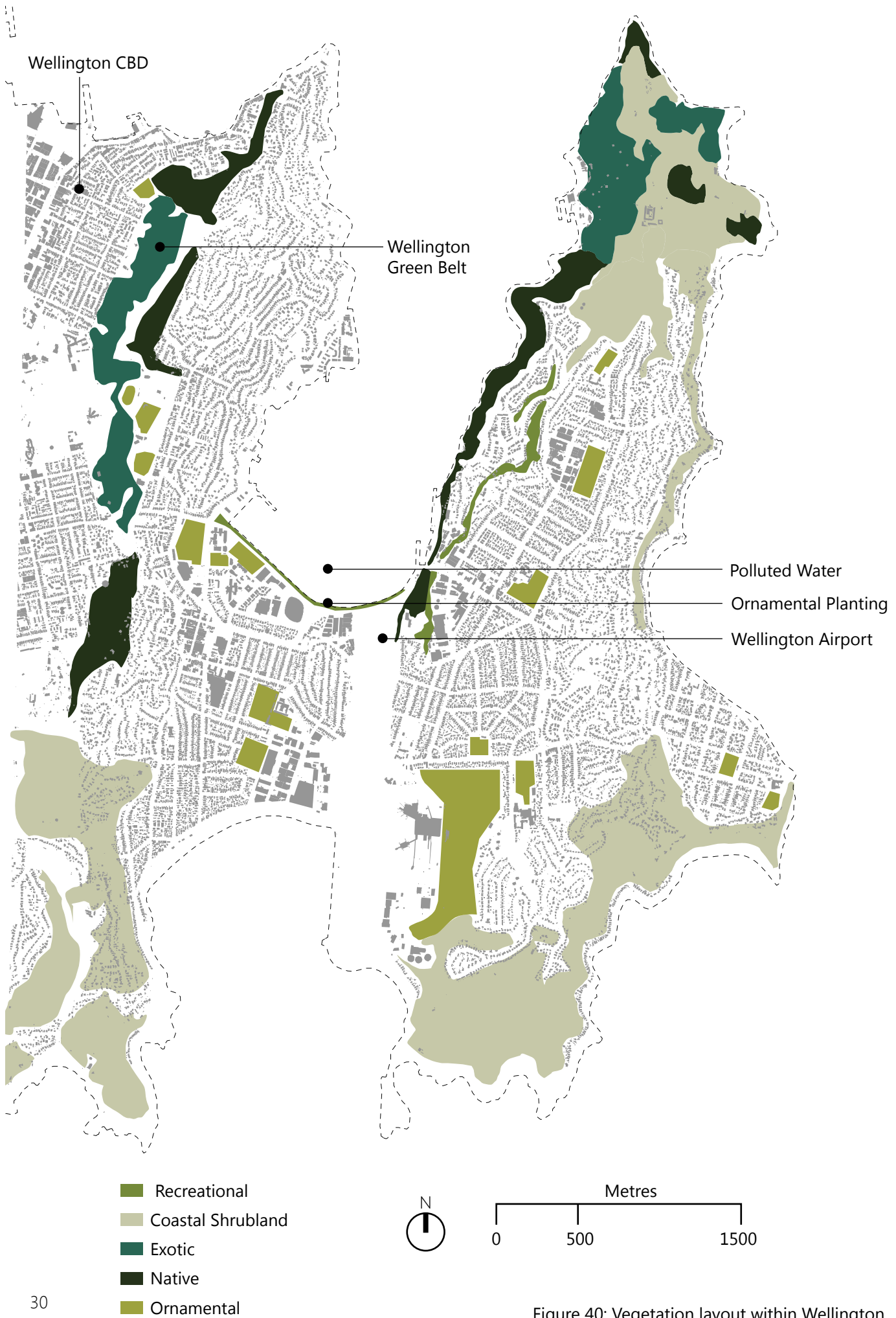


Figure 40: Vegetation layout within Wellington.

## 2.6 Vegetation

### Green Infrastructure

Wellington's green infrastructure is reasonably strong throughout the region, however areas can be stunted due to the weather conditions. The green belt surrounds the CBD with both exotic and native plantings, providing a large natural ecology. Small patches of native planting still exist in Wellington, but are overwhelmed by exotic species such as *pinus radiata*. The Evans Bay area largely consists of ornamental planting design to improve the aesthetics of the area. The planting is a mixture of native and exotics species however does not significantly enhance the ecologies.

### Blue Infrastructure

Wellington's relation with the water is a significant part of its character. However due to the stormwater outlets entering the harbour, the water is highly polluted. The pollutants and sediments that enter the water destroy the water ecology making it hard for aquatic species to thrive.

### Ornamental

The coastal area was planted in order to create an aesthetically pleasing entrance from the Wellington Airport. However, due to the harsh conditions present, plants struggled to survive. The plants that do grow on the site are stunted and grow low to the ground.



Treasure flower  
*Gazania rigens*

The Gazania flowers cover the ground and grow a bright orange flower.

Figure 41



Pohutukawa  
*Metrosideros excelsa*

The Pohutukawa trees are dotted around the coast, however do not grow to their usual large sizes.

Figure 42



Salt horn  
*Salicornia australis*

The Salt Horn is a hardy ground cover, decorating the area with its bright red stems.

Figure 43



Ice Plant  
*Carpobrotus edulis*

The Ice Plant thrives well in slaty harsh conditions, but unfortunately the dull greenery adds little to the area.

Figure 44



Taupata  
*Coprosma repens*

The Taupata grows as a ground cover/ shrub due to the harsh winds.

Figure 45



Harakeke  
*Phormium tenax*

The Harakeke on the site grows very small due to the wind and salt .

Figure 46

## 2.7 Coastal Activities

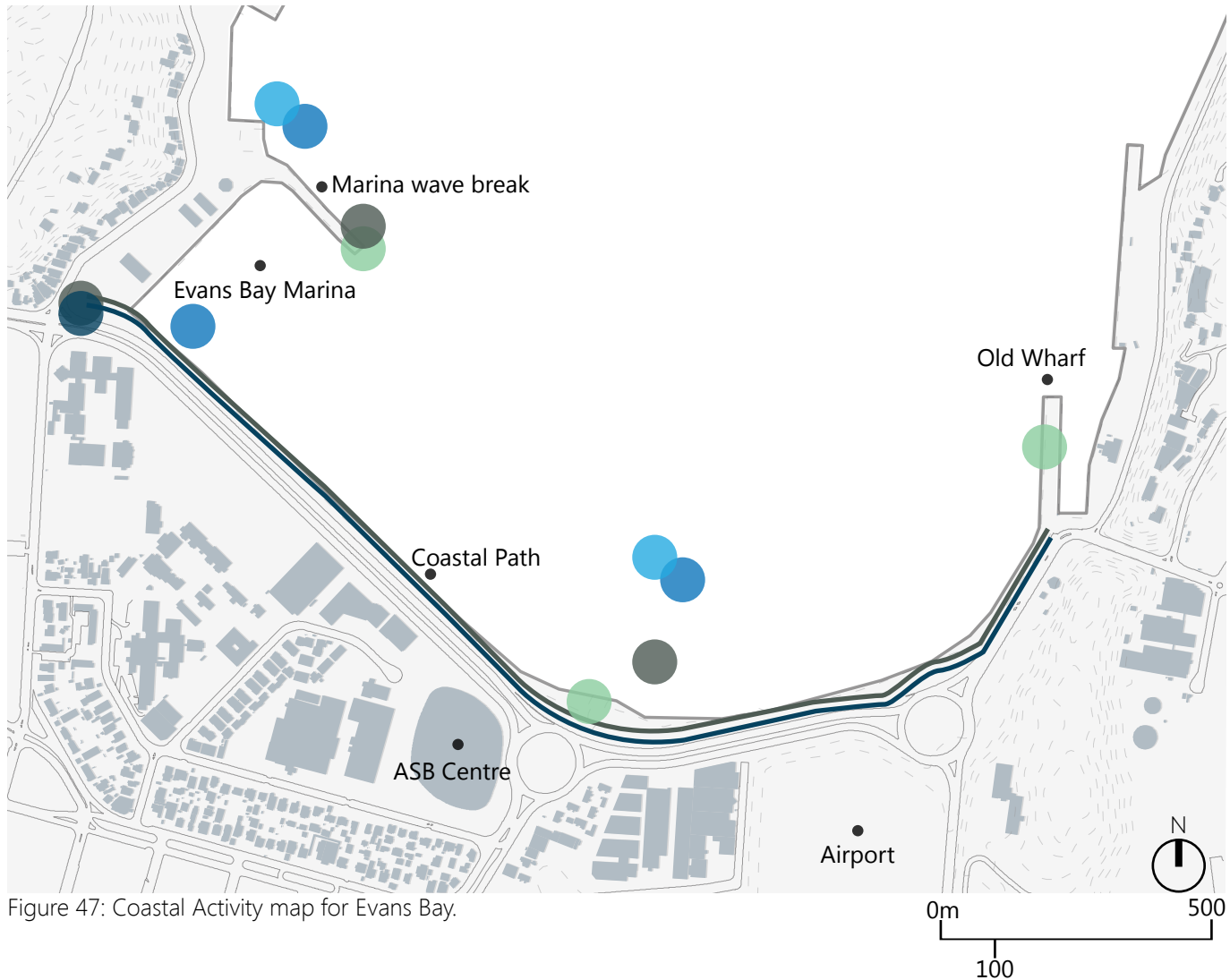


Figure 47: Coastal Activity map for Evans Bay.

Evans Bay is a popular recreational area for both land and water based activities; the mix of these activities is what makes Evans Bay attractive to users. The structures such as the old wharf and wave break allow people to easily access the bay from unique points. The complex collection of activities can however cause congestion between users. Maintaining, but managing the existing activities is important in order to keep the character of the bay alive.

#### Fishing

Evans Bay is a popular fishing area for shore-fisherman as the access is relatively easy. The wave break on the western edge allows fisherman to walk 100m into Evans Bay. The other two popular spots are the central parking bay and the old wharfs on the eastern edge.

#### Coastal Path

The coastal path is a popular route for walkers, using both the footpath and the meandering gravel walkway.

#### Swimming

Swimming is not a significant activity in the area. There are a few swimmers located around the north-west edge.

#### Water Activities

Canoeing and paddle boarding are an increasing activity in the area. The access points are concrete ramps on the north-west edge and use most of the bay when paddling.

#### Sailing

With the local sailing club and marina located in Evans Bay, the bay is often used by sailors. The central bay hosts several smaller classed yacht races.

#### Cycleway

The Evans Bay cycleway is located on the edge of the coastal walk.

## 2.8 Coastal Access/ Boat Passages

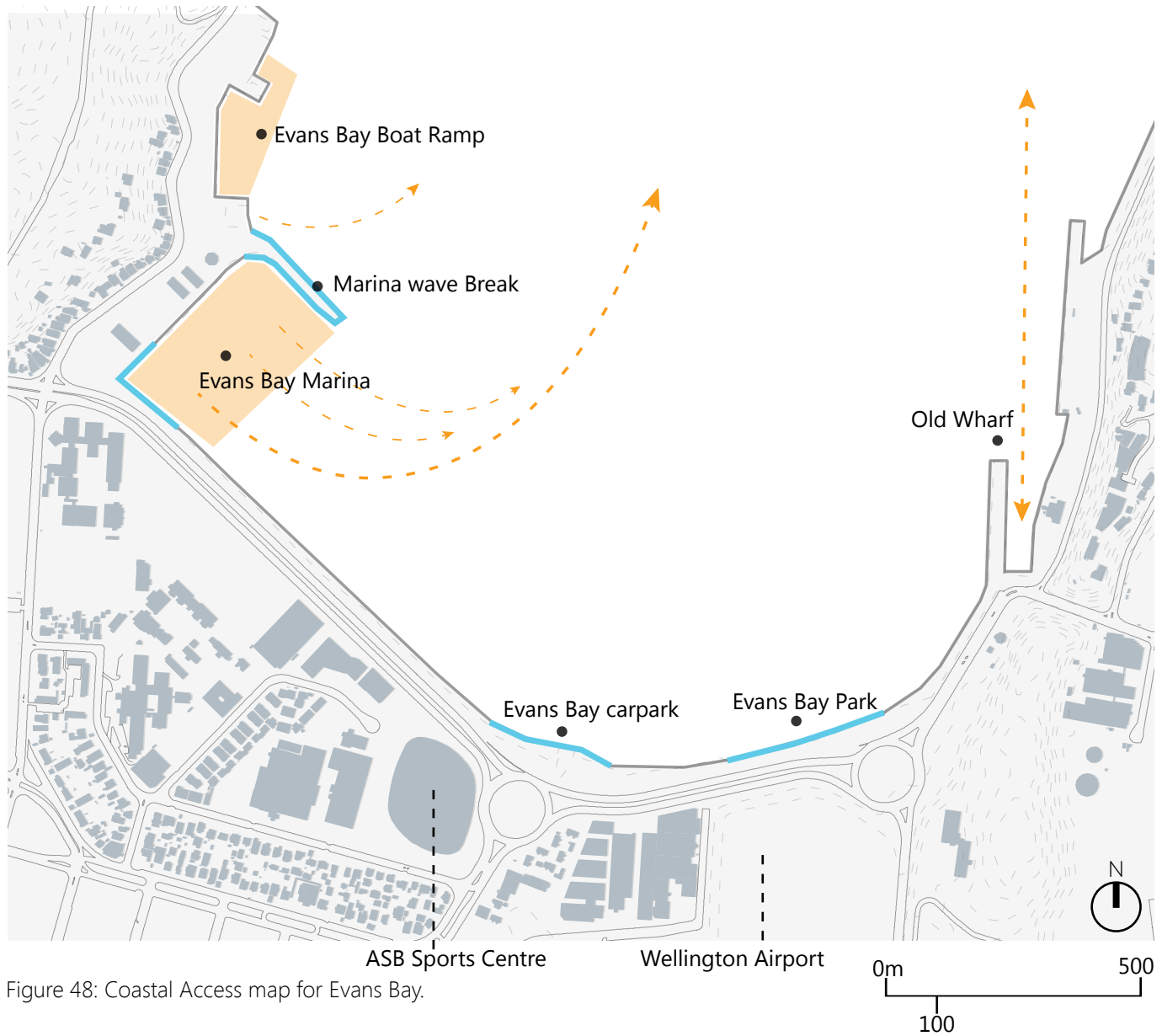


Figure 48: Coastal Access map for Evans Bay.

The shape of Evans Bay can at times provide a sheltered area for boats to moor or use as a thoroughfare. This area is an important arena for Wellington's boating community and must be integrated into considerations for future designs.

## Coastal Access

Despite being a popular location for both water and land based activities, the coastal access is extremely limited. The degraded coastal edge makes it difficult to access the tide-line around the bay. Due to the quality of the coastal edge and water, people often refrain from entering the water. Regaining suitable conditions to ensure access is safe and inviting will be a vital component to draw people to the site.

## Boat Passages

With the marina and boat ramps, there is a lot of boat activity moving around the western edge of Evans Bay. This can cause water congestion in the popular boating months. The wharfs on the eastern edge are occasionally used by container ships temporarily, before being properly docked at Central Port Wellington.



## 2.9 Roothing Congestion

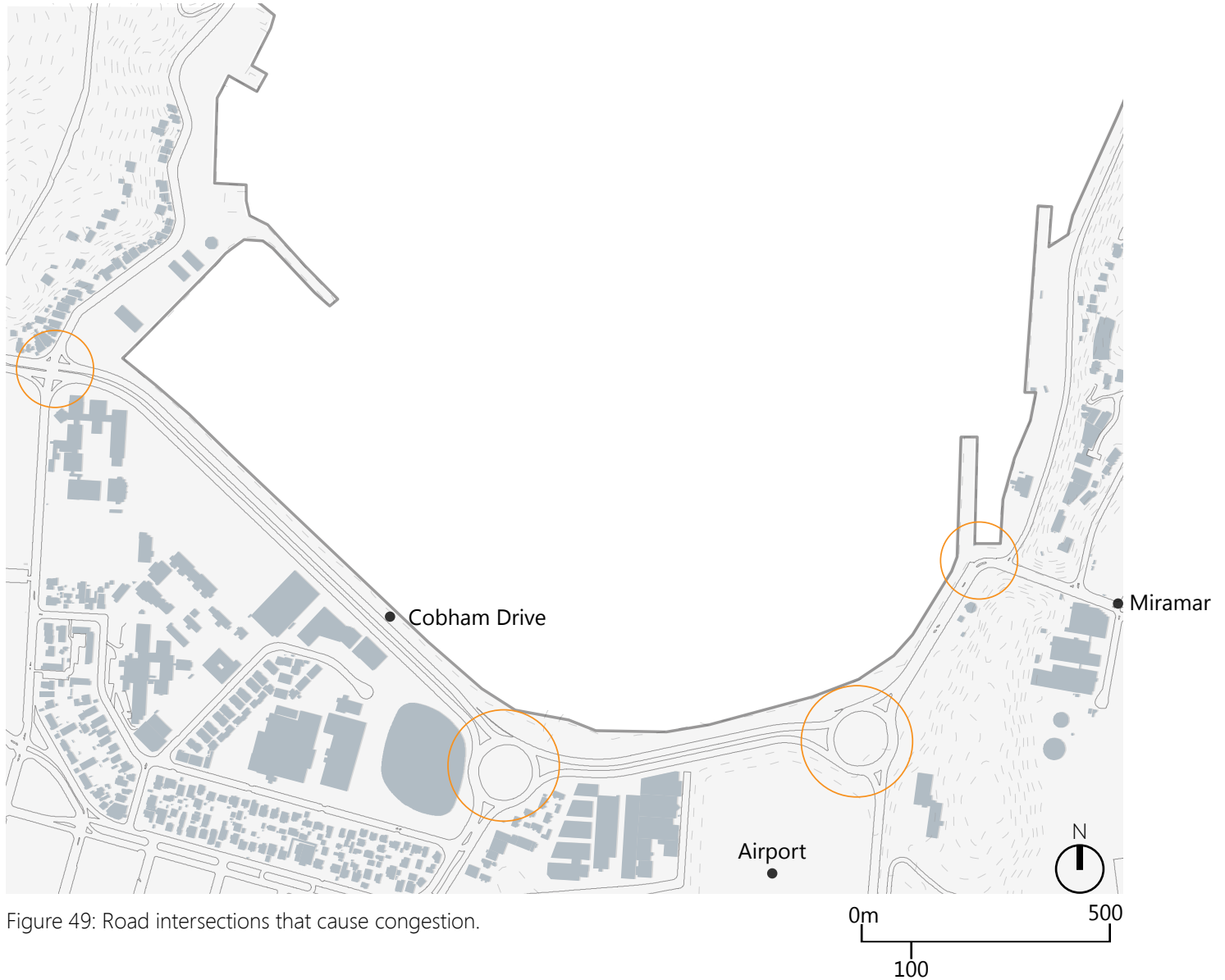


Figure 49: Road intersections that cause congestion.

The local roads see a lot of traffic due to the amenities in the area, as well as the eastern suburbs. Cobham Drive is the main arterial route from the east through to Wellington's CBD. The airport also produces large amounts of traffic in this area. The two large roundabouts maintain flow through the area, however often the traffic builds up and creates congestion. The small coastal strip on the seaward side of Cobham Drive is the only area safe for cyclists and pedestrians. This means that all types of cyclist and pedestrians are forced to use the small 2m wide costal footpath in order to travel through Evans Bay, often resulting in conflict.



## 2.10 Wind



Figure 50: Wind Roses

Wellington is the windiest city in the world with the average speed of 29km/h and the highest recorded is 248km/h ("Is Wellington Really The Windiest City In The World?"). The wind is most common from two directions, North and South. However the most common wind is the northerly which blows 37% of the year (Fitzsimons). This wind creates an extremely challenging environment for people travelling around the area whether they are walking, cycling or even driving. Evans Bay coastline is affected by the northerly winds more so than the southerlies and in high winds, this coast becomes difficult to travel along.

## 2.11 Stormwater

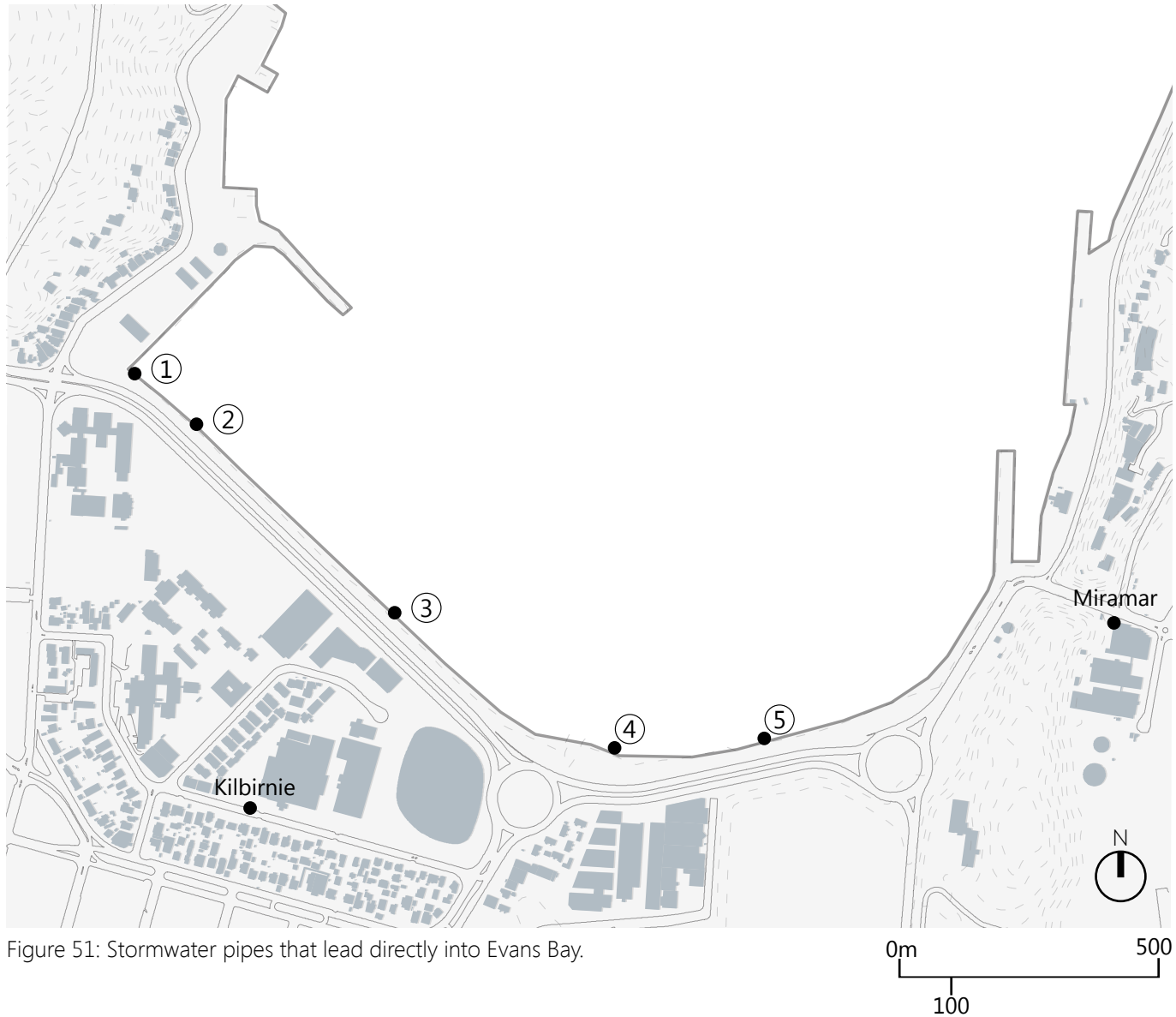


Figure 51: Stormwater pipes that lead directly into Evans Bay.

The Evans Bay site has five storm water outlets that flow straight into the bay, with no filtration intervening. The storm water within these pipes is from the Kilbirnie, Hataitai and Miramar area. These areas are either steep in gradient or highly developed, creating a high percentage of impervious surfaces, resulting in large amounts of runoff. This runoff enters Evans Bay without any of the pollutants collected from the area being removed. The evidence of the impact is clear around the outlets where large amounts of sediment build up and the sea life is significantly damaged.



