URBAN RIVERSCAPES

RECONNECTING URBAN ENVIRONMENTS WITH THE RIVER LANDSCAPE

ELLE FAIRGRAY

URBAN RIVERSCAPES

RECONNECTING URBAN ENVIRONMENTS WITH THE RIVER LANDSCAPE

ELLE FAIRGRAY

*A 120-point thesis Submitted to the Victoria University of Wellington in partial
fulfilment of the requirements for the degree of Master of Landscape Architecture*

Victoria University of Wellington School of Architecture

2019

“Strong enough to offer life, tough
enough to drown it away”

-Rupi Kaur

“Nature doesn’t trick us, we trick
ourselves.”

—Brad Zarnett

ABSTRACT

Water is a fundamental component of New Zealand's landscape, culture, history and identity. It is moving, changing form, accumulating and dispersing, it is ever changing never in the same context twice. Rivers are a single representation of this process in which we experience water in the landscape.

New Zealand has beautiful and intense water ways that pass through urban environments, yet due to the flood protection measures in place, they are disconnected from the urban environment. They are difficult to access and do not hold a presence in our growing urban environment which they once had significance in.

Stopbanks are the most common form of river flood protection infrastructure in New Zealand. They treat the river as a static element without giving them the space to move, flood and meander. They create a physical barrier between the urban environment and river space and do not respond to the differences of rivers and urban environments.

Growing urbanisation is increasing the pressure on stormwater infrastructure and growing the risk and effects of flooding. Increasing magnitude and frequency of rainfall events is only putting more pressure on flood protection infrastructure and stopbank infrastructure is crumbling under the pressure. Urban environments are requiring a larger level of flood protection that the traditional stopbank can provide.

This thesis is an investigation into the role of stopbanks for flood protection in urban river spaces and their effect of the experiential and ecological experience of the river. This investigation, developed through an analysis of the Waiwhakaiho River in New Plymouth, the Waikanae River in Kapiti and the Waipoua River in the Wairapa informs a redesign of flood protection measures in New Zealand medium sized towns to repair the disconnection of the urban environment to the river.

1	INTRODUCTION	01
	THE PROBLEM	
	BACKGROUND	
	RESEARCH QUESTION	
	METHODOLOGY	

2	RESEARCH TOPICS	19
	INTRODUCTION	
	ECOLOGY	
	FLOOD MANAGEMENT	
	SOCIAL	
	CONCLUSION	

5	RIVER SPACES	59
	SITE CONDITIONS	
	SPATIAL ARRANGEMENTS	
	RIVER SPACES	

6	RIVER SPACE APPLICATION	95
	WAIKANE SITE INVESTIGATION	
	WIDER URBAN ANALYSIS	
	RIVER SPACES IN SITE	

9	DISCUSSION	167
	DISCUSSION	
	METHOD REFLECTION	
	FORWARD	

CONTENTS

3	PRECEDENT REVIEW	31
	RIVER AIRE	
	ROOM FOR THE RIVER AT WAAL,	
	URBAN WETLANDS	

4	CONTEXT	47
	RIVERS IN NEW ZEALAND	
	WAIWHAKAIHO RIVER, NEW PLYMOUTH	
	WAIKANAE RIVER, KAPITI	
	WAIPOUA RIVER, MASTERTON	

7	TPOLOGY DESIGN	117
	URBAN STREAM	
	OPEN CORRIDORS	
	PERMANENT AND OCCASIONAL WETLANDS	
	INNER BLOCK TYPOLOGIES	
	COMMUNITY TYPOLOGIES	

8	APPLIED DESIGN	129
	SITE LOCATION	
	MASTERPLAN	
	IMPLEMENTATION	
	RECREATIONAL SPACE 01	
	RECREATIONAL SPACE 02	
	RECREATIONAL SPACE 03	
	DEVELOPMENT HOUSING

[1.]

INTRODUCTION

FRAMING THE ISSUE

THE PROBLEM

FLOODS ARE NEW ZEALAND'S MOST FREQUENT NATURAL DISASTER

66%

OF NEW ZEALANDERS LIVE IN NATURALLY FLOOD PRONE AREAS

RAINFALL EVENTS ARE INCREASING IN MAGNITUDE AND FREQUENCY

INCREASING IMPERVIOUS SURFACES ARE CREATING MORE RUNOFF FOR URBAN WATERWAYS

89%

OF NEW ZEALANDS WETLANDS WERE DRAINED BY 2008

New Zealand has beautiful and unique waterways which pass through urban environments yet the recreational potential is not able to be fully experienced due to their flooding hazard. Traditional flood protection methods have created a separation between the urban and river environments which are rapidly increasing due to the effects of climate change and increasing urbanisation.

In April 2017 a floodwall in Edgecumbe was breached by floodwaters from the Rangitaiki River. The flood breach resulted in the destruction of 15 homes and damages to another 250 homes (Rangitaiki Scheme Review Panel). This is not an isolated incident in New Zealand with similar situations occurring throughout the country. With the degradation of dated flood protection infrastructure and increasing flood events, if the same approach to flood protection continues, this kind of disaster is only going to become more frequent in New Zealand's future.

Medium sized towns are most at risk as they typically use stopbanks as forms of flood protection and are growing in density increasing the number of people affected by possible stopbank breach. Wetlands which are a vital element in water retention to the landscape but have been drained to increase land for development. By 2008 89% of New Zealand's wetlands had been drained with evidence that this figure is increasing (Stats. NZ).

Climate change is resulting in an increase in flood events. Floods are already New Zealand's most frequent natural disaster effecting the increasing urban population with over 66% of New Zealanders already living in naturally flood prone areas (Rouse). Urban growth and an increase in the frequency and magnitude of rainfall events are causing a larger amount of water runoff into urban waterways during flood events. This is causing