1

Figure 52



2

Figure 53



3

Figure 54



4

Figure 55



5

Figure 56

## 2.12 Cyclist Classification

There are many different categories of road cyclists that each require and desire different things. The types of cyclists can generally be grouped into four categories: touring cyclist, sports cyclist, commuter cyclist and recreational cyclist. These cyclists are common on New Zealand roads and cycleways. Evans Bay is used by all four categories of cyclists.



### Touring Cyclist

The touring cyclist uses the bicycle to travel long distances generally carrying all of their necessities with them. These riders will travel from travel between sites as tourists.

Cyclist Preferences:

- Good views
- Good Surfaces
- Rest areas



### Sports Cyclist

The sports cyclists uses the bicycle as a form of exercise and their goal is to travel long distances on difficult terrain to burn the most energy. They travel at speeds around 30-40km/hr.

Cyclist Preferences:

- Safety
- Good surfaces
- No delays
- Steep/ challenging terrain



### Commuter Cyclist

A commuter cyclist is somebody who uses the bicycle as a form of transport to get from A to B. Their average speed is around 20-30km/hr and average distance is roughly 5km.

Cyclist Preferences:

- Good road surfaces
- No delays
- Minimal conflicts with other transport



### Recreational Cyclist

The recreational cyclist is somebody who is cycling for fun and is not focused on time or energy output. The cyclist is generally seen in the weekends along areas that are visually pleasing, like coastal edges, rivers etc.

Cyclist Preferences:

- Comfort
- Views
- Low degree of slope
- Good surfaces
- Safety

# Cyclist Paths

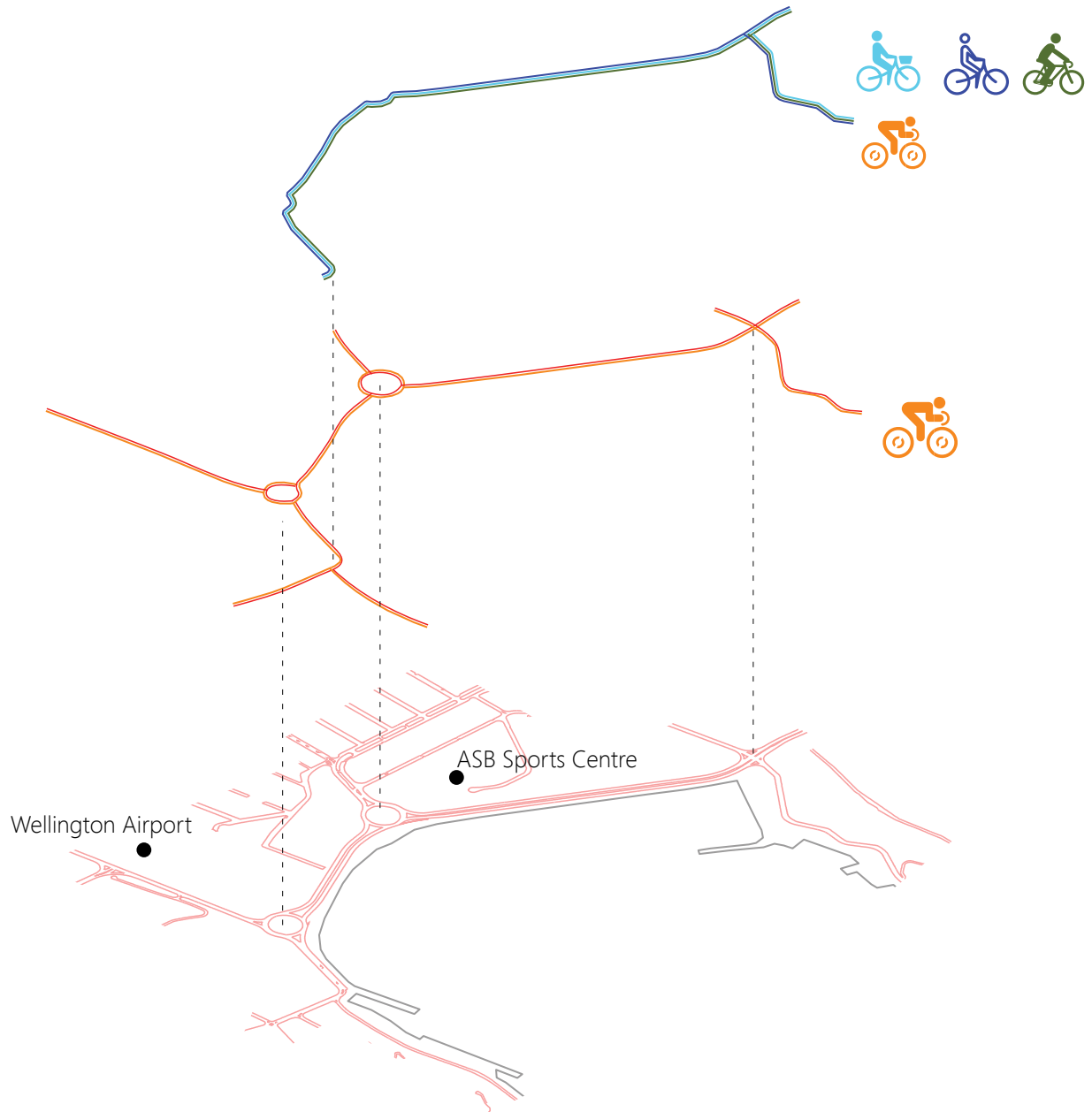


Figure 57: An overlay of the paths each category of cyclist takes.

The recreational, commuter and touring cyclists generally use the cycleway/foot-path along the coastal edge to travel through the bay. The sports cyclist uses the road with other vehicles, however the 70km/hr speed limit makes the road intimidating and dangerous for inexperienced cyclists. This results in large amounts of congestion on the cycleway as the narrow path can only accommodate two people passing at one time.

## 2.13 Site Analysis Reflection

The Evans Bay coastal margin is a dynamic collective of activities, ecologies and amenities. Little appreciation for the coastlines, means that Evans Bay is used but not respected. The declining ecologies and eroding shoreline provide the occupants with an unpleasant coastal edge. The bay is a result of intense infrastructural developments and is simply been used as thoroughfare; becoming disregarded and degraded. The key findings from the analysis developed several principles that the design needed to incorporate and address. They are as follows:

### Coastal Access/ Water Access

The coastal section of Evans Bay is a serene section of Wellington and is used by many people as a recreational site. However the current access and pollution prevents the bay from becoming a popular destination. Developing the bay into a public realm will enable the design to bridge the eastern suburbs to central Wellington and connect people with the local environment. Increasing access to the water also enables neighbouring schools to provide educational purposes, eg. sailing, kayaking, swimming.

### Multi-modal Integration

The implementation of a safe transport network is essential to promote the use of active modes (Beetham, J, 78). Ensuring that the commuters integrate with the diverse range of activities will allow Evans Bay to become a coherent public space.

### Green and Blue Infrastructure

The current state of the ecologies and water in the bay is detrimental to reconnecting people with the coastline and water. The revitalisation of suitable natural systems will reduce pollutants and demonstrate the importance of healthy ecologies.

The principles highlight the character of the bay and provide the research with a site specific framework. As the research develops each component will be tested against the principles to ensure the design captures the essence of the bay.





Figure 58: Analysis of the key factors found through site research.









## 3.0 Literature Review

## 3.1 Literature Review One

### Paths, Tracks and Trails

Ceccon, Paolo and Laura Zampieri

Integrating multiple activities is a complex and difficult task to undertake. Each mode must have a safe suitable path or area in which they can travel and must interact safely with parallel modes with a given site. Growing cities must have the infrastructure that allows people to move efficiently and effectively within and around its centre. Wellington especially, relies on this flow.

Due to Wellington's geographical form, many people live in neighbourhoods bordering the CBD. Providing links that allow all forms of transport into the city is something has been attempted, but often does not provide the people with what is needed. The text, *Paths, Track and Trails*, explores and outlines the key points needed for pedestrians and cyclists to integrate safely and efficiently. The book also highlights the importance of sustainable mobility and the opportunities it provides.

#### Importance of Sustainable Mobility

Sustainability has become the topic of discussion around the world, with the increase in greenhouse gases, the demand for sustainable practices is only increasing. Cities are often the focus of this issue as the density and functionality of everyday activities means the greenhouse gas emissions are high; this density means that natural ecologies can be lacking, damaged or destroyed. However the unsustainable essence of a city can lead to greater opportunities to implement sustainable practices, such as sustainable mobility.

The text, *Paths, Tracks and Trails*, highlights the point that sustainable mobility can support and benefit other factors, such as ecological restoration, social inclusion, economic growth and regional development. These principles are justified through the fundamental idea of 'ecological restoration'.

"The conservation of ecosystem values and ecological functions in infrastructure development will generate wider economic, social and environmental benefits. The protection of ecological and cultural values could not only increase aesthetic and recreational potential of landscapes, but also have a positive economic impacts on tourism-related activities" (Ceccon and Zampieri, 10)

Ceccon and Zampieri also specify how public spaces can provide positive impact in terms of environmental and ecological functions, social functions, human resources and structural and symbolic functions. (Ceccon and Zampieri, 11)

#### Environmental and Ecological Functions

- Improving climate
- Noise protection
- Hydrological cycle and stormwater management
- Supporting biodiversity

### Social and Human Functions

- Providing spaces and facilities for recreation and leisure
- Promoting contact and social communication, including cultural and commercial activities
- Allowing access and direct experience with nature
- Producing positive effects on health and wellbeing of people

### Structural and Symbolic Functions

- Creating articulation, separation and connection between areas of "urban tissue"
- Increasing the understanding of urban space
- Communicating identity, values and meanings

(Ceccon and Zampieri)

### **Path- User Requirements**

Each mode, activity or user interacts with the space differently and each one of them will require certain aspects in order for the space to work effectively, safely and enjoyably.

The text, Paths, Tracks and Trails outlines these requirements for both pedestrians and cyclists, as follows:

#### **Pedestrians**

Connected- The network must ensure direct access for pedestrians to the destinations they want to reach. The paths must be well connected to public transport and the surrounding networks.

Clear- The network must be clearly identified, published in local maps and described through applications for smartphones so that the first-time visitor can navigate comfortably.

Comfortable- The paths must not be contaminated by excessive noise or traffic fumes. They must be quite large, with smooth surfaces and gentle slopes. Providing shelter and resting spots.

Convenient- The paths must be continuous, good condition and without many obstacles.

Safe- The road crossing and those at the driveways should be safe from traffic.

#### **Cyclist**

Security- The bike paths are safe and limit conflict between other path users.

Comfort- The bike paths should be smooth, clean and designed to make travelling easy.

Attractiveness- The bike paths should be built to interact with the environment and enhance the look of the landscape. In urban areas they should be well integrated into public spaces.

## Evans Bay Cycleway



Figure 60



Figure 61



Figure 62



Figure 63

	Connected	Clear	Convenient	Comfortable	Safe	Comfort	Security	Attractiveness
Pedestrians	✓	✗	✓	✗	✗	✗	✗	✗
Cyclists	✗	✗	✓	✗	✗	✗	✗	✗

Table 1: The current cycleway compared to the requirements stated by Paths, Tracks and Trails.

Evans Bay is an area that is a key linkage between the CBD and Eastern Suburbs. The site contains many urban amenities such as the airport, local sport centres, schools, public spaces and local shops. However it is also ecologically disadvantaged with large amounts of pollutants from surrounding stormwater systems and roading networks. Table 1 displays how unsatisfactory it is compared to the requirements outlined in Paths, Tracks and Trails. Ensuring that each user requirement is met is vital to create effective link for active transport.

## 3.2 Literature Review Two

### Sustainability and Cities: Overcoming Automobile Dependence

Jeffrey R. Kenworthy and Peter Kenneth Newman

Although sustainable and active transport needs to be integrated into everyday functionality, the world's dependence on the motor vehicle is far too great to create an instant change. Cities like Copenhagen have had the bicycle ingrained into their culture through necessity and is now the 'normal' everyday tool. Other cities such as Wellington have not had the predominant need to change the main mode of transport. In order to change the view on cars and incorporate sustainable transport into Wellington's culture, gradual steps need to be made over a period of time. Ceccon and Zampieri in *Paths, Tracks and Trails*, outline how to integrate cyclists and pedestrians safely and effectively, however incorporating this infrastructure into the city needs to be a physical change of our infrastructure and a mental change in our culture. This maybe a difficult change to design for, however it is not impossible,

" Despite widespread cynicism that you cannot control the car, there is a growing awareness of need for non-automobile-dependent planning."  
(Newman and Kenworthy)

This research details five steps for cities to become more sustainable. These can be implemented over time and gradually improved on:

#### The Techniques for Overcoming Automobile Dependence

##### 1. Traffic Claming

To slow auto traffic and create more urban, human environments better suited to their transportation modes.

##### 2. Quality Transit, Bicycling, and Walking

To provide genuine alternative options other than the car.

##### 3. Urban Villages

To create multimodal centres with mixed and dense land use to reduce the need to travel and that are linked to good transit.

##### 4. Growth Management

To prevent urban sprawl and redirect development into urban villages.

##### 5. Taxing of Transport

To cover external costs and to use the revenues to help build a sustainable city based on the previous concepts stated.

(Newman and Kenworthy)

In relation to Wellington these steps are highly achievable and have already begun to be implemented at large and small scales.

#### Traffic Calming

Traffic calming means to slow or calm traffic and therefore making it safer for other users, such as pedestrians. Techniques such as speed bumps, material change or S-curves can be used to slow traffic. Wellington uses several examples of these techniques, such as Cuba Street - a central arterial street that is the hub of pedestrian traffic in Wellington. In figures 64-65, we can see the use of material change and colours are used to bind the footpahts. The traffic calming techniques used, create a pedestrian dominated environment, where cars do not have the right of way.

(Newman, Kenworthy, Vintila)

Figures 64-65: Cuba St, Wellington is a popular pedestrian hub.

#### Quality Transit, Bicycling, and Walking

In order to remove the dependence on the car, alternative and effective options must exist to promote sustainable transport. Wellington's transit system is fairly effective in its current state, with bus and train being two main modes. Most people who utilise the bus and train systems are coming in and out of the CBD from the outer suburbs, with 83% of users saying it was an effective system (FORBES). The prevailing issues with the system are cost and time delays. Wellington is slowly increasing its cycleway network and prioritising the bike first. However the cycleways implemented are extremely basic and do not provide a safe link for users. In order to promote bus, train and cycling in Wellington, more time and infrastructure needs to be invested in these modes to increase use to insure efficiency and safety is achieved.

#### Growth Management

Wellington is a relatively compact grid, due the nature of its topography development can be limited. 'Sustainability and Cities' states that the use of green belts or an urban growth boundary are effective tools to limit urban sprawl; Wellington has a large green belt around the city that is protected from development (figure.) Although the green belt only limits growth within the central district, steep terrain limits the outer suburbs from expanding further.



## Taxing of Transport

Taxing unsustainable vehicles is an effective way to discourage certain modes of vehicles. However in New Zealand, this method is not fully utilised. Although some vehicles are taxed - for example diesel cars with road user charges, it is not enough to discourage high usage. Producing tax-free systems is another effective system that some countries have utilised.

As an example, The United Kingdom Department of Transport have created a 'Cycle to Work' Scheme. The scheme allows employers to offer a tax-free renting system for employees. Studies have shown that people who cycle to work are more proactive throughout the day. The scheme reduces the cost of a bicycle and safety equipment significantly and increases the availability of sustainable transport. (Cycle To Work Guidance). The UK have also introduced 'congestion fees', which charge people £11.50 per day, if users drive through a charging zone. This system discourages the use of the vehicle and minimises congestion through cities. (Matters)

A collection of Wellington based councils put \$20 million towards creating safe and efficient cycleways within the region (Wellington). Although this is an important step in promoting sustainable transport, further steps need to be taken. Many people in New Zealand see the car as a more important object and the bicycle as an extra expense. Wellington's compactness offers a unique opportunity for commuters to utilise the bicycle to and from work, using the vehicles for longer trips. Providing cheaper bicycles for purchase or rent, along with incentives will significantly lower the overall cost and enable a wider spectrum of people to cycle.

## Design versus Discouragement of Cars

Often infrastructure is driven by functionality rather than aesthetics - which for vehicular transport, can work. However with sustainable transport people are far more engaged and exposed to their environment. Current cycleways are developed alongside roads with little separation from cars, forcing users to put up with fumes, noise and frightening situations. Growth management and urban sprawl are concepts that need to be considered on a larger regional scale - not a smaller scale project, like this research. However, better sustainable infrastructure, taxing transportation and traffic slowing are all concepts that can be implemented in Evans Bay to encourage sustainable transport for not only this region, but the greater Wellington district too.





Figure 66: The harbour view from the current coastal walk.

## 4.0 Precedent Review

The literature review outlined key principles and strategies on how to integrate sustainable transport into our cities. However the ideas highlight that Wellington provides ineffective infrastructure in order to enable or promote sustainable transport. Understanding how design can enable the integration of sustainable transport is critical to replicating these systems in Evans Bay. The following precedents are examples of how these key principles and strategies can be implemented successfully through design. The precedents also highlight how design driven infrastructure can respond to the site context and form a diverse series of public spaces.

Project: Superkilen  
Copenhagen, Denmark  
Bjarke Ingels group Topotek 1,  
Superflex

Figure 67

## 4.1 Precedent One

### Cultural Development

Copenhagen is a unique city that has developed and evolved with times through choice and necessity. The city has a long entwined relationship with sustainable transport -in particular the bicycle, and although Copenhagen has one of the largest integrated cycle networks in the world at present, it has not always been a main mode of transport. Prior to the twentieth century, Copenhagen cyclists were forced to with ride on uneven surface or share the roads with the horses. (Geografisk, 146)

From 1900 to early 1930's, cycleways were beginning to develop and many people in Copenhagen chose the bicycle as their main form of transport. The bike allowed people to live in outer suburbs and easily commute into the city hub; the simplicity and affordability meant that everybody had the opportunity to bike despite social hierarchy. (Denmark.dk)

World War II and the development of the car, brought a significant change to the structure of the city and the peoples' choice of transport. As the car advanced and became more affordable, people chose cars over bikes and therefore, priority was given to cars. City planners began to remove buildings and cycleways to make way for car parks and wider streets. However, the dramatic growth in vehicle use also increased fatal crashes, pollution and congestions in the city and soon people started to learn the disadvantages of the vehicle. Around the 1970's an oil crisis struck making the once affordable car, increasingly unaffordable. (Lotte Ruby)

The city's realisation of these disadvantages brought about new legislation that marked the turning point of Copenhagen and its sustainable transport. 'Car free Sundays' was the one of the first pieces of legislation that prevented personal vehicles access into the city; people soon began to recall the benefits of cycling as a form of transport. City planners began to give cyclists priority over drivers, creating cycleways that made it the most efficient way to commute around the city. (Lotte Ruby)

At present there is a total of 454km dedicated cycle lanes and 56% of people who work or study in the city, use the bike to commute. (Cycling Embassy of Denmark)

The perceptual change in urban planning and sustainable transport has lead Copenhagen to become the bicycle city of the world. It is also the precedent for bicycle infrastructure around the world. Bicycle infrastructure does not only supply an opportunity for efficient transport, the reduction of needed space required for the bike means there is more space for public spaces.

Figure 69: Pedestrians and Cyclists share the space safely.

Figure 70: The diverse series of spaces promote community based activities.

Figure 68: The masterplan of the different areas in the Superkilen Urban Park.

Figure 71: The Superkilen Urban Park develops a series of spaces for all users.

The Superkilen Urban Park is an example of how public spaces can be combined with sustainable transport to create a diverse space where urban life can thrive. Initially designed to encourage physical activity for all ages in the local community, this park is a prime example of how sustainable commuting can encourage and promote public spaces within urban environments. The park was designed around three main principles:

1. To accommodate a diverse range of ages, interests and abilities (including activities from high to low physical demand)
2. To encourage cycling in the community
3. To represent and involve the diverse range of cultures in the surrounding communities

(Centre for Active Design)

The key success of the park is due to the integration of public spaces and the cycleway. The sequence of spaces creates a community hub, that is removed from the noise and sound pollution produced by cars. The combination of pedestrians and cyclists are also a safer relationship, than the likes of vehicles and cyclists. This relationship can be justified by the social capability of each transport form; cars are an anti-social form of transport and is a key role in social exclusion (Susan Kenyon, 210).

The Superkilen Park highlights the key point that the use of bicycles as an alternative mode removes all social hierarchy and exclusion, enabling a diverse range of people to interact - therefore social barriers are diminished.

Although the success of Copenhagen's infrastructure is partially due to the wealth of the country, they are a precedent example of how alternative transport can benefit environmentally, economically and socially.





## 4.2 Precedent Two

### Development of Form

The Kastrup Sea Baths is a large timber structure located 100m offshore. The circular structure creates an enclosure, where its high seaward walls protect the inner arena against the sea breeze. The mosaic of timber creates an artistic yet functional form, allowing a multitude of spaces for the public to enjoy. The sea baths were designed to provide an 'untraditional' arena for activities; allowing people to spectate from the viewing platforms or take the plunge from the diving podium.

The untraditional nature of the design provides a very flexible opportunity for interaction. Without the strict formalities of a lane pool, or of a water park; the baths encourages the community to explore and utilise the installation. Although the Kastrup structure looks like aesthetics have driven its form, engineering has also played a part. Being exposed to the ocean means that the coastal breeze is a common deterrent for swimmers. The exterior walls minimise the effects of the breeze by creating a wind break. The slatted structure breaks the wind - significantly reducing its force.

Although the design does not incorporate active transport, it is a key insight into how untraditional thinking can create a public space for the entire community. The unique creation of space attracts people to particular sites and in conjunction with active transport, a diverse and creative space can thrive. Evans Bay is a thoroughfare for fast moving traffic (day walkers or sailors all with a disconnection to the coastline) constantly move through the site, however do not stay within it. The developed design must not only allow people to travel through the site, but also to engage with it.

Figure 73: The spa extends far into the bay.

Figure 74: viewing platforms allow user to sprawl out and relax.

Figure 75: The high sides provide protection from the sea breeze.



## 4.3 Precedent Three

### Modal Integration

Auckland City is well known for its density and chaotic traffic. The sprawl of suburbs makes it difficult for outer suburbs to utilise active modes of transport, due to the commuting distances. Recently The Auckland City Council and The New Zealand Transport Agency invested in cycleways and public infrastructure, in order to make the inner-city a 'public friendly' place. Due to the high density of development around the CBD, building new links were limited by space. The insufficient space led the design to revitalise an unused off-ramp.

The 'Light Path' is a 600 metre long path, located amongst Auckland's most congested motorway section. The 'Light Path' is a small section of the greater Auckland cycle-network that aims to provide an easy and efficient link into and around the city.

The main aim of this project was to create an inclusive pathway, allowing pedestrians and cyclists to integrate safely and commute into the CBD. The path acts as a beacon for public life and encourages people to use alternative transport - averaging around 1000 cyclists per day (Auckland Council). Due to the sudden popularity of the path, art exhibitions, busking and community groups are beginning to emerge and evolve the space into a dynamic community space. The convergence of active transport and public life is an effective way to promote alternative transport and reduce the volume of vehicles in the city.

The 'Light Path' highlights several key factors on how to successfully design public infrastructure and how integrating public space and cycleways is beneficial.

#### Colour

People respond effectively to bright colours as they associate feelings or memories with them. For example, red, orange and green colours are associated with traffic signals in an urban context. The bright magenta of the path stands out amongst Auckland's heavy infrastructure and will become associated with the public space. Car users passing by on the motorway will be curious and willing to experience the cycleway - encouraging more users.

#### Recycling Infrastructure

The abandonment and deconstruction of roading infrastructure is an unsustainable system that New Zealand continues to practice. The utilisation of existing infrastructure re-purposes the once obsolete sections of the motorway, which is a far more sustainable and cost effective method than a new build. The design is an example on how existing infrastructure and spaces can be adapted to reduce extensive construction. With Wellington's grid-locked roading system, refurbishing infrastructure is an effective means to develop the cities resilience and re-develop abandoned areas.

Figure 77: The panelled lights framing the walk, make the path stand out in all lights.

Figure 78: The magenta pathway incorporates Māori patterns.

Figure 79: Congested traffic either side of the path promotes the use of the free flowing cycleway.

## 3.4 Precedent and Literature Reflection

The theoretical context provides a series of systematic strategies to implicate sustainable transport into the city grid and the potential improvements following these changes. Due to the significant development required to implement transport infrastructure, many of these strategies propose progressive construction. Although urban development is pertinent to large scale design, the following theory outlined can be overlaid with the Evans Bay context to develop a sustainable transport system and begin to understand possible enhancements. These principles are,

-The separation of vehicular traffic is the key to provide safe and sustainable transit network.

-A successful network must provide users with:

- efficient connecting links
- clear entry and exit points
- comfortable pathways
- convenient access
- safe and secure passages
- an attractive overall design

-The implication of sustainable transport provides the opportunity to implement ecological restoration, social hubs and centres, connecting networks between urban centres.

In conjunction with the key design principles - coastal and water access, multimodal integration and green/blue infrastructure - the attributes identified through the theoretical research can develop a site specific strategy to test the future design in Evans Bay. Although these attributes offer an insight to how we can implement sustainable transport, the theoretical studies lack real world implication. The precedent studies demonstrate how design can be used to create effective solutions.

With the high exposure to wind in Evans Bay, environmentally conscious solutions need to enable user comfort throughout. The Kastrup Sea Bath addresses the site conditions and utilises form to create aesthetically enhancing wind protection. Evans Bay lacks human interaction due to the severity of the wind. Reconnecting people with the coastal environment will require wind systems that are both

functional and aesthetical.

Effective multimodal integration is critical to ensure the safety of users and efficiency of the cycleway. The theoretical research implies that the removal of cars and integration of pedestrians and cyclists, is an effective option. However, the design needs to develop a system within the network to reduce congestion between cyclists and pedestrians. The Superkilen and Light Path portray examples of how the use of form and colour can enable safer integration.

Form is a practical way to subtly direct and control people's movements through the site. The meandering shape of the Light Path enables the design to remove the need for traffic markings. Current cycleways utilise strict and clear road markings to safely direct users, although effective, it creates a rigid form that discourages engagement. Directional changes of path can subconsciously slow users down. This is visible in the Light Path as users begin to reduce speed when travelling around the curvature of the ramp. This allows for the diverse range of activities and users to integrate without causing congestion in Evans Bay.

The concentration of activities, commuters and communal amenities in Evans Bay, can generate conflict between users. Colour is an effective way to create boundaries and safely weave the multitude of activities into one space. Drawing the community to the site is a crucial aspect of the design, however can only be achieved if the infrastructure provided is suitable.

Through theoretical studies and precedent analysis, this research has a series of strategic principles and concepts that can be adapted into the design for Evans Bay. The ideas, paired with the design principles set out through site analysis, will guide the iterative concept stage and ensure that each component is fit for purpose.



Figure 80: Desire paths created by people weaving through the natural landscape next to the main cycleway. One of the few areas in the site where people use as more than a thoroughfare.





## 5.0 Preliminary Design

## 5.1 Form

This section of preliminary design focuses on the development of form through various scales and how it can inspire functionality. The concepts explored in this section rely on the protection of users from natural elements and the use of form to direct the flow of different modes. Due to the exposure of high winds, the initial sketches explore ways to create protection, whilst maintaining access to the coast and the site's views.

### Wellington and the Fish

The Māori culture has been ingrained into the identity of New Zealand. To create design that reflects both the cultural background of Wellington and New Zealand, Māori mythology has inspired the form of the design.

The Māori have many creation stories throughout their culture, the legend of Māui and the giant fish is about the capturing of Aotearoa/ New Zealand.

Māui, a great god in the Māori culture, ventured out fishing with his brothers. Having to prove himself to his them, Māui cast his hook deep into the sea, coated in his own blood for bait. The hook was swallowed instantly by an enormous fish. The weight of the fish nearly tipped the brothers out of the boat and they insisted Māui cut the line, however Māui continued to pull the fish in. Eventually the fish surfaced and dwarfed the brothers and their canoe.

Māui, impressed with his catch, went to gather his people to show them. However, when he returned with his tribe, the brothers had already begun to devour the fish - removing large chunks.

Over many years the chunks removed by the brothers became valleys and mountains, forming the land of Aotearoa as we know it today.

The South Island of New Zealand is said to be the canoe Māui and his brothers used to capture the great fish. With the North Island being the fish, Wellington Harbour as the eye and Kaitiaki as the tale.

("Māui And The Giant Fish")

## Form

The initial sketches explore the forms from a fish to develop human scale interventions.

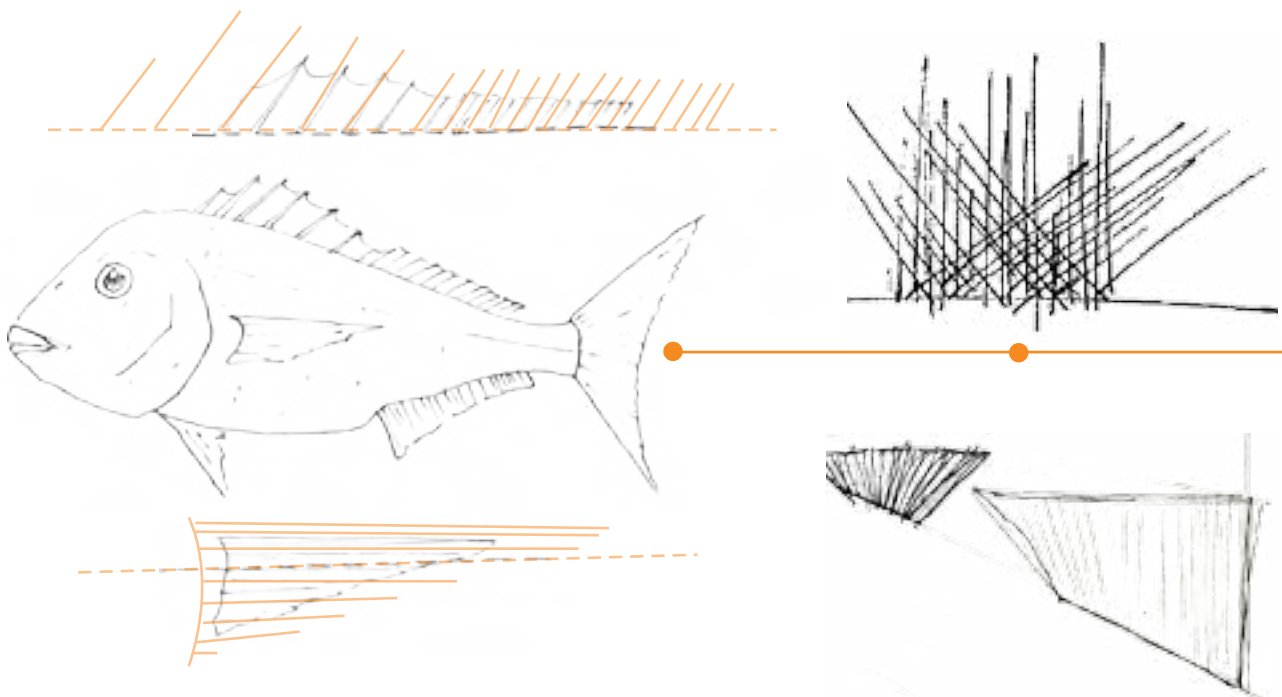
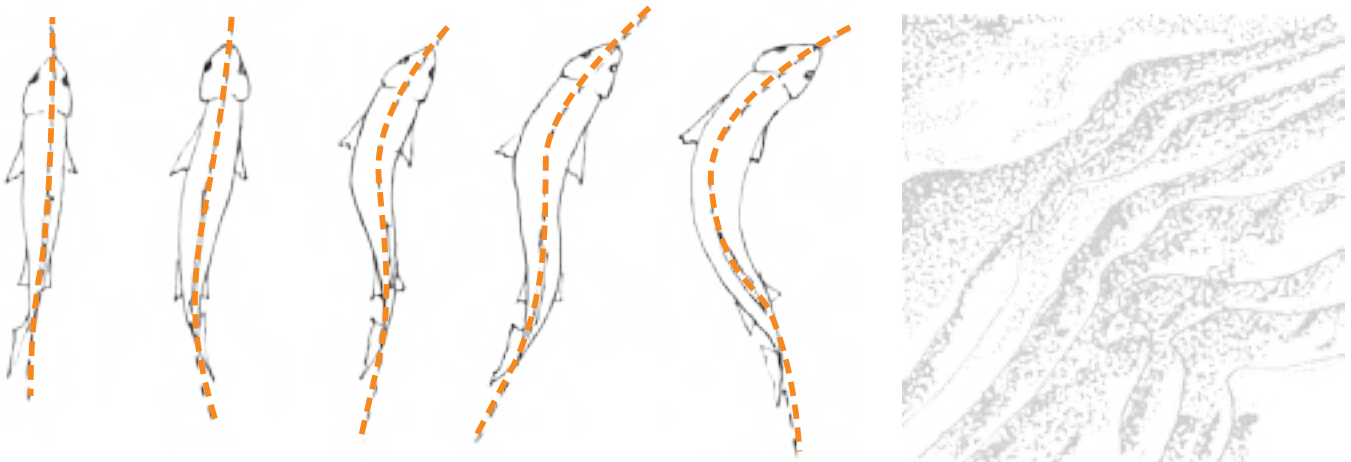
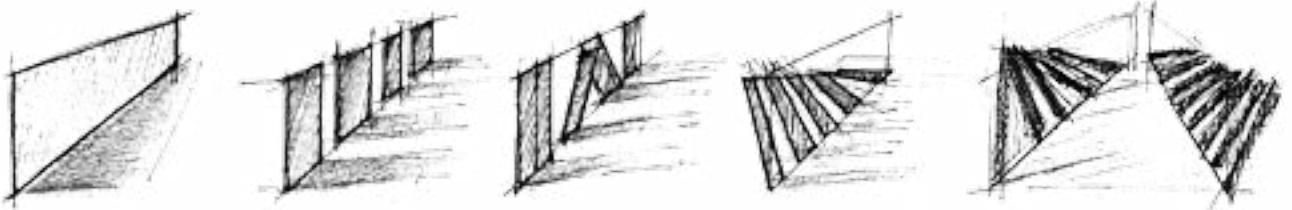
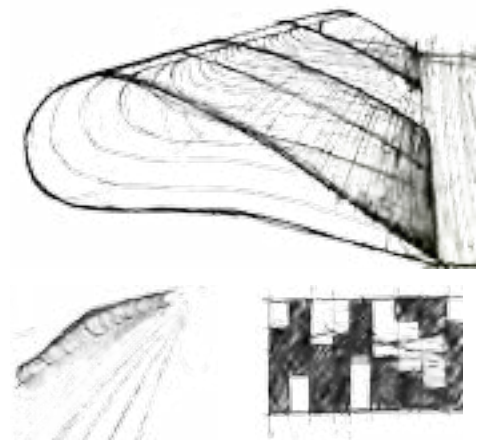
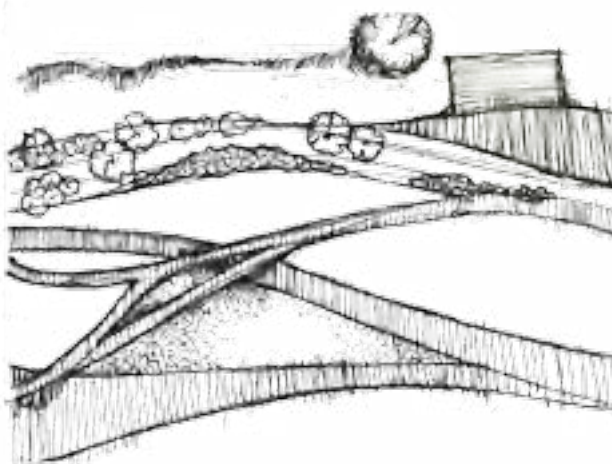
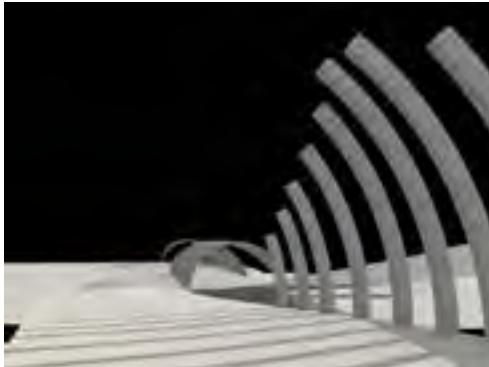


Figure 81: Developing the structure and movement of a fish into human scale interventions.





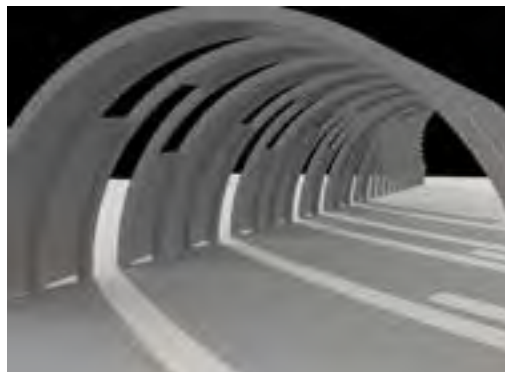
## 5.3 Digital Models



The sketch designs looks at how the 'fish spine' forms can be developed into a sculptural elements, whilst maintaining function. The aim is to separate cyclists and other active modes from vehicles. The solid barrier means there is distinctive separation and also will provide protection from the high winds that are common on this site.



Figures 82-85, use Computational Fluid Dynamics (CFD), to test whether the spine forms will reduce the intensity of the wind. The software did show some reduction in the speed of wind, however a higher porosity level would improve the reduction of wind speeds.



Figures 82-85 : Experimenting with the spine form to create barriers to separate traffic and provide protection from the elements.

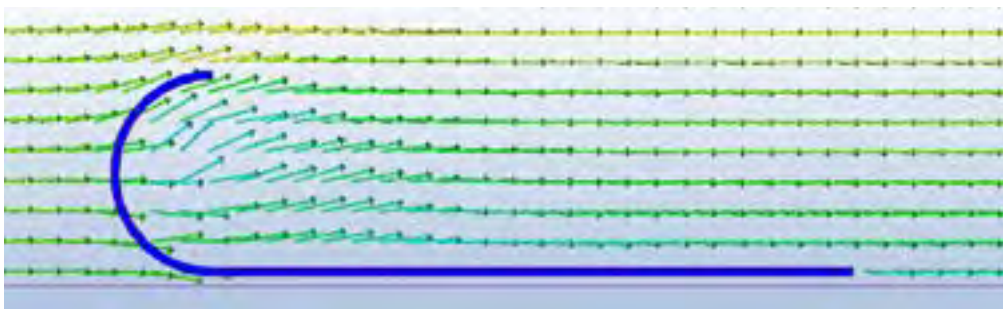


Figure 86: Using fluid dynamics to test the effectiveness of the spine like form in wind conditions.

## 5.4 Physical Models



Figures 87-90: Continuing the fish spine concept through physical models.

Separation from vehicular traffic is an important aspect to the cycleway/active path. These concepts explore the decreasing in the porosity of the structure in order to reduce the effects of the wind and rain for users. However, the decreasing of porosity means that the important vista of the site is also reduced. Maintaining the view for users is important as it is one of the driving aspects to use the site. The contorting form is aimed to replicate the impacts from the natural forces and to break up the structure.

## 5.5 Multimodal Testing

### Coastal Integration

The first iterations aim to draw different modes to the coastal edge safely. Currently the coastal walk allows people to view the coast, however access to the water's edge is limited and dangerous. The current access also forces users to share a narrow two meter wide path.

The beauty of coastal edges is the opportunity to explore different areas as the tide changes. Low tide enables us to explore the once submerged sections of the natural environment; however high tide reduces the area, making users choose a different path. Designing to clearly portray this change will enable users to develop environmental awareness.



Figure 91: Low tides exposes more platforms, allowing people to explore the coastal edge.

A covered path will both separate faster moving traffic (cyclists, runners, scooters' etc.) and protect them from strong winds. The breaks in the slats allows the users to cross over into other areas.

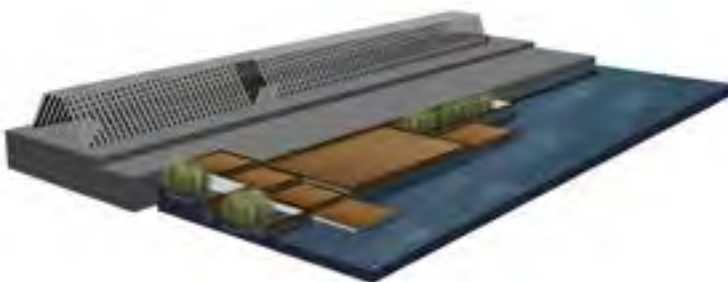


Figure 92: High tide submerges different platforms, creating a different space.

Integrating sections of marsh type wetlands will begin to bring back the natural infrastructure which the site is lacking. Focusing these around the storm water outlets will provide a barrier to filtrate the pollutants. High tides will provide the upper wetlands with water.



Figure 93: A section through the iteration showing how commuters use the covered path and other users can explore the terraces on the shores edge.



## Coastal Integration



Figure 94: The wave like path opens up at low tide allowing people to walk on the outer most path.



Figure 95: At high tide the outer path is broken up by water.



Figure 96: Wetlands utilise the high tide water, while recreational walkers can enjoy the coastal path.

## Coastal Attractions

### Water Activities

The current site has several water activities that take place within the bay, but have minimal safe water access. Developing edge conditions to include these activities will allow the site to engage a wider range of users.

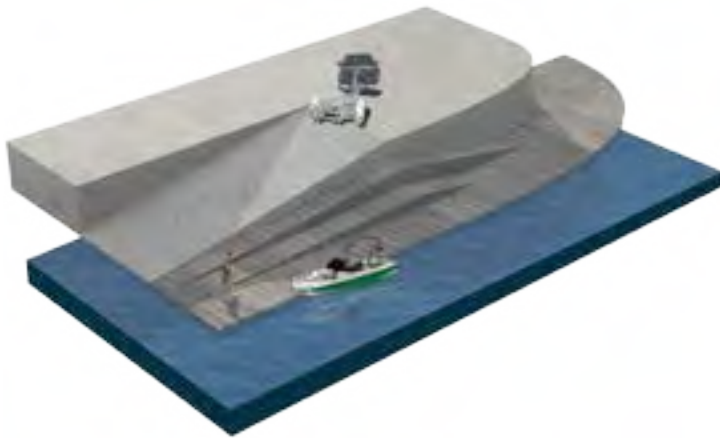


Figure 97: Creating an accessible boat ramp with platforms to allow people to enter their boats safely.

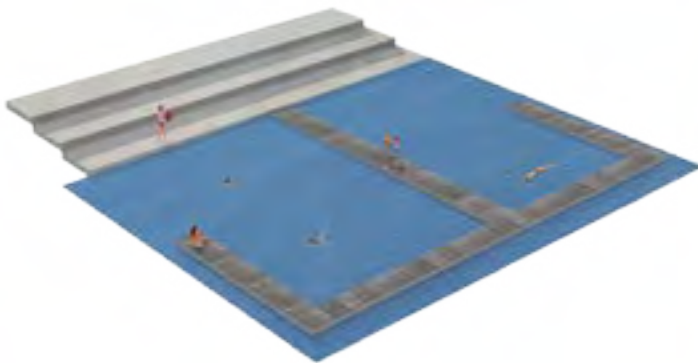


Figure 98: Saltwater pools create a safe and sheltered area for people to enjoy the bay.

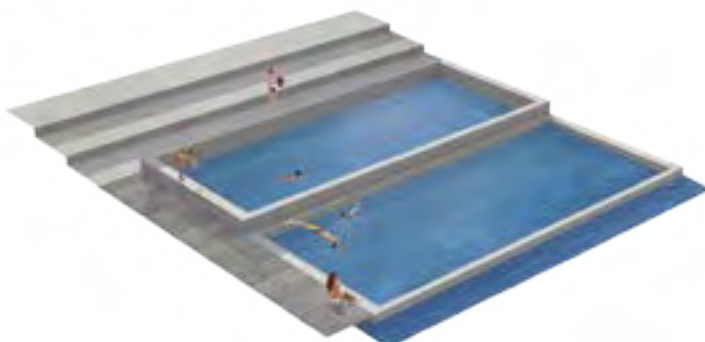


Figure 99: Enclosed pools mean that the depth of the pool can be consistent, making for a safer environment.

## Coastal Attractions

### Water Activities



The boardwalk (figure 100 ) aims to create interaction between water and land activities. Creating the boardwalk also allows people to easily access the water front.

Figure 100: Coastal boardwalk



Creating a boardwalk with extruding sections (figure 101 ) allows people to engage further with the coast and create personal spaces for picnics or swimming.

Figure 101: Active pathway with staggered wharfs



A sloping edge as seen in figure 102, can be used as an informal ramp for water access. The weaving paths acts as desire lines to encourage wandering through the site.

Figure 102: Weaving paths creating different spaces for people.

## Coastal Attractions

### Educational Activities

Evans Bay holds several education and sporting facilities, including St Patrick's College, Evans Bay Intermediate and the ASB Sports Centre. These facilities provide an opportunity to integrate learning with the coastline - through water education or swimming sports. Providing successful facilities for the schools to use will rapidly increase the popularity and importance of the site within the community.

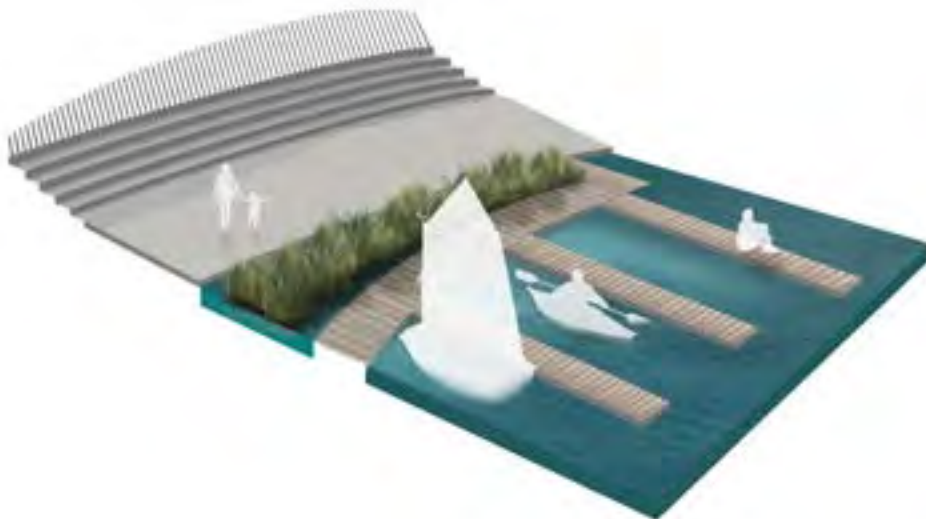


Figure 103: Small wharf structures create safe entry points for users.

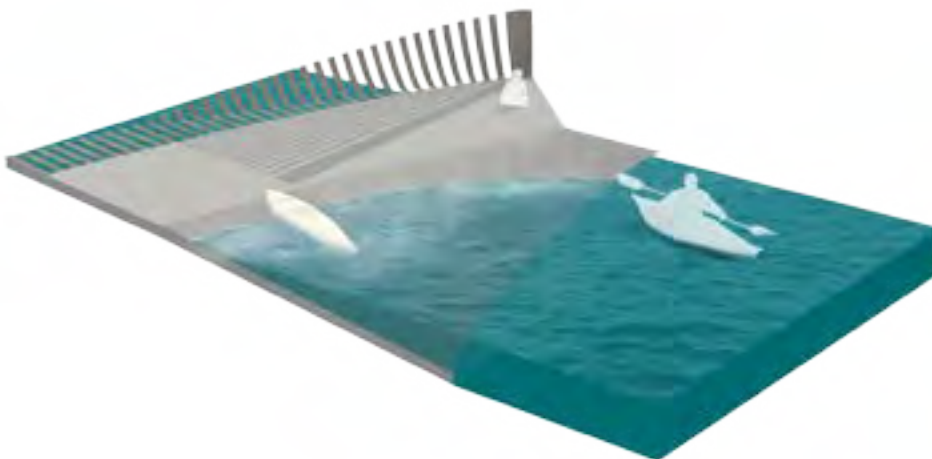


Figure 103: Utilising the spine like structures to block wind creates a sheltered area.

## Coastal Attractions

Due to the exposure to higher winds, the outer pathways utilise a 'fish spine' structure to create a wind break on the northern face of the bridge. The porosity of the wind breaks enables the users to experience the view. In areas of extreme exposure, the density of the spines is increased to ensure user comfort.



Figure 105: The porose 'fish spine' structure has spaces to be more effective and to maintain the views.



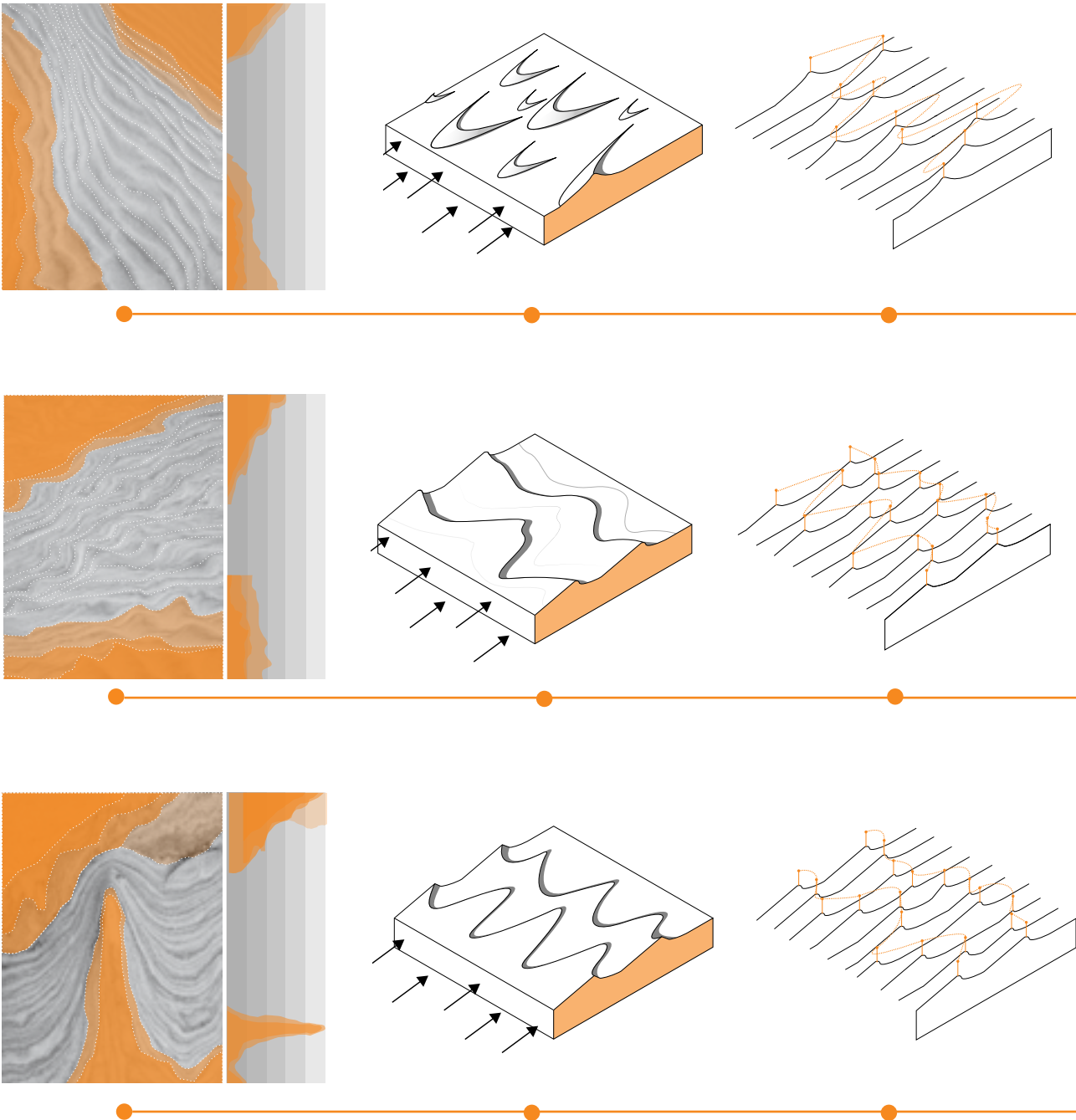
Figure 106: Exposed areas will have a higher density of spines, providing more sheltered spaces for users



Figure 107: A panorama shot of the bridge and the Evans Bay view.

## 5.5 Form Development

In 1909 the flats between Evans Bay and Lyall Bay were once dune lands, but were demolished for development shown in figure 35. This section aims to abstract large scale form through sand patterns and erosion caused by strong head winds. The incorporation of these forms helps to reference historical forms of the site; the forms also create a series of 'paths' that can be woven through the site, creating an unique experience in Evans Bay that has a sculptural element enhancing the site.





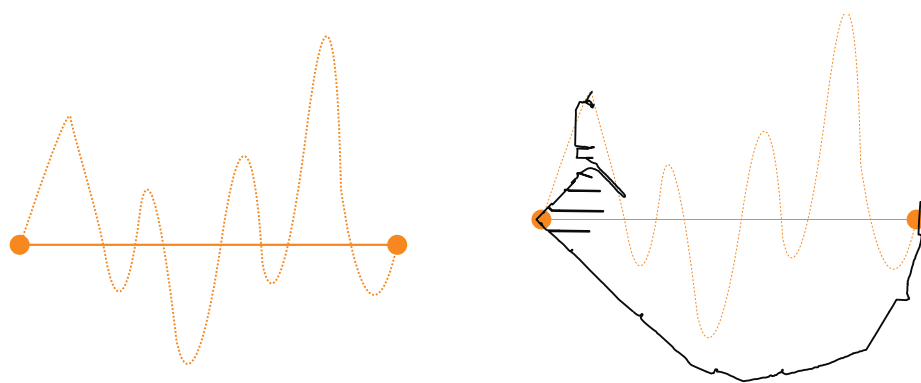


Figure 108 : High speed winds create small elliptical shaped ridges, creating more elongated forms.

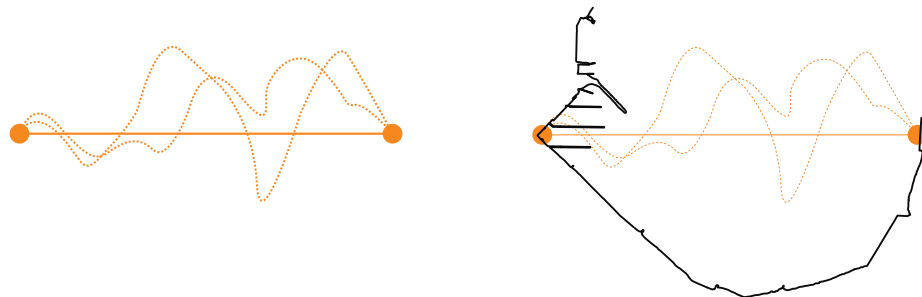


Figure 109: Low speed, fluctuating winds create more irregular shaped patterns.

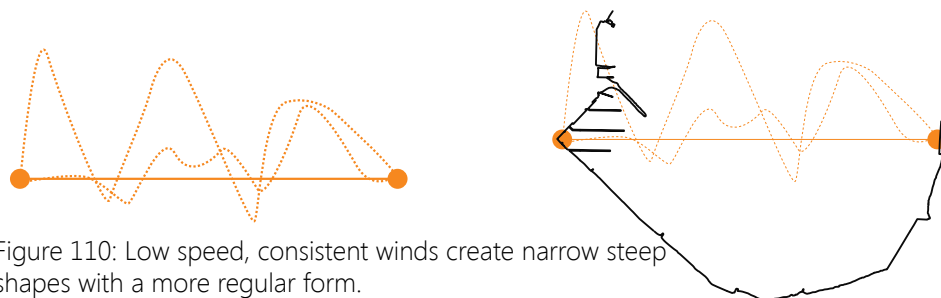


Figure 110: Low speed, consistent winds create narrow steep shapes with a more regular form.

## Form Development

The three pathways shown in figure 111, allow people to choose on how to travel through the site. The pathways also provide the opportunity to use shelter areas and create safer spaces for water activities. The form, inspired by patterns of sand dunes, connects the vital points in Evans Bay, allowing for different modes to integrate and travel through the bay safely. The meandering path draws people into the bay to experience the environment. With the curvature of the path reducing the speeds, cyclists can safely integrate with pedestrians.

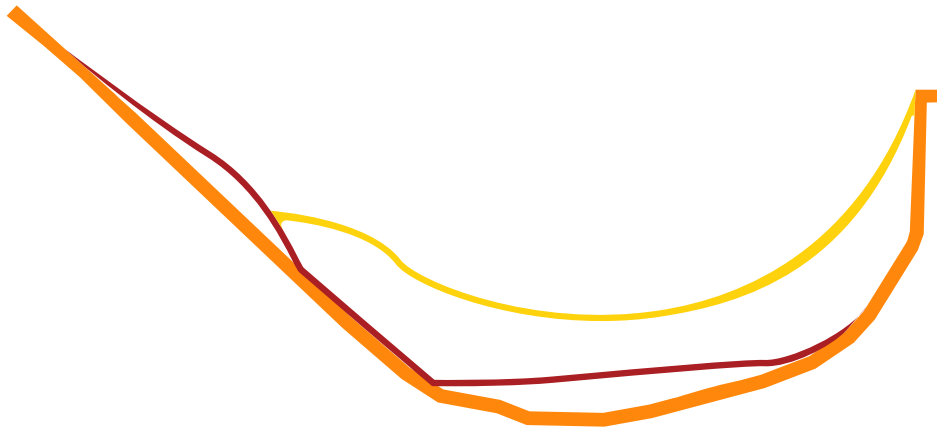


Figure 111: Iteration one

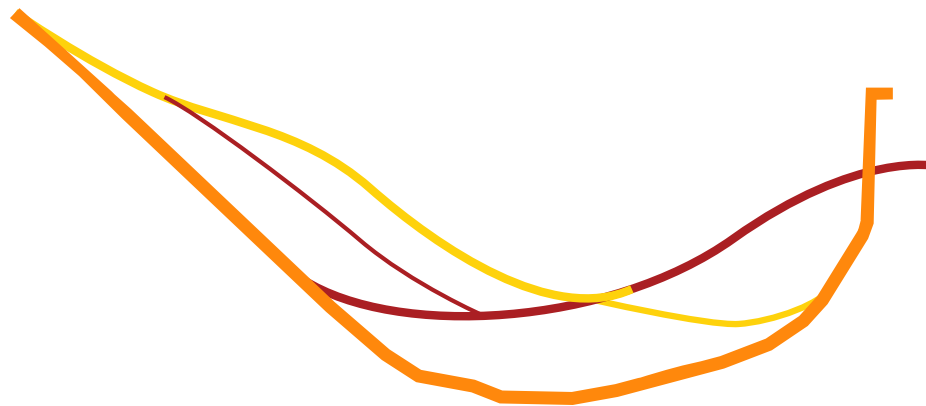


Figure 112: Iteration two



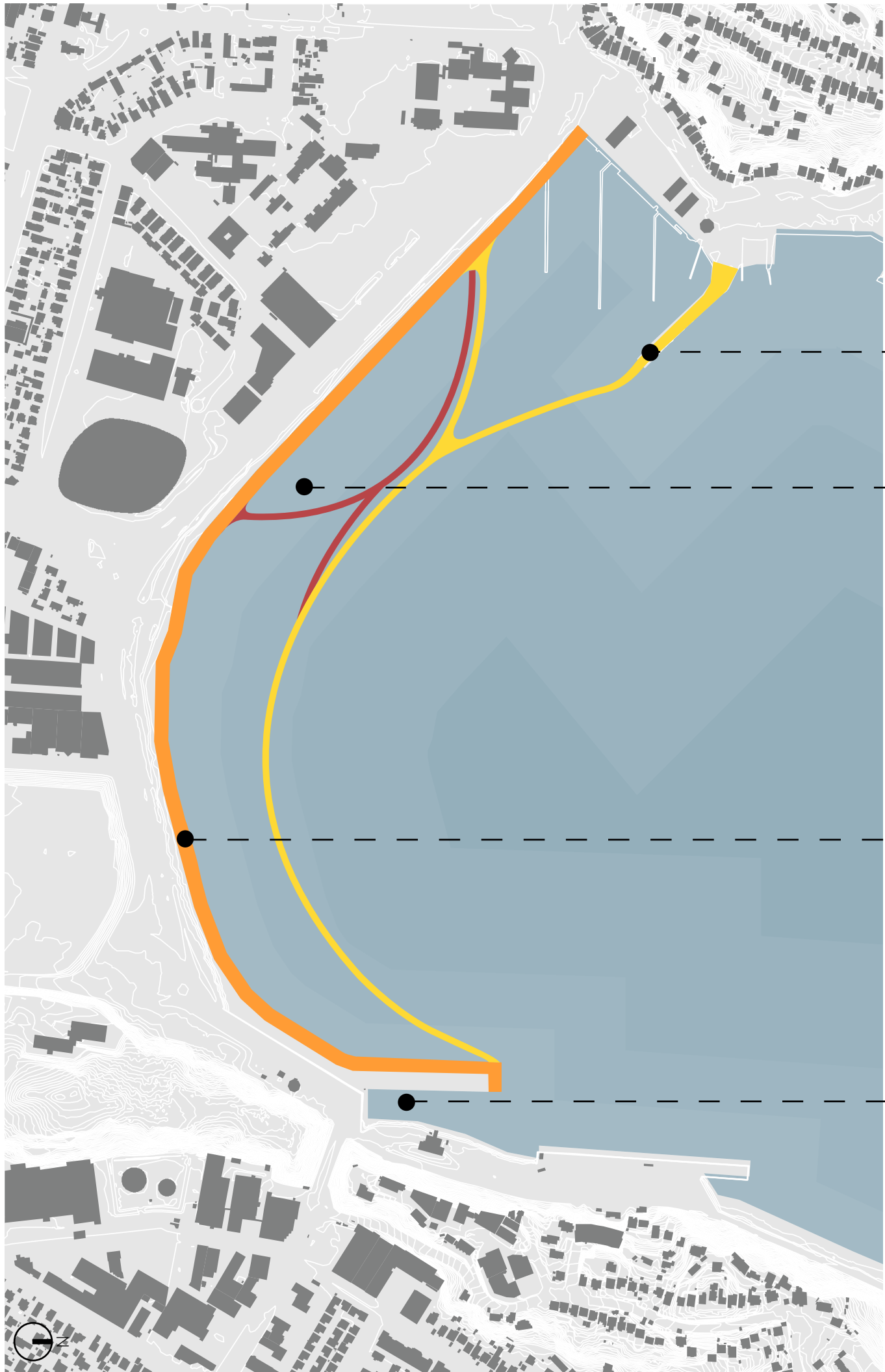
Figure 113: Iteration Three





- The inner coastal path is designed for higher speed modes e.g. cyclists, skateboarders, scooters. This path utilises the 'fish spine' form due to the exposed nature of the path. Hugging the coast creates a direct route for commuters looking for an efficient and functional path.
- The enclosed pool is an area in which people can use for recreational needs. The low lying path means that users can access the water's edge safely, with several edge conditions to encourage water activities. The goal is to develop an area where schools and other community groups can interact with the water in a safe and controlled environment.
- The outer path is a raised walkway, which invites people to explore the Evans Bay area in a unique design. Extending from the shell wharf to an extended sea break, people can explore the area, whilst the functionality of the docks is still maintained. This walkway also has integrated wind design to help combat the high winds in this area.

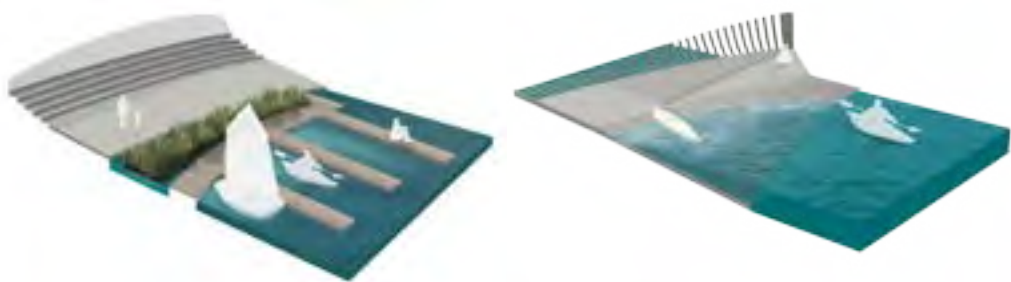
Figure 114: The overall form of the preliminary design.



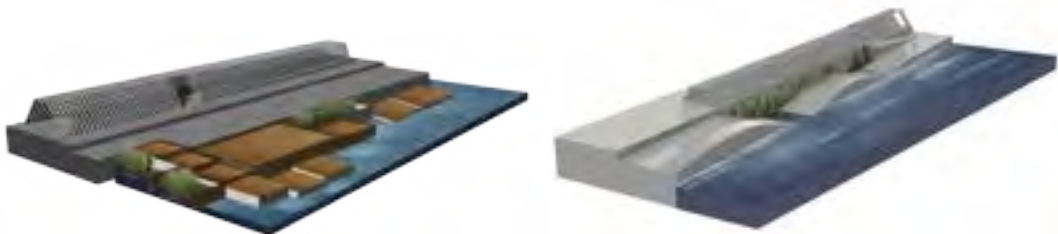
## 5.06 Concept Design Components



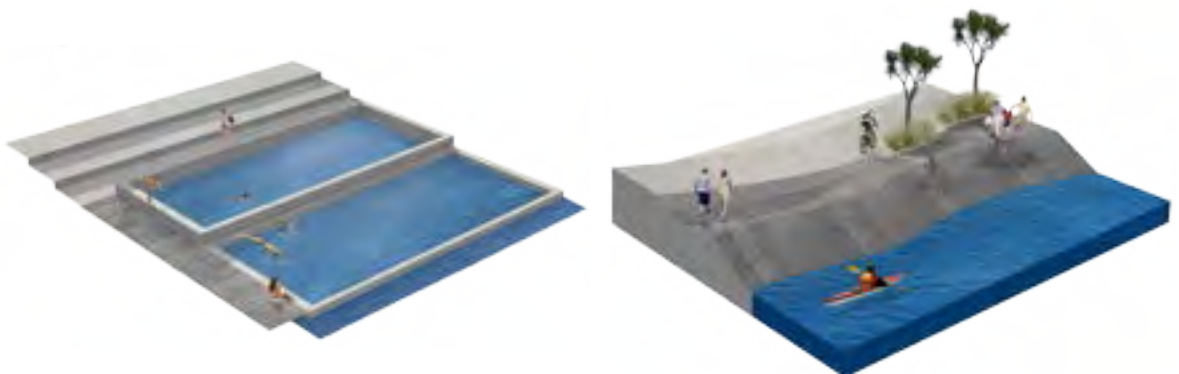
The outer yellow path in figure 115, will be a raised bridge with 'fish spine' structures on the northern edge; these will protect users on the path and shelter the other paths.



The inner bay framed by the red path in figure 115 is designed to host educational activities such as water wise for the local schools. The sheltered area creates a safe environment where younger kids can learn to experience and value New Zealand's Coastlines.



Maintaining efficient and safe pathways for faster moving traffic is vital; the inner orange path in figure 115, provides a faster, safer way through the bay. Coastal access will be maintained, however everyday commuters can utilise this path.



The eastern area in figure 115, is an ideal area to create a saltwater pool. It is currently not utilised and is relatively shallow. People can use the wharf to set up for the day and enjoy the water.



Figure 116: A view looking east towards the wharf. Large rocks prevent people from accessing the waters edge.



## 5.7 Preliminary Design Reflections

The initial design focuses on the overall form and how we can develop a site sensitive solution that holds a high level of functionality. The series of bridges extending into Evans Bay aim to draw people to the coastal edge and away from the vehicular traffic. The form of the bridges is derived from both physical and mythological narratives relative to the site. The edge conditions allow users to create a stronger relationship with the water. The bridges are accessible for all active modes of transport and provide a wide path for users to interact safely. However, alternative paths for higher speed transport are separated using boundaries to ensure safety. The spaces between the walkways create pockets that can be utilised for water treatment, ecological enhancement and educational activities. These spaces can be adopted and developed by the community - allowing them to create a responsive landscape that adapts to the local needs.

### Design Principles

#### Green and Blue Infrastructure

The quality of the water in Evans Bay is not suitable for swimming or interaction due to the storm water outlets. The design implements a series of small wetlands, which contain the storm water and naturally filter out the pollutants. With the removal of pollutants, water based activities can safely enjoy the bay.

#### Multi-modal Integration

The design is based around the concept that cyclists integrate better with pedestrians than they do with cars. The idea of the bridges is to separate the modes from vehicular traffic and integrate active modes. The variety of pathways creates a multitude of spaces users can explore, whilst maintaining efficient links for active commuters.

#### Water Access/ Coastal Access

Initially the site had minimal safe or public water access points. Activities such as boating, swimming and sailing were limited to the boat ramps and marina. The preliminary design introduced edge conditions that accommodate water activities and provide a series of safe entry points to the water. Creating safer links with the water will encourage local schools and communities to safely interact with the water for educational activities.

#### Positives:

The unique form creates a sculptural element to the bay that will encourage interaction. The current design provides a safe route for all active modes of transport to commute through. The overall form of the design allows for a diverse range of activities to take place.

#### Negatives:

The design is a significantly large piece of infrastructure and takes up the majority of Evans Bay. With the bridges extending into the bay, the functionality of the docks are impaired, which is an important aspect in the bay that needs to be maintained. Although the green and blue infrastructure has been addressed by the implementation of small wetlands, the design has not developed a natural system large enough to deal with the storm water runoff. The overall form of the design does not fit onto the site context and needs to be developed further to create an effective solution.

## 6.0 Developed Design

The initial preliminary design explored form through various scales. Although iterations where successful in terms of multimodal integrations and improved coastal/ water access; the design did not capture the essence of the bay or enhance the natural ecologies. In order to effectively produce a design that addresses the key design principles, further development at the larger scale is required.

## 6.1 Form Refinement Pathways



Figure 117



Figure 118



Figure 119



Figure 120



Figure 121



Figure 122

The Evans Bay coastline is significantly degraded on the southern edge and vegetation struggles to grow on the exposed area. The site is not appealing to explore or stay in for long periods of time, however on the eastern corner there is a particular section that stands out from the rest of the coastline. A small area has a poetic feel, where desire paths weave through patches of vibrant green ground cover (figures 117-122). Plants and driftwood sculptures are stacked up like totem poles (figure 118). This area has human interaction that creates a completely different feel to the rest of the bay and is an area that has potential to thrive.

## Desire Lines

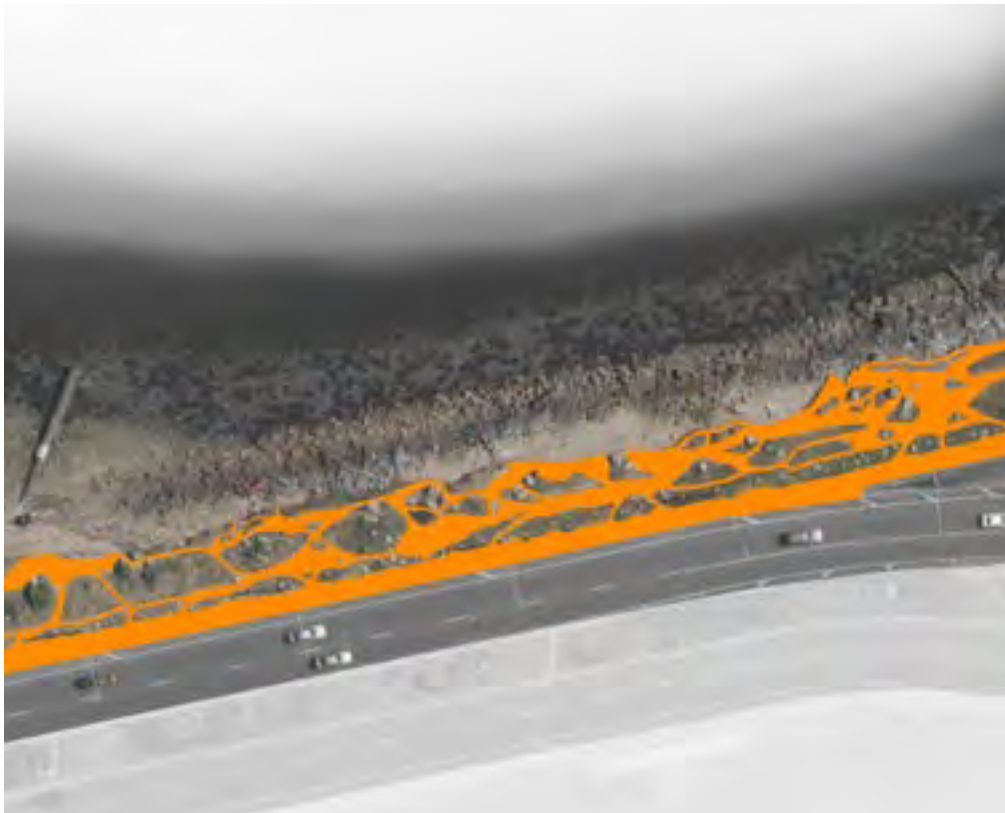


Figure 123: Interesting sections of the desire line patterns.



## Final Iteration

The drive for the design is to integrate public space and active transport in order to demote the everyday use of the vehicle. The initial design created opportunity to remove active modes away from cars, however did not offer efficient space for the public.

Desire lines naturally create pockets of spaces within the weaving tracks. In Evans Bay these spaces are used to create totem poles or cultivate vegetation. Using the concept of desire lines to refine the overall form and individual spaces, this will create a matrix of spaces that can be designed for specific activities or left for interpretation.

## Iteration Process

Desire lines are representations of the most efficient way to a particular point, created by people. These can be used to create a faster way from point A to point B; they can also be used to slow water. A meandering river creates a similar pattern as desire lines, with waterways weaving through the land, slowing the water down. The design iterations begin to focus the patterns around the stormwater outlets, shown in figure 124, in order to slow the water down. By slowing the water down at the outlets, this provides the opportunity to begin to filtrate the water.

Overlaying water filtration with interconnecting pathways, the design can begin to develop a matrix of spaces and access routes for people to utilise and enjoy.

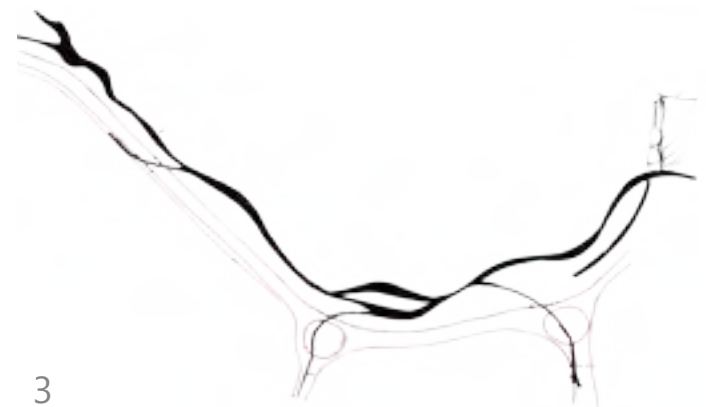
- 1 Figure 124: Overlaying the patterns around the five storm water outlets.
- 2 Figure 125: Tracing over the patterns and linking the key connections.
- 3 Figure 126: Refining the paths into a functional collection of routes.
- 4 Figure 127: Refining the paths further and assessing the vital entry points of Evans Bay.



1



2



3



4

## Final Iteration

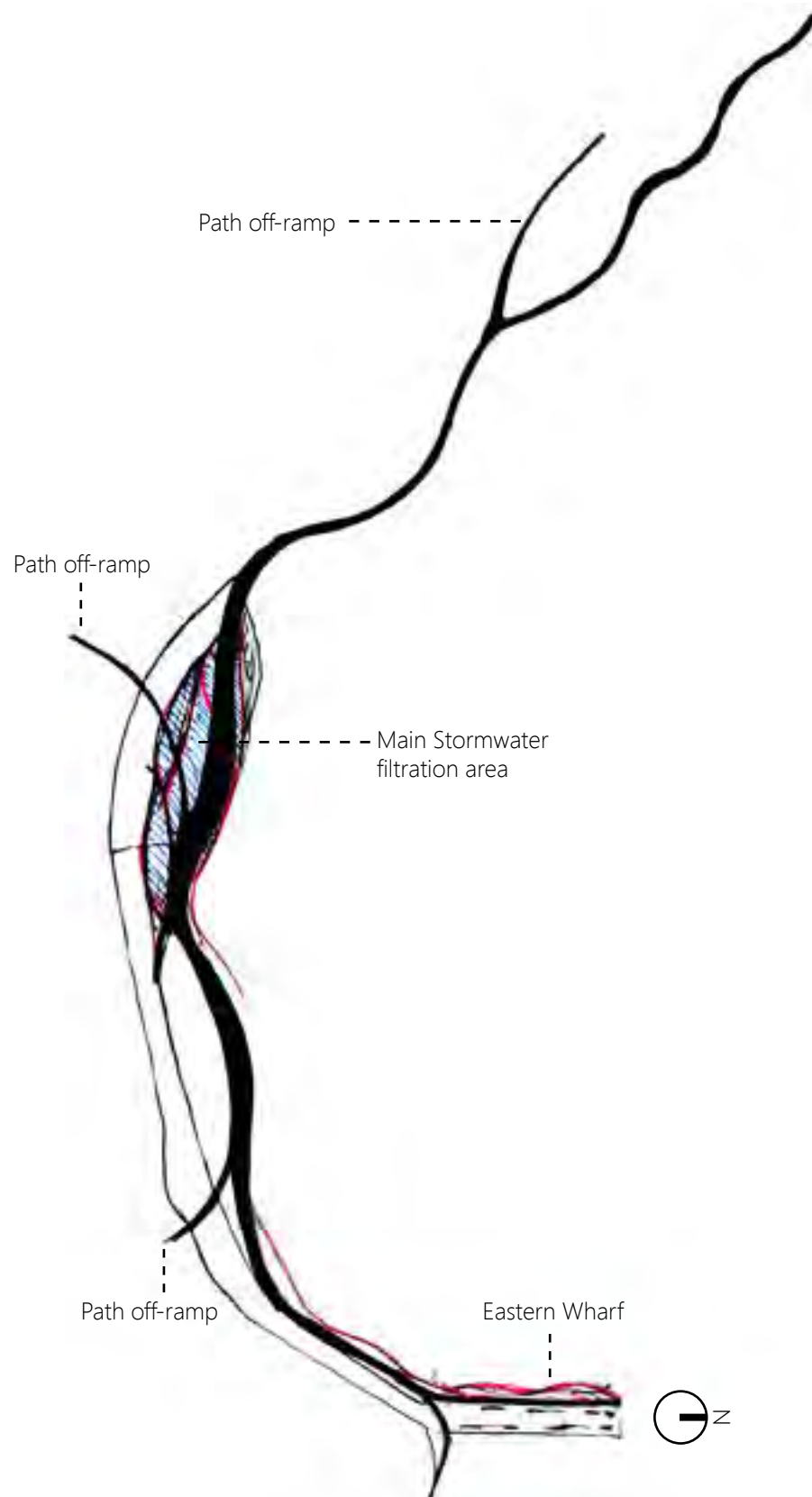


Figure 128: The refined iteration and developed overall form.

## 6.2 Model Testing

### Model Testing



Figure 129

The base model was a scaled version of the Evans Bay area created using a CNC router. Each component of the proposed design was lazer cut and overlayed on the CNC foam model. This technique provided an accurate representation of both the bay and the design. Seeing the design through modelling clearly portrayed the proportions of the form relative to its context - more effectivley than through computing techniques.

## Model Testing



Figure 130: A close up of the lower wetland area.



Figure 131: The eastern wharf in Evans Bay with an potential path attached.



Figure 132: Looking east towards the airport. The proposed path weaving in and out from the coast.

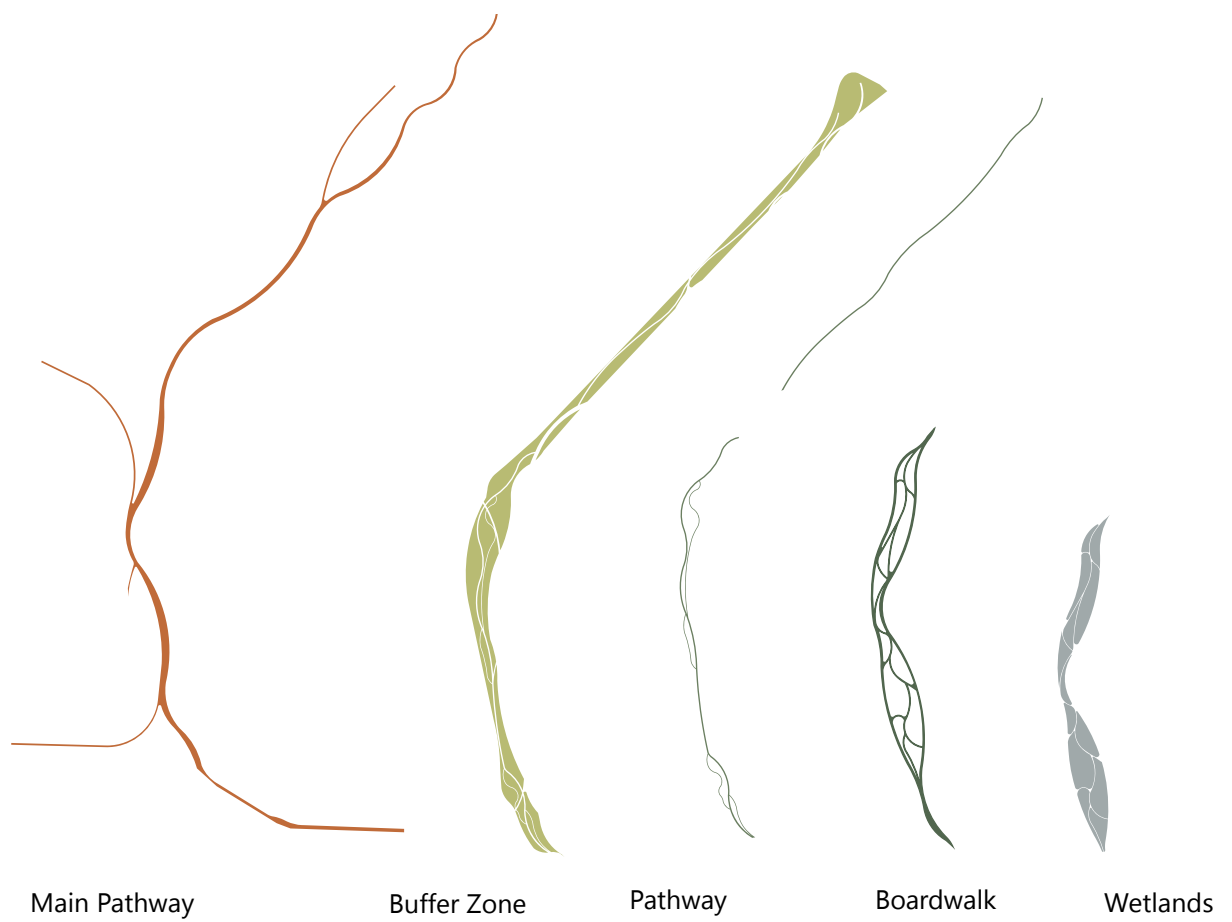
## 6.3 The Proposal



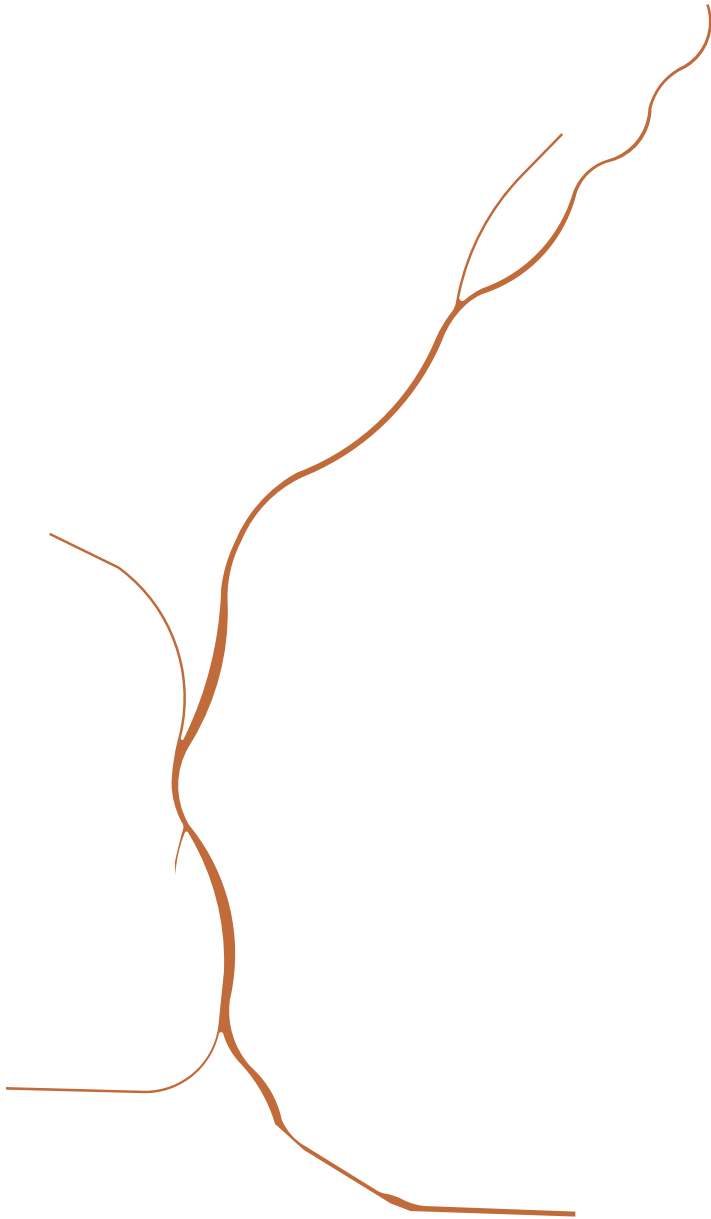


Figure 134 : The proposed masterplan for Evans Bay.

## Design Components



## Main Pathway



**Figure 136:** The boardwalk aims to draw people to and around the site. Meandering in and out the coastal edge. Extending arms link people under Cobham Drive and onto the water's edge. Commuters and other users of the site will use this path. The average width being around 3 meters and widening when other paths merge to safely intertwine users.



## Buffer Zone



Figure 137: This area is created to make a barrier between the vehicles and people on the site. The mounds create pockets for people to explore, whilst the vegetation borders the road.

## Pathway

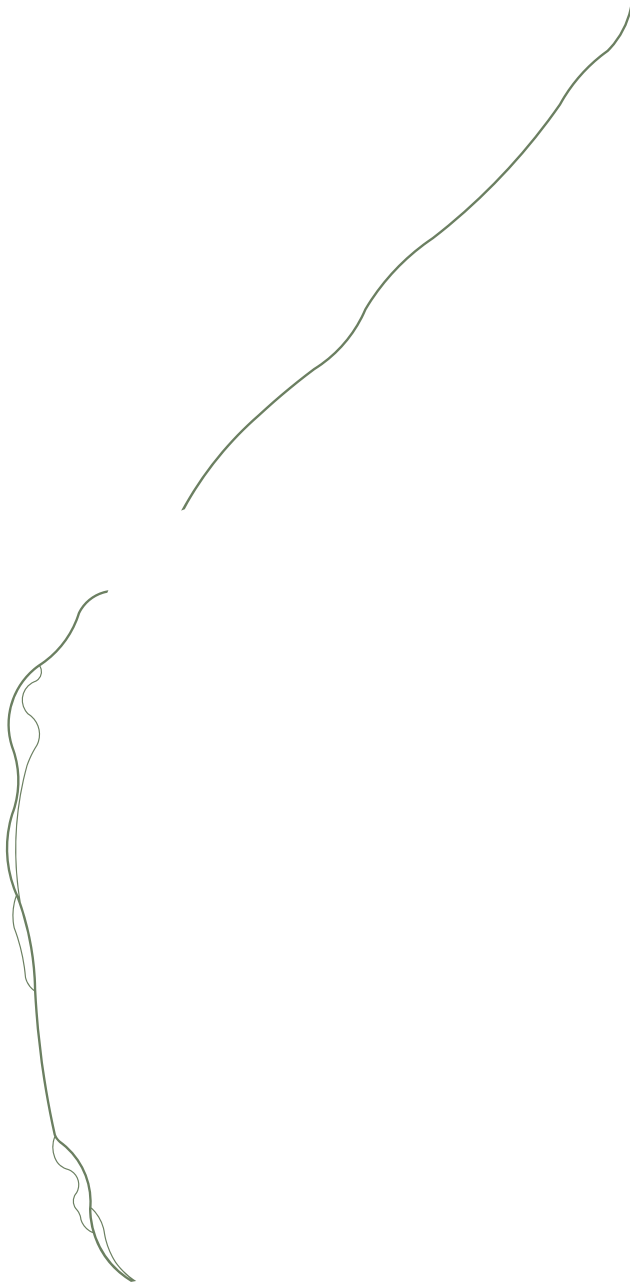
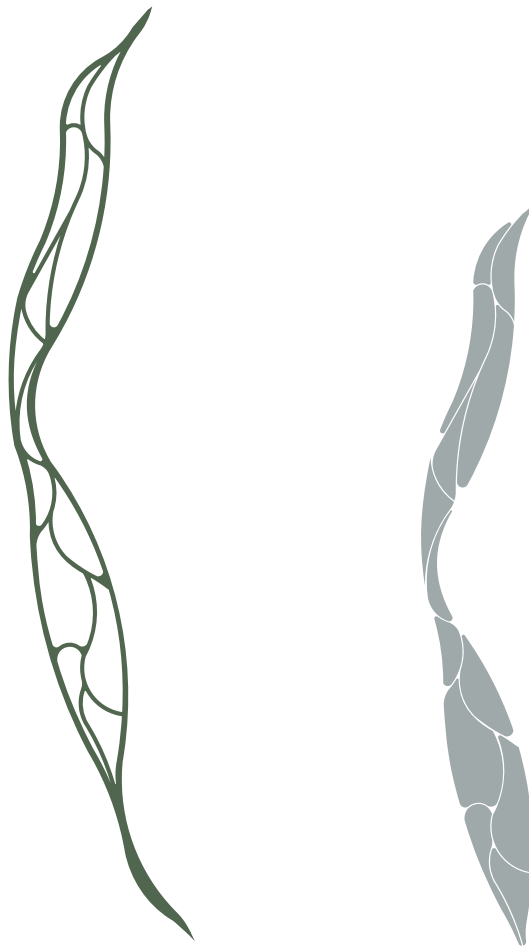


Figure 138: The pathway is designed to allow people to meander through the buffer zone and find small pockets of spaces planted by native vegetation. The path is shaped like desire-lines, so people can begin to develop their own way through this area.

## Lower Boardwalk and Wetlands



**Figure 139**

### Lower Boardwalk

The lower boardwalk brings people down to sea level and to the wetlands. This walk exposes people to the implemented natural systems and allows them to explore the space.

### Wetlands

The Wetlands/salt marsh, is a tidal system that aims to filtrate the water from two of the main outlets in Evans Bay. Providing a barrier for the sea and enhancing the local ecology.



Figure 140: Traffic matrix of where different categories of cyclists travel.  
(Not to scale)



## Proposed Traffic Matrix

The path design allows all four categories of cyclist to travel through the pathways. As seen in figure, the cyclist can choose between the multitude of pathways, with the exemption of sports cyclist. Sports cyclist generally have vast experience riding on the road with vehicles and aim for the fastest route. Due to this, the sports cyclist would often prefer to cycle on the road- however are not prohibited from the other paths.

Outline by the text Paths, Track and Trails, each cyclist has a list of preferences in order to provide a successful cycleway (figure). The preferences were integrated through the design process to ensure that cycle safety and enjoyment was achieved.

## Cyclist Categories and Preferences



### Touring Cyclist

- Good views
- Good surfaces
- Rest areas



### Sports Cyclist

- Safety
- Good surfaces
- No delays
- Steep/ challenging terrain



### Commuter Cyclist

- Good road surfaces
- No delays
- Minimal conflicts with other transport



### Recreational Cyclist

- Comfort
- Views
- Low degree of slope
- Good surfaces
- Safety

## Cyclist Times

The average speed of the cyclists is based on the text Paths, Tracks and Trails. Cobham Drive from A to B (figure) is around 1.7km and the proposed pathways average around 2.5km in length. The times are dependent of whether the cyclist stops and the amount of traffic. Touring cyclist and recreational cyclist are not bound by time limits and are simply riding to enjoy the environment. Therefore will not be considered in the following, (Ceccon and Zampieri)

Sports Cyclist: average speed 30-40km/hr  
Road time= 3 minutes  
Pathways = 4 minutes

Commuter Cyclist: average speed 20-30km/hr  
Road time= 4 minutes  
Pathways= 6 minutes

The design does not aim to provide the fastest way through Evans Bay, instead it offers a safer route away from cars for all active modes to enjoy.

## 6.4 Detailed Design

## Area 1

The Trees



## Area 2

Marshlands



## Area 3

The Seawall Bridge



## Area 4

Off-Ramps



Each area was chosen to detail due to its importance to the proposed design. The four areas are the key sections that capture the essence of Evans Bay and are vital to the design's success.

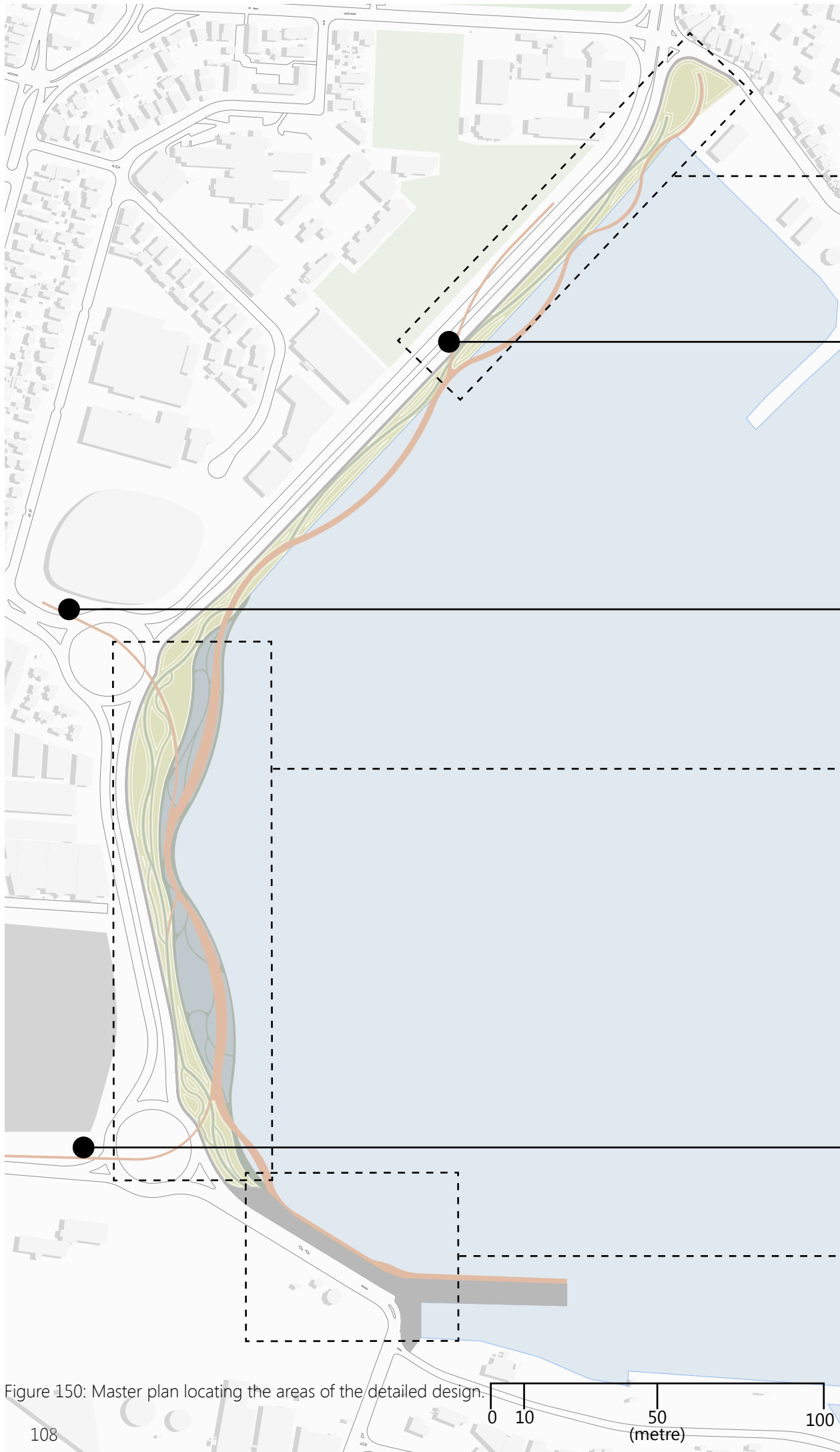
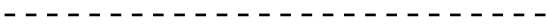


Figure 150: Master plan locating the areas of the detailed design.

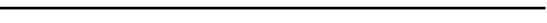




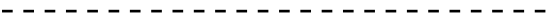
Area 1  
The Trees



Area 4  
Off-Ramps



Area 4  
Off-Ramps



Area 2  
Marshlands



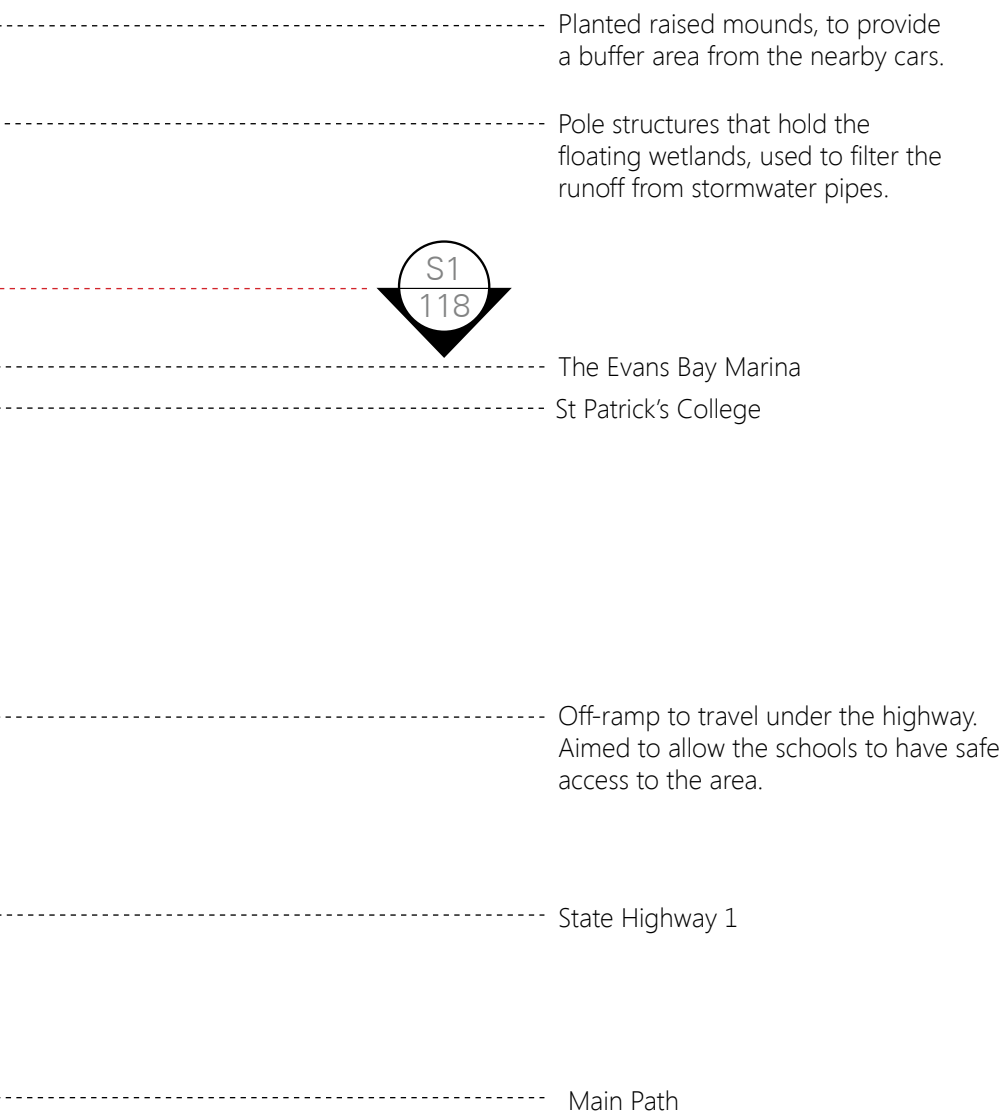
Area 4  
Off-Ramps



Area 3  
The Seawall Bridge



Figure 151: Plan of the area 1



## 6.5 Area 1- The Trees

### The Trees

Area 1 is the western entry point for the site where the main path begins. This area has a forest like structure inspired by the marina, mimicking the docking posts. The posts give a sculptural touch by creating a forest like appearance, but also host a series of floating wetlands. The wetlands are designed to form a saltwater marshland that will begin to filtrate the two smaller stormwater outlets located in this area. The floating marshlands will begin to enhance the local ecology providing a natural habitat for aquatic species in the area. Previously users could observe the coastal ecology from a distant path, but the curvature of the path now weaves people through the changing environment - advertising the natural beauty of Evans Bay.



Figure 152: The view from the coastal path through the wetland trees.













Figure 153: The view from the coastal path through the wetland trees.

S1

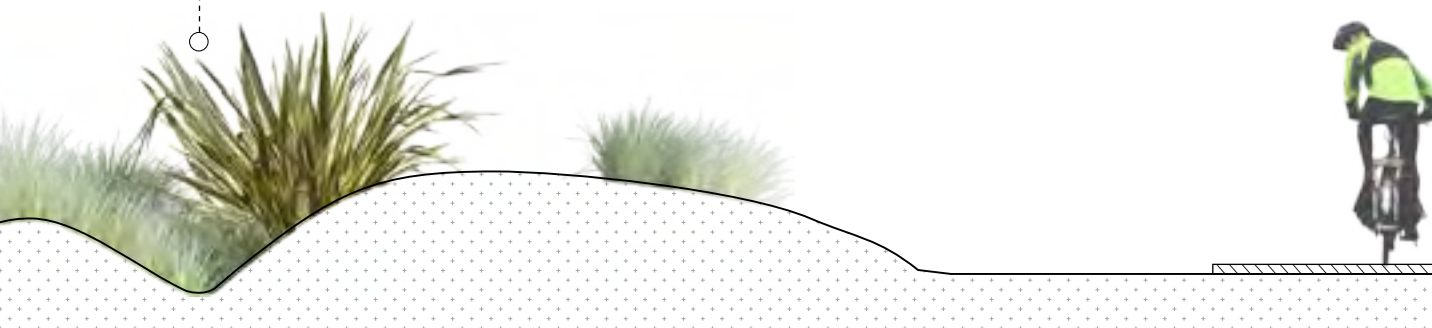
SECTION 1



Figure 154: Section 1 showing the planted buffer zone.  
1:50 @ A4



----- The planted mounds increase the ecological strength of the site. The root systems will also stabilise the ground to prevent erosion.



Cyclists can weave through mounds or choose the boardwalk to travel through Evans Bay. -----

S1

SECTION 1

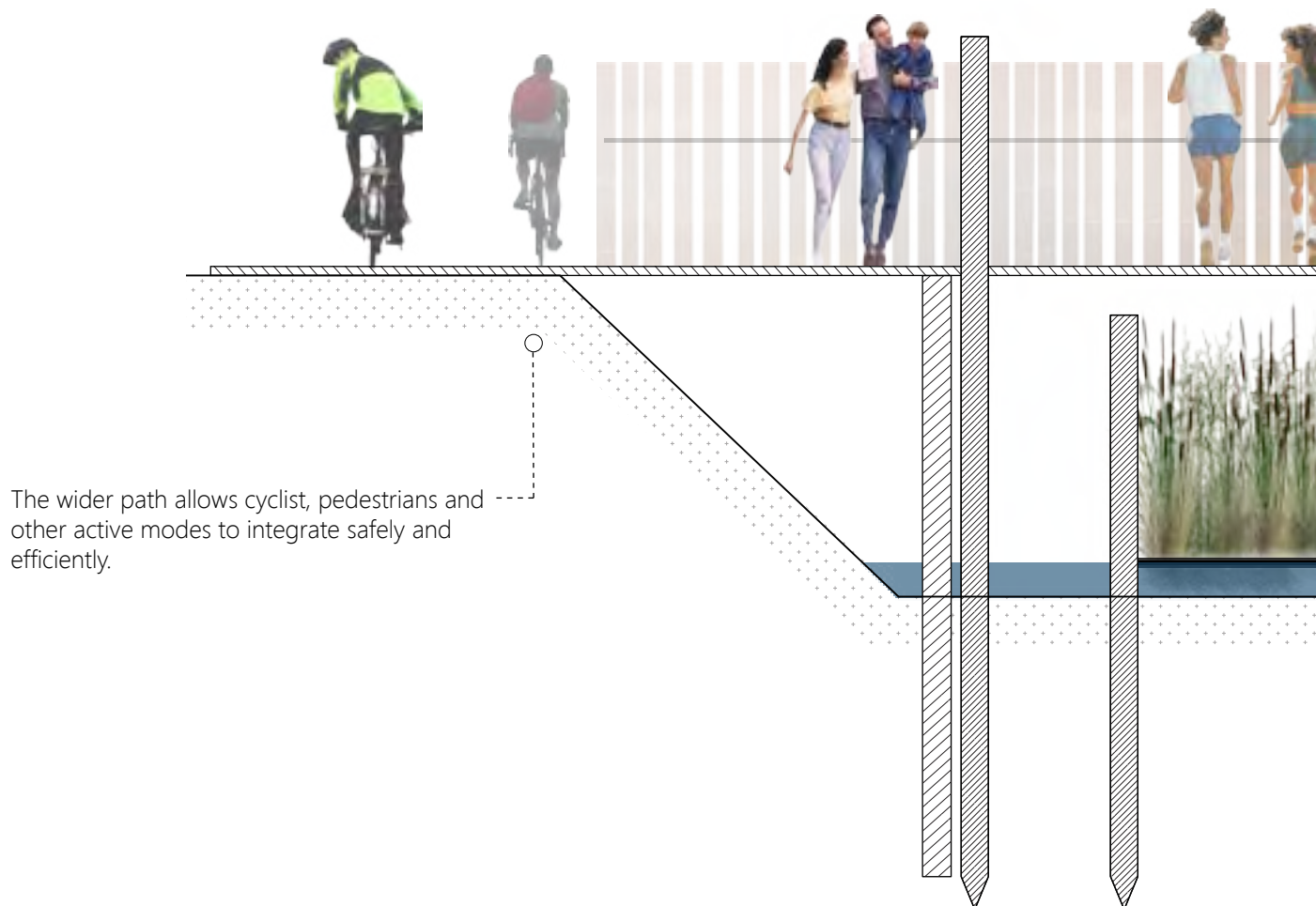
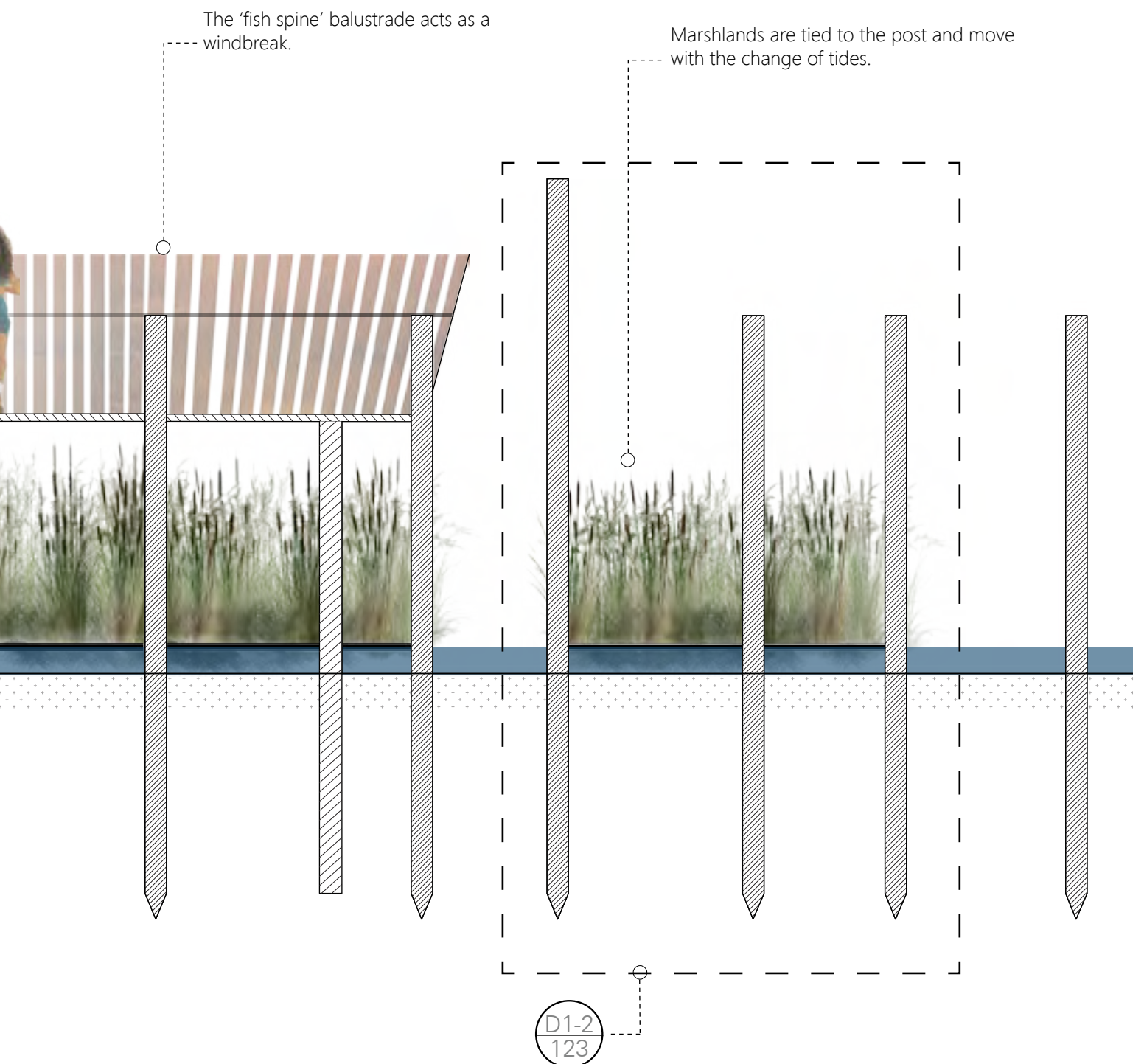


Figure 155: Section 1 showing the coastal boardwalk amongst the 'Trees' and marshlands.  
1:50 @ A4



# D1

## Marshland Detail 1

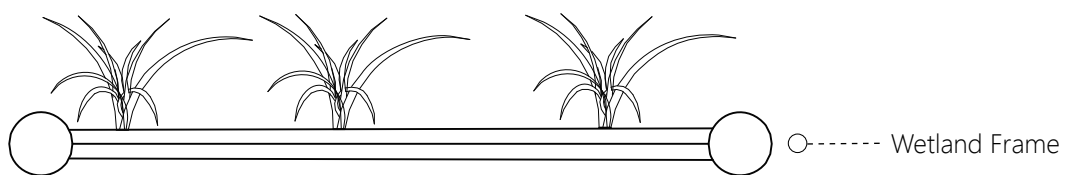
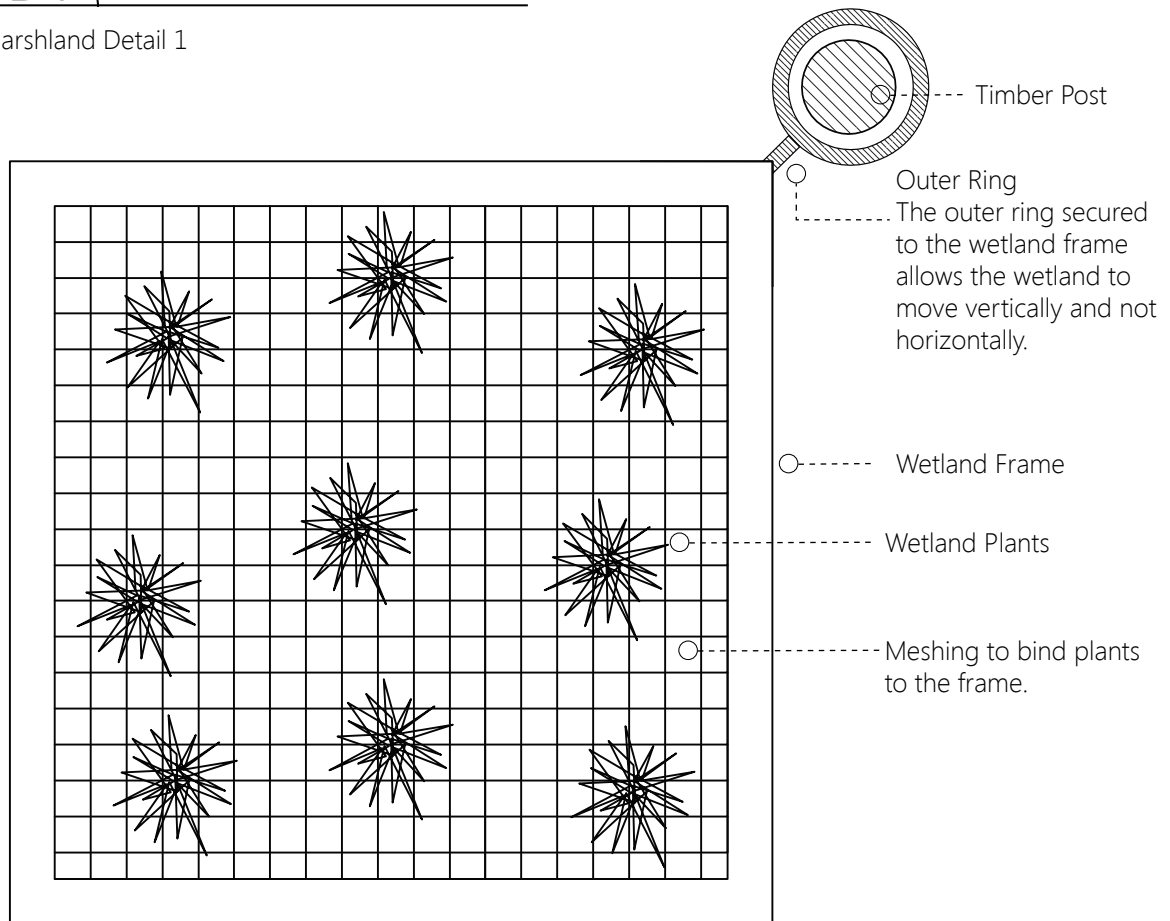


Figure 156: Detail of the floating marshland systems. Root system will extend into the water.



Figure 157: Remuremu



Figure 158: Oioi



Figure 159: Wiwi



Figure 160: Purei

The species used are a section of native marshland species that are tolerant to saltwater. Together these plants will create a dense root system that will trap sediment and filtrate the pollutants that flow from the storm water outlets.

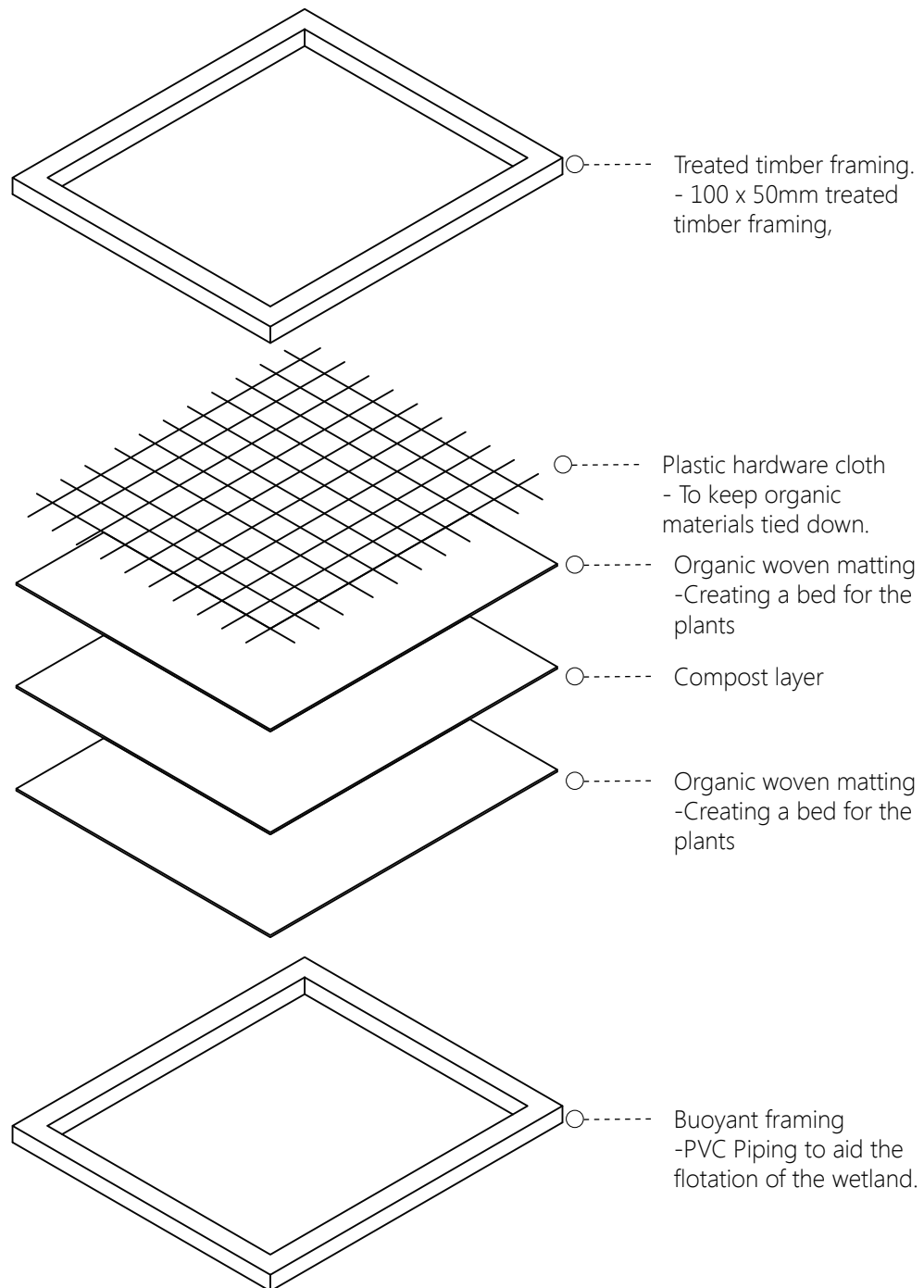
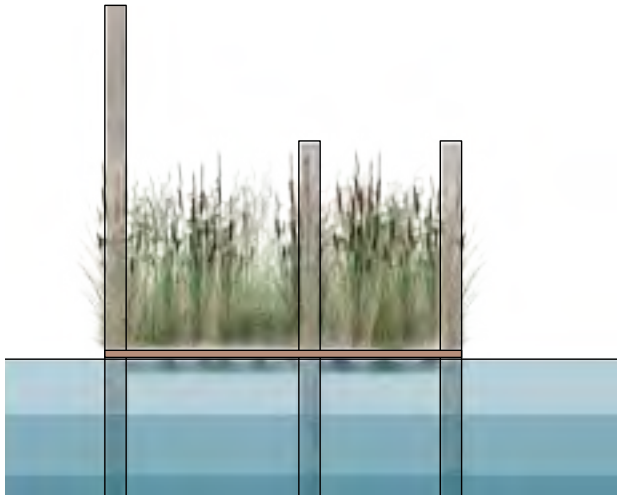
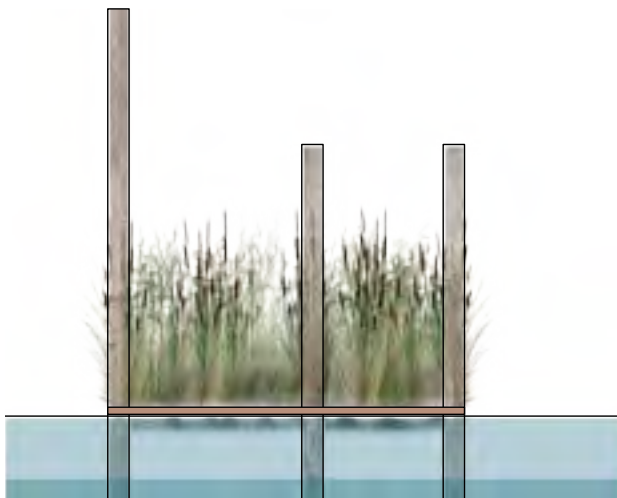


Figure 161: Exploded diagram showing the detail of the floating marshlands.

## Tidal Change

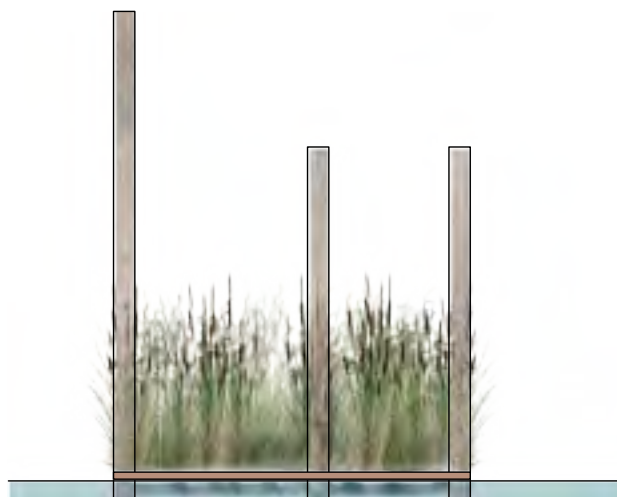


High Tide



Natural marshlands are often found in estuarine areas; the shallow water means at low tide the marshlands are virtually dry. In areas where the water is deeper, marshlands do not naturally form.

In order to provide these marshlands with the right amount of water, they must change with the tide. The buoyancy of the framing and loose connection to the poles, allows the marshlands to stay on top of the water level as the tide changes.



Low Tide

Figure 162: Detail of how the wetland changes with the tides.





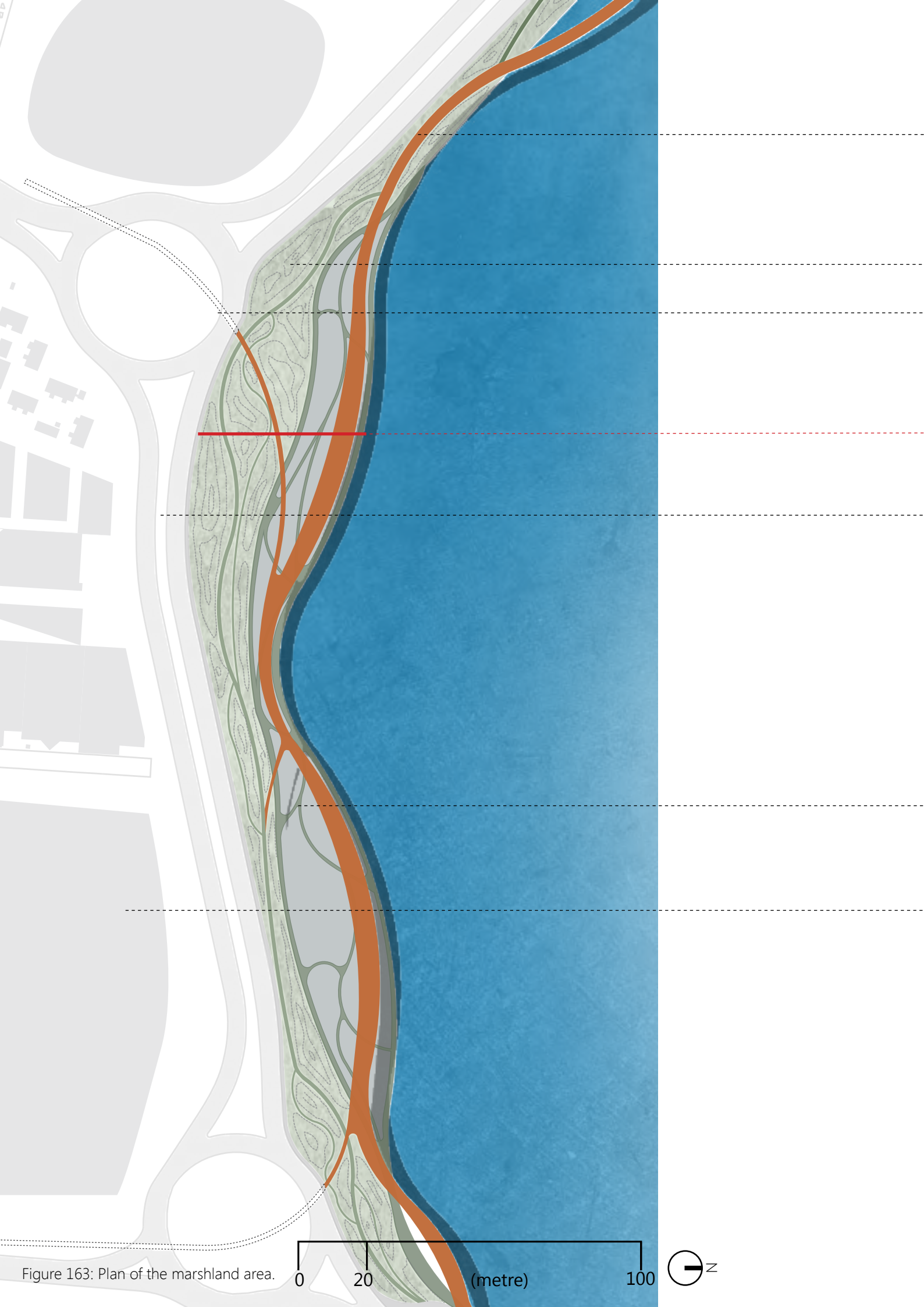
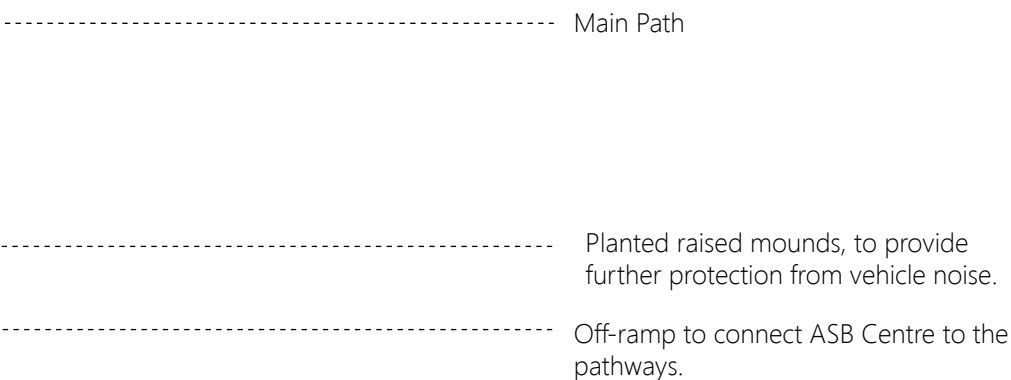


Figure 163: Plan of the marshland area.





## 6.6 Area 2- Marshlands

The Marshlands are located around the two largest storm water outlets in the bay and is the area where water filtration is the main focus. There are two main elements to this section - the marshlands/ lower board walk and the main boardwalk path. The boardwalk in this area is a continuation of the boardwalk throughout the site and continues to offer efficient and safe paths through Evans Bay.

### Marshlands

The marshlands are a series of man-made ponds that direct and slow the stormwater in order to allow the plants to effectively filtrate pollutants and sediments. The ponds will fluctuate with tidal change, however the designed topography will still allow for filtration. A boardwalk is set amongst the vegetation to allow for people to explore and understand how important strong ecology is. Increasing people's knowledge of the effects of stormwater outlets is a key step into changing our overall view of ecologies in urban environments.



Figure 164: View of the marshlands from the lower walking area.











Figure 165: View within the marshlands on the lower walking area.







Figure 166: View of the marshlands on the upper boardwalk





S2  
SECTION 2

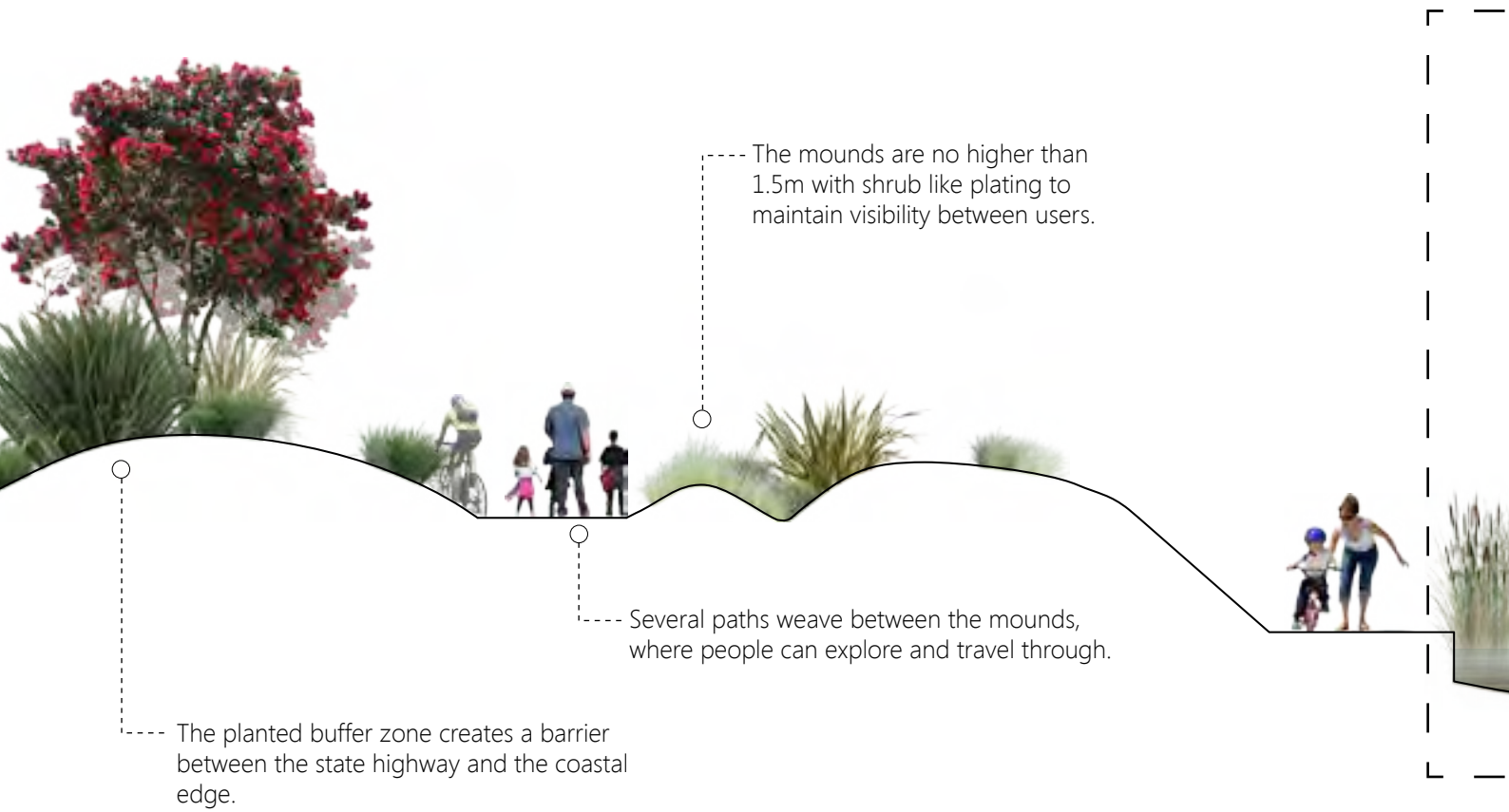
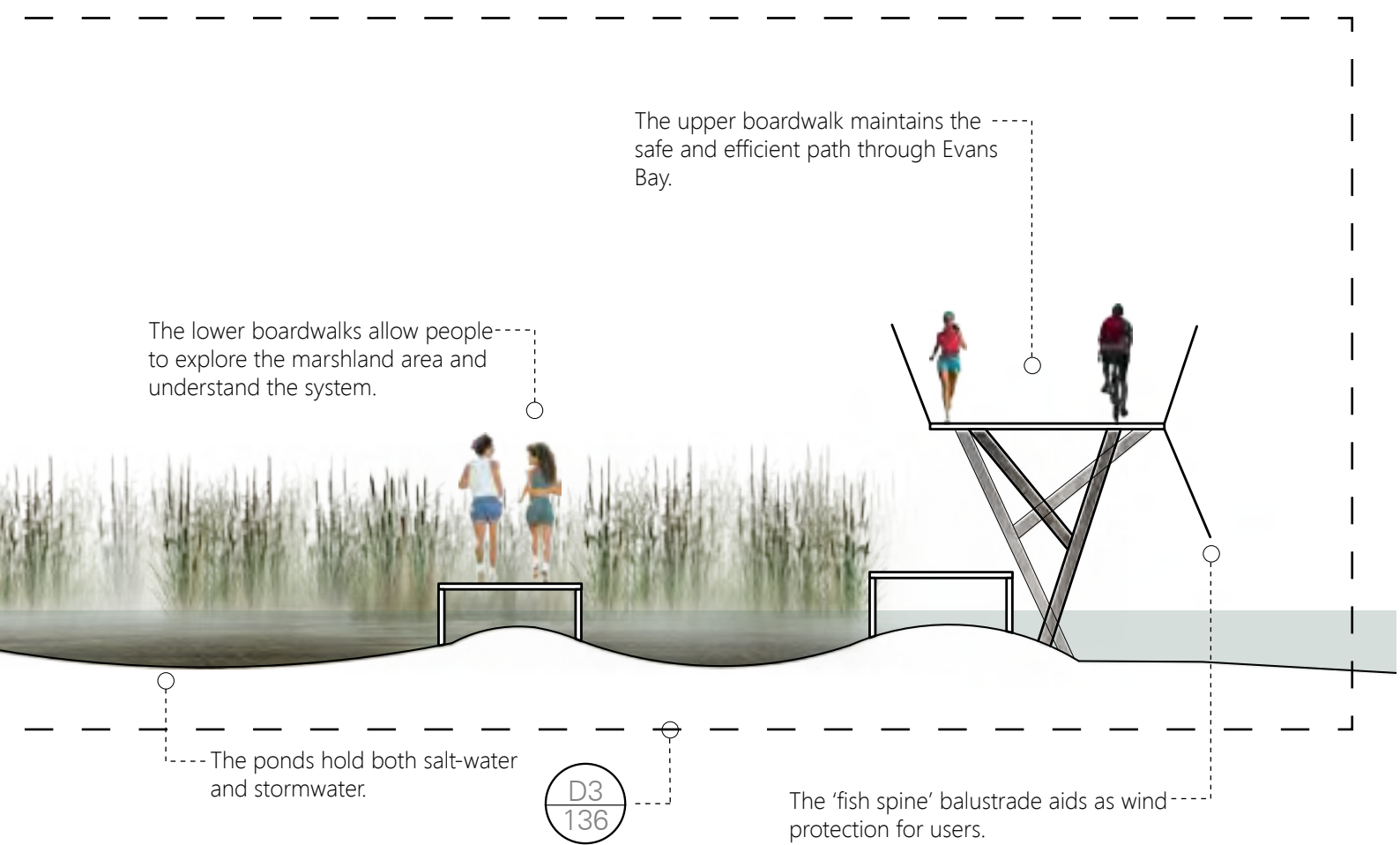


Figure 167: Section of the large marshland area.  
1:100 @A4



**D3**  
DETAIL 3



Figure 157: Remuremu



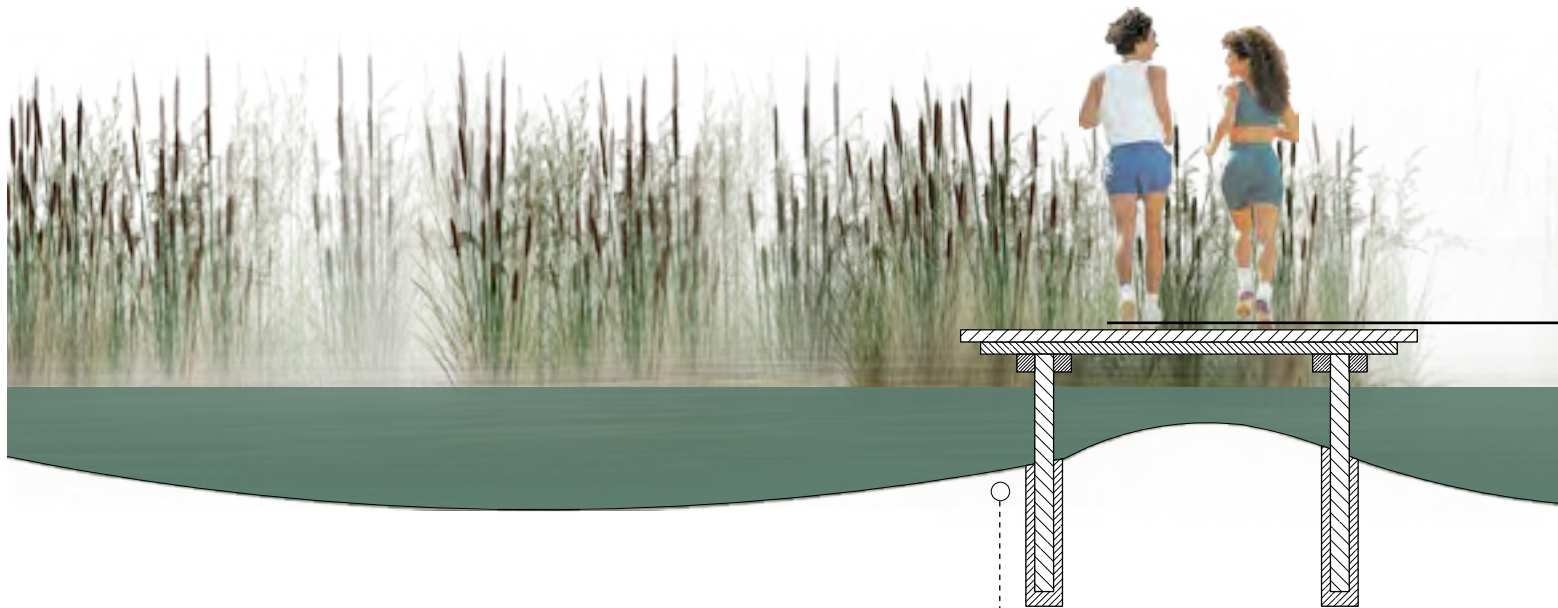
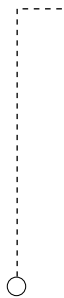
Figure 158: Oioi



Figure 159: Wiwi

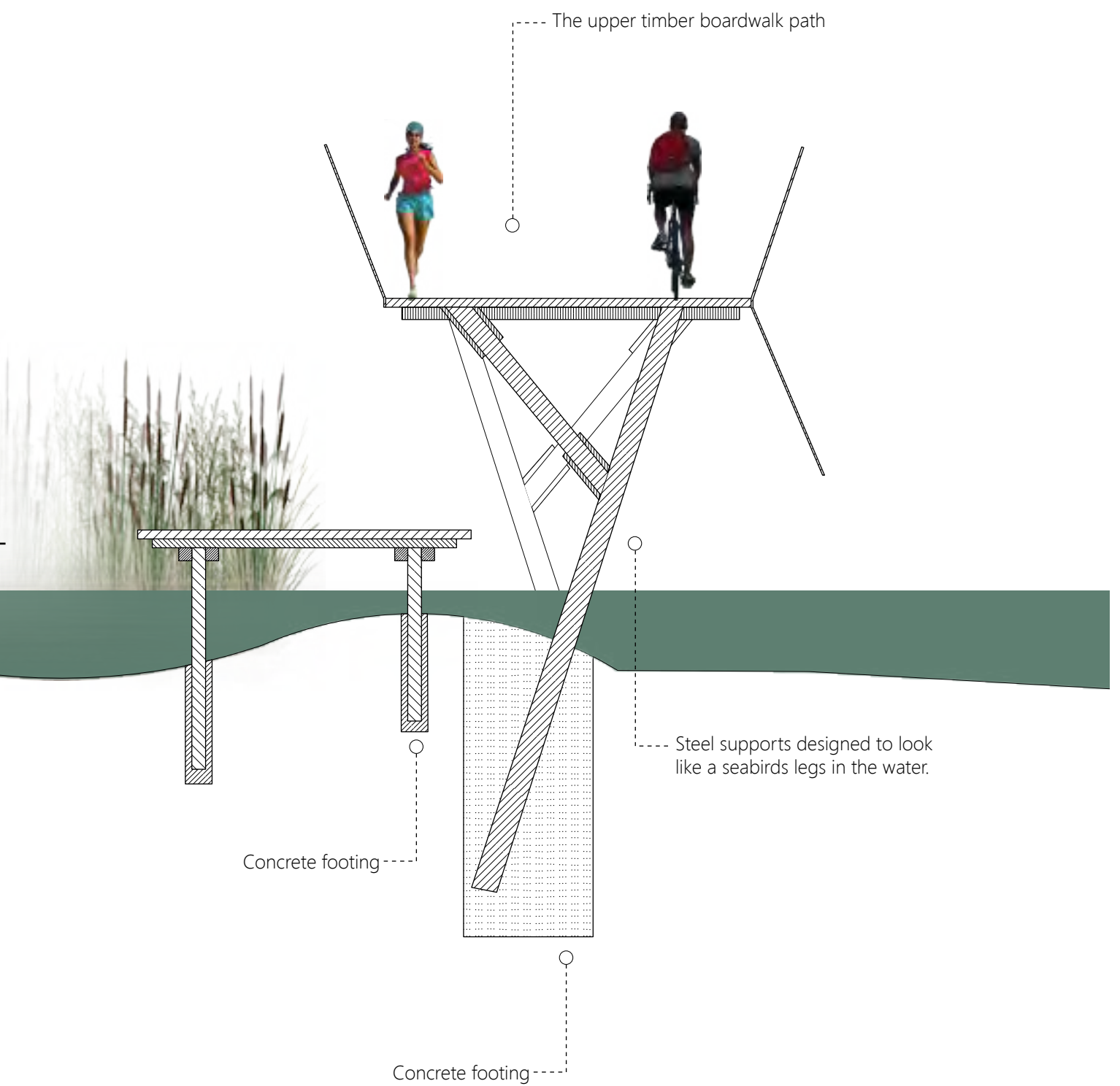


Figure 160: Purei



3m timber boardwalk between-----  
marshlands

Figure 168: Section of the large marshland  
area.  
1:50 @A4



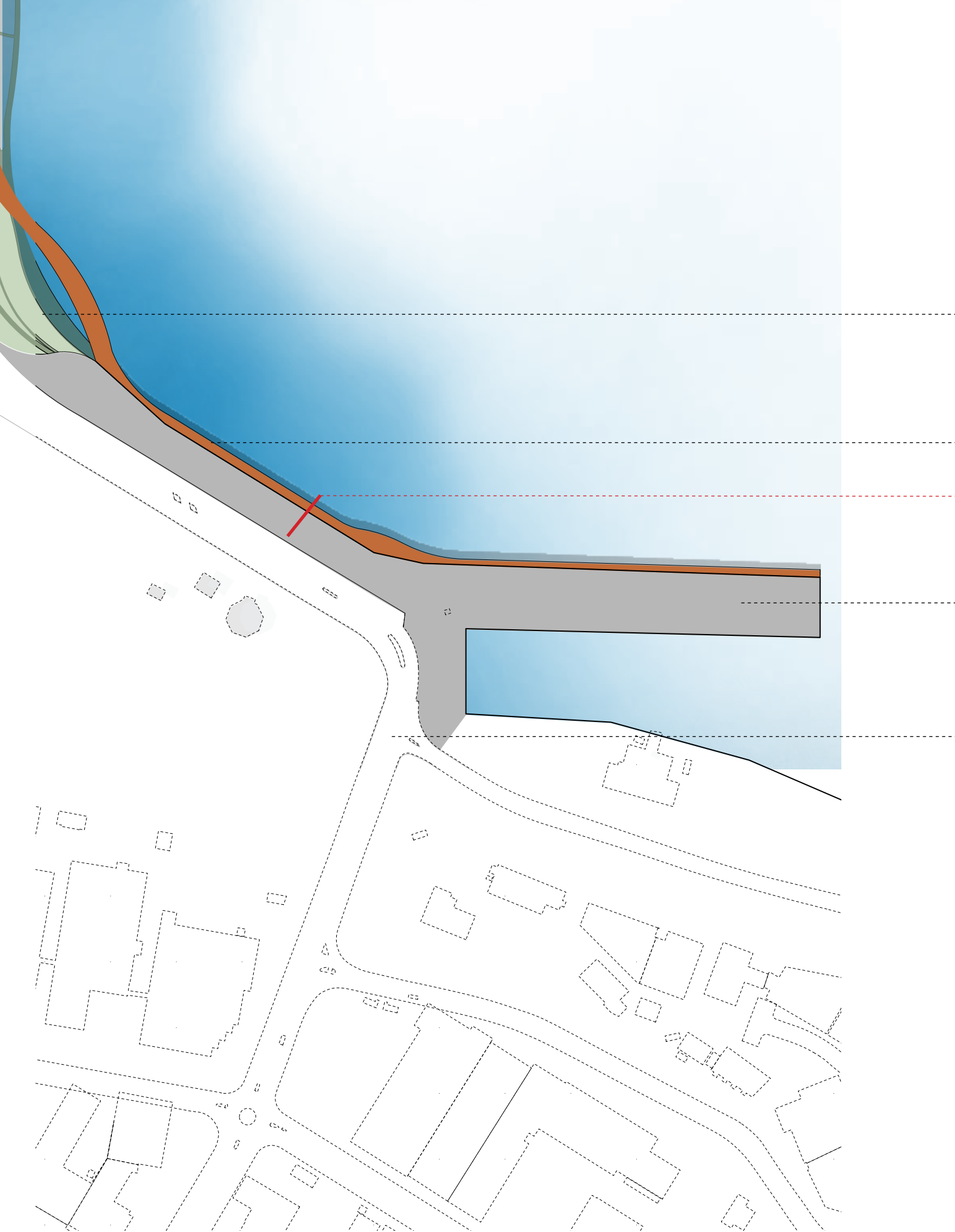
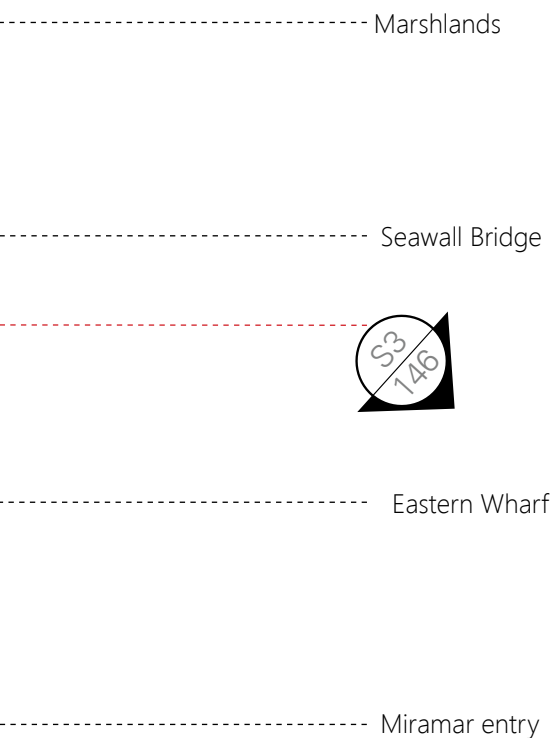


Figure 169: Plan of the Seawall Area.



## 6.7 Area 3- Seawall Bridge

The seawall and wharf has significant historical value to the Evans Bay and Miramar region. The wharf and seawall were constructed in 1909 - the seawall acted as a retaining wall for the reclaimed land around Evans Bay. Due to the historical significance the seawall has within the bay, the design aims to maintain and highlight the structure. The Seawall Bridge utilises timber beams strapped onto the seawall to support the walking surface. The bridge allows people to explore a new part of the bay and provides a uninterrupted path leading to the rest of the bay. (KELLY and DODD)





Figure 170: View of the bridge heading towards the old wharf.







Figure 171: The view towards the south within the bridge. The 'fish spine' balustrade acting as protection from the wind.







Figure 172: The original seawall is maintained and pedestrians can use the current footpath.





Figure 173: View of the bridge from the sea.



S4  
SECTION 4

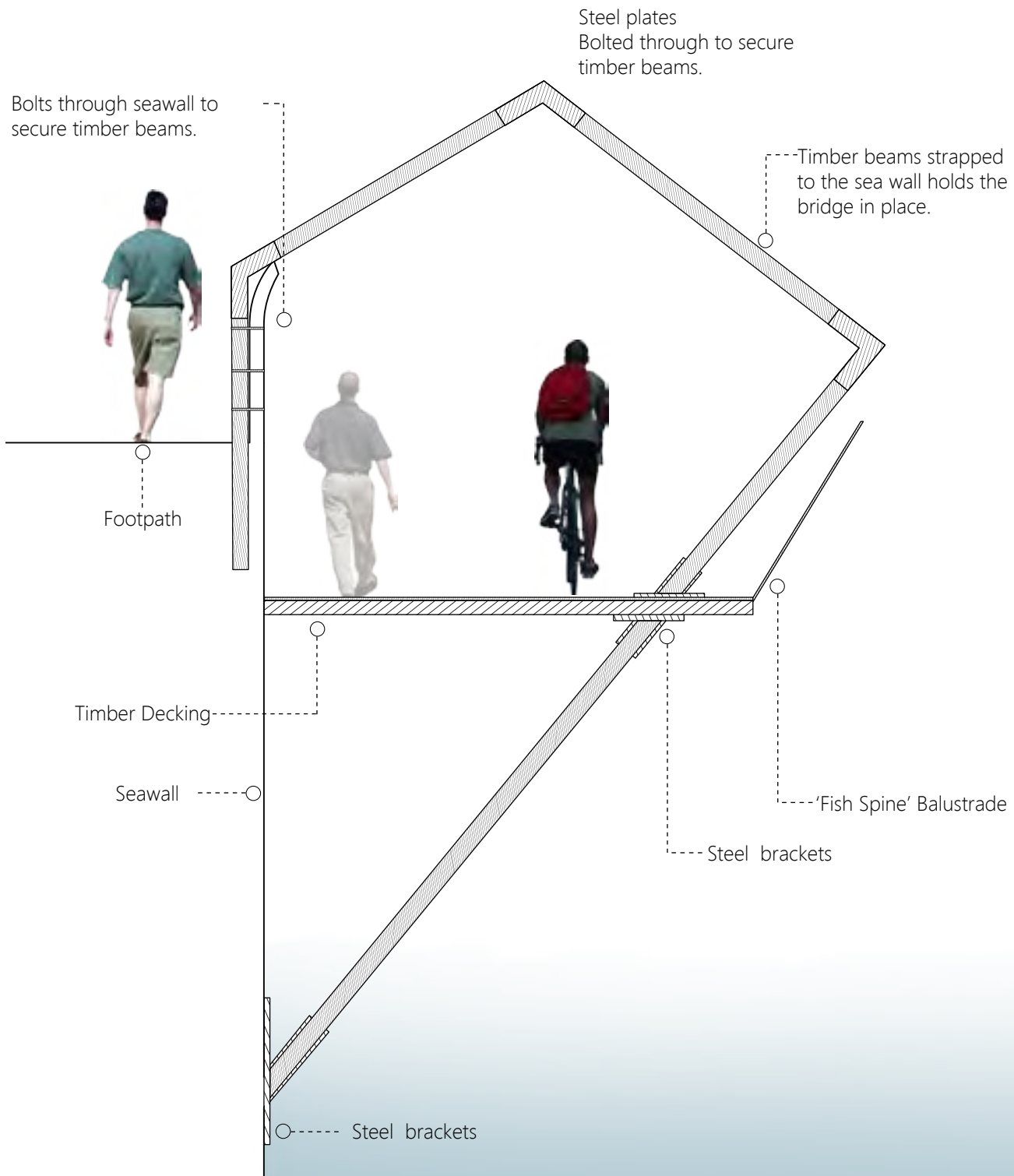


Figure 174: Section 4 showing the details of the Seawall.



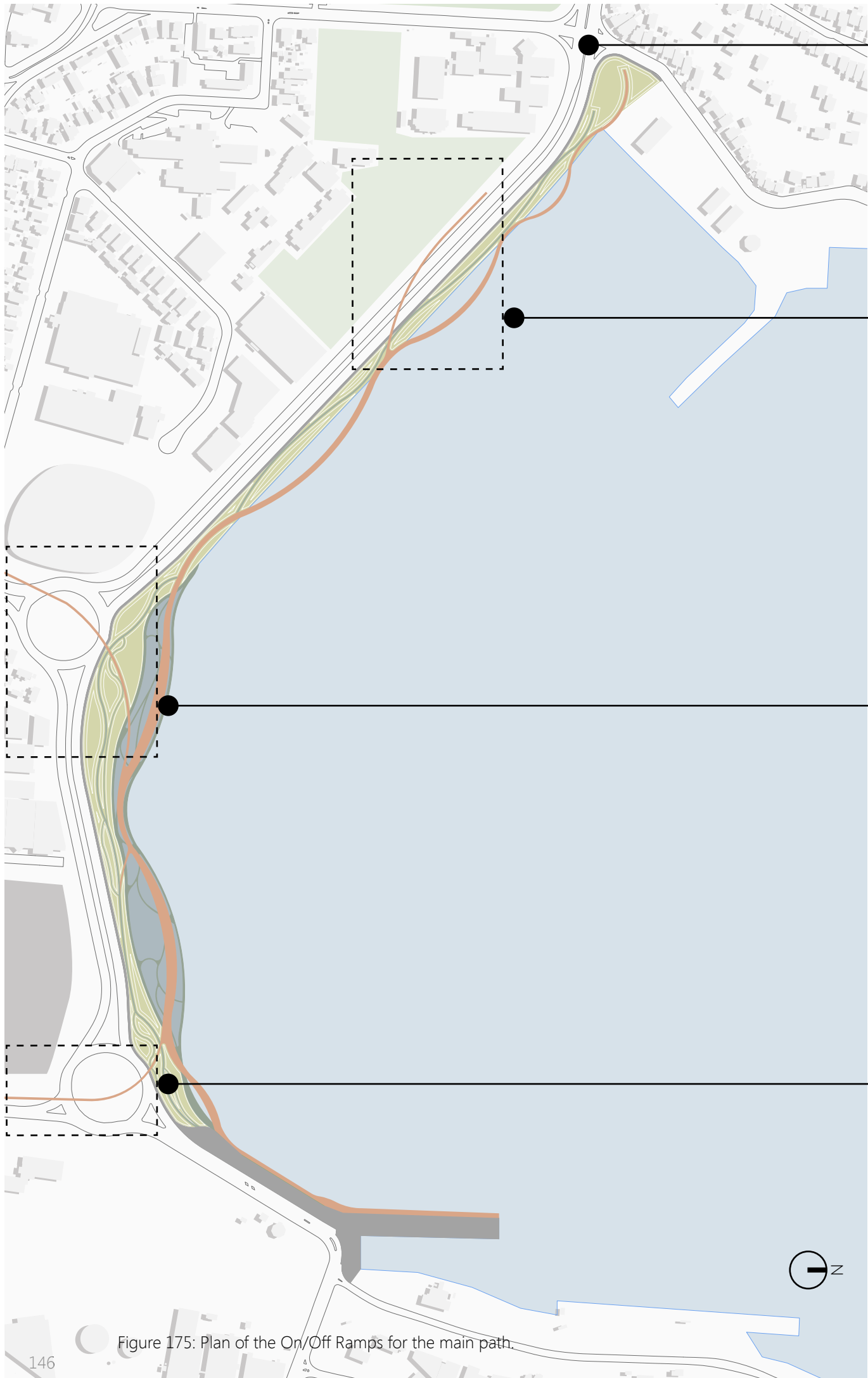


Figure 175: Plan of the On/Off Ramps for the main path.

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Pedestrian Crossing (current)

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Off- Ramp to St Patriks College

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Off- Ramp to Kilbirnie Village

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Off- Ramp to Wellington Airport

## 6.8 Area 4- Off-ramps

The off-ramps are designed to provide access from areas south of the motorway. Due to the heavy traffic, pedestrians and cyclists can currently cross the road safely at one point (figure). Enable safe access to the coastline is key for the success of the pathway. Each off-ramp travels underground and integrates with the design at three points.



Figure 176: The underground tunnel allows users to flow through the site safely and with no interruptions.











Figure 177: The entry points are located on the side-walk of near by roads.

## 6.9 Developed Design Reflection

The key concept for this research was to promote active transport, through the integration of public spaces and multimodal transport. Initial designs were developed around three key design principles such as, green and blue infrastructure, multimodal integration and water/coastal access. Through an iterative process it was concluded that further development of the design principles was needed. The developed design focused on creating a site-specific solution that responded to both the environment and commuters needs, along with the key design principles.

### Green and Blue Infrastructure

The current site has a terribly deprived natural ecology, due to the storm water outlets and lack of vegetation. The storm water outlets are addressed by the plotted wetlands along the coastal edge. The wetlands consist of two designs, floating wetlands and marshlands, with all native planting. With the wetlands implemented the ecological diversity and water quality can be improved.

### Multi-modal Integration

Effective modal integration was achieved through using Ceccon and Zampieri design guidelines for path user requirements.

#### Pedestrians

Connected- The design connects people from all corners of Evans Bay, with the main links from east to west and several other off-ramps connecting the airport and Kilbirnie to the path. The design also connects people to the ecology and water more effectively than the current edge condition at Evans Bay, providing the opportunity for people to safely explore the bay.

Clear- The form of the design is intended to be a sculptural aspect of the area and hosts a multitude of activities, in order to promote this as an identified safe area for active transport.

Comfortable- The path is designed with several routes through Evans Bay, so people can choose their preferred path. Each path is of suitable width to allow people to comfortably share the area with other users.

Convenient- The new design makes Evans Bay a safer, efficient and more enjoyable experience. The design also provides links across the busy highway, allowing more users to access the coastal edge.

Safe- The existing sidewalk forces pedestrians and cyclists to share a 2m wide path with little protection from vehicular traffic. The new design provides several paths with a minimum width of 3m and draws people away from the vehicular traffic.

#### Cyclist

Security- The cyclists are provided with wider and more links through Evans Bay, therefore there is less conflict and congestion between users.

Comfort- The path is designed to efficiently move people through the site with no interruptions. The underground off-ramps allow people to connect to the main path safely without having to stop for vehicles. The handrails on the main path double as wind protection, so in high winds user can comfortably travel along the path.

Attractiveness- The overall form of the design was derived off existing desire lines on the site, to convey a 'sculpture like' form. With the site being enhanced with increased biodiversity and safe access, people will be drawn to the site - both cyclists and pedestrians. The design follows a new form of cycleway layout, where users are separated from vehicles and given their own area to utilise. People can now view the beautiful bay and interact with the environment safely.

#### Water Access/ Coastal Access

Evans Bay is a popular water sports ground for sailing, paddle boarding, boating etc, however the access is limited to boat ramps and rocky shorelines. Enabling access to the water is an important factor in order to inspire appreciation for the natural environment. The design implements a series of paths above and on the water. These paths emerged in the ecology will expose people to the importance of functioning natural systems. The natural systems will filter out the sediment from the storm water, making it safe for people to enjoy - further emphasising how natural ecology must be maintained.

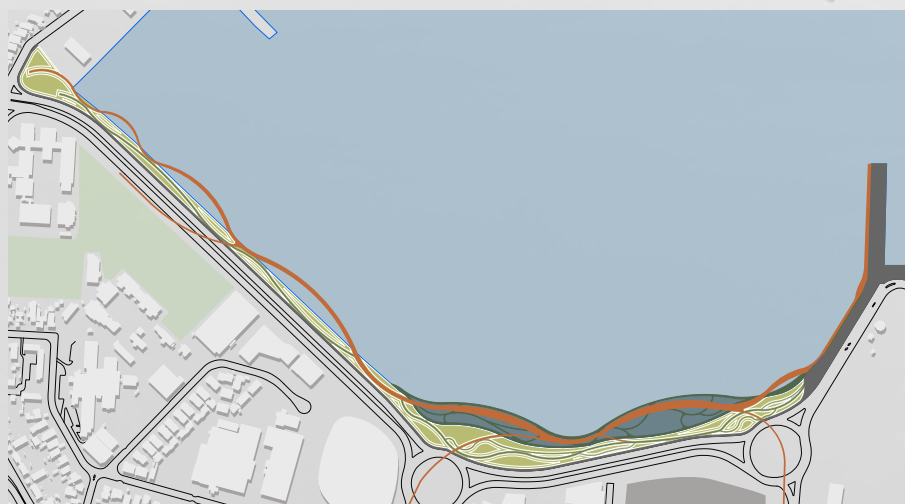
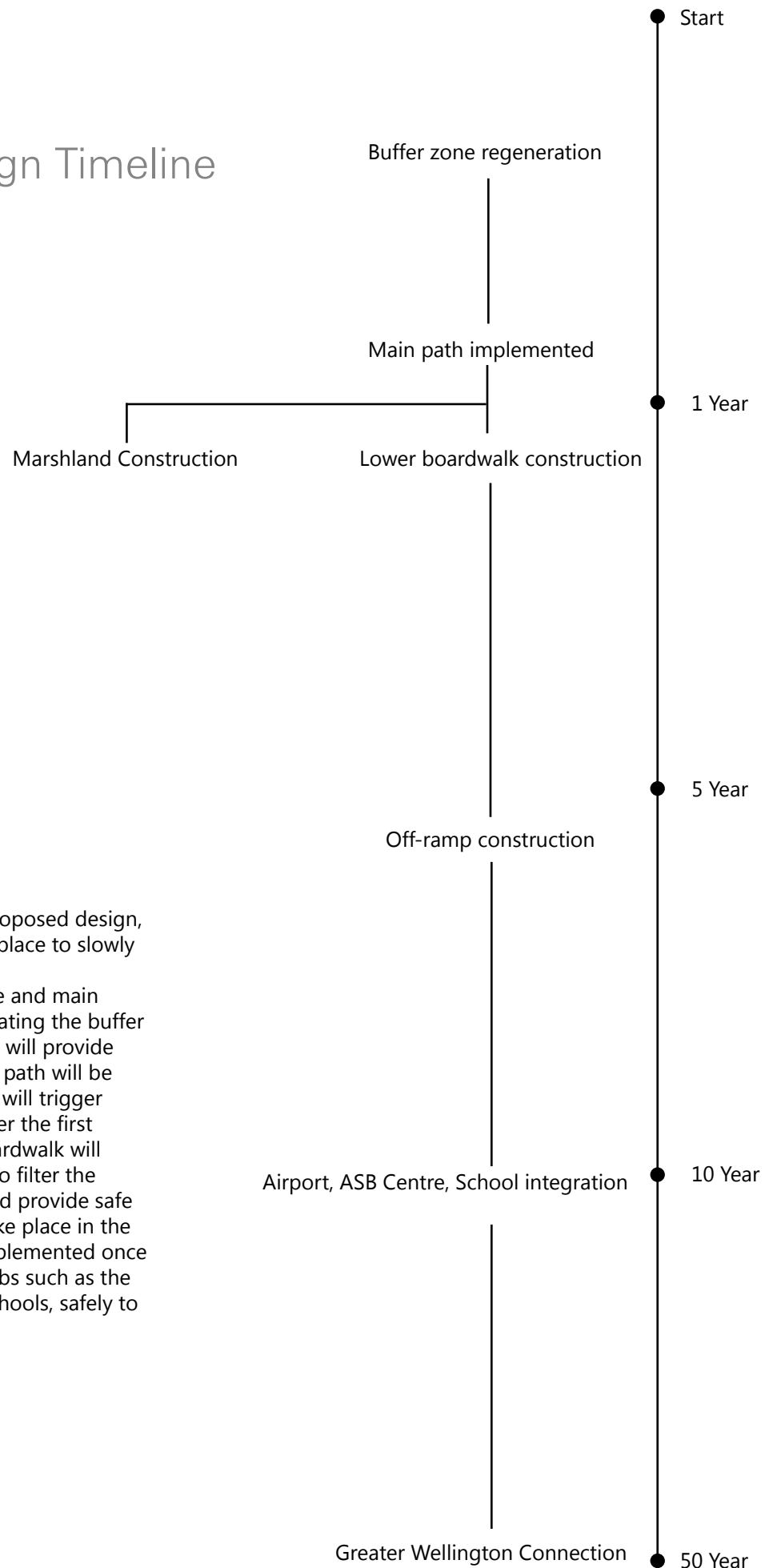


Figure 178: Development of the overall form.





## 6.10 Design Timeline



Due to the significant size of the proposed design, a timeline of construction is put in place to slowly implement the components.

Within the first year the buffer zone and main path will be implemented. Regenerating the buffer zone is an important first step, as it will provide shelter for future growth. The main path will be the most utilised by the public and will trigger interest for future components. After the first year, the marshlands and lower boardwalk will be implemented. These will begin to filter the sediments from the storm water and provide safe conditions for water activities to take place in the bay. The three off-ramps will be implemented once the site gains popularity, linking hubs such as the airport, ASB centre and the local schools, safely to the rest of the path.



# Conclusion

The integration of active transport into our cities, communities and culture is a fundamental concept to create a sustainable future. People are becoming more disconnected with their environment, neighbours, and colleagues due to the exclusion vehicular transport creates. However, the current infrastructure in Wellington creates a daunting and unsafe experience for active modes of transport, leaving commuters with little or no alternative option. Cycleway infrastructure is currently designed with the same mentality as vehicular traffic and given little aesthetical input. To encourage and promote sustainable active modes of transport, a change in the design process needs to be made and aesthetical value needs to be the central driving point.

Wellington offers a unique opportunity to test the potential of active transport, due to its topographic formation and low commuting distances. Despite Wellington's steep topography and with electric bikes becoming readily available, these issues are easily overcome. Evans Bay's existing cycleway, is a fitting example of how unsafe cycleway infrastructure can be.

Reviewing the site analysis of Evans Bay revealed how actively used the bay currently is - even though the current infrastructure is degraded. The bay hosts both land and water activities that are a significant part of the community. This identification of the importance of multi-modes extended the research scope to include all active-modes; rather than exclusively cyclists. Theoretical studies and research concluded that the integration of active modes and the exclusion of vehicular traffic, enabled safer passages - creating an opportunity to implement ecological interventions.

The developed design created a diverse esplanade that allowed all active modes of transport to be integrated safely, along with the enhancement of natural ecologies. The esplanade weaves through the shoreline of Evans Bay, offering a multitude of different paths highlighting the beauty of it. The implementation of natural marshlands serves not only to enhance the natural ecologies, but to expose users to the beneficial importance of maintaining our landscape.

Overall, the final design offers a new approach to implement a sustainable transport matrix within a city. With the combination of public spaces and natural ecologies, these active pathways offer more than an efficient way to commute. The layering of space, natural systems and the removal of cars, establishes a public realm where communities can personalise as well as utilise. Although the design is based only in a small area of Wellington, it can be intertwined and pieced with other site-specific narratives to formulate a connected sustainable highway.

This thesis offers the discipline of Landscape Architecture an opportunity to change infrastructural developments and create an integrative approach where form and function weave together; producing a layered design that is constructive, rather than destructive to our natural landscapes. It needs a system that binds the public realm with active transport, allowing people to reconnect with their communities, health and natural surroundings. Reconnection establishes awareness - the key to regenerating our cities into sustainable and enjoyable hubs.

The reliance of vehicular transport is not going to reduce, unless efficient and sustainable alternatives are developed. Cities can no longer afford to put the car first, reducing natural ecologies and increasing atmospheric pollution. Sustainable transport is only part of the solution, however is essential to reduce the impact and repair the extensive damage humans have had on our environment.

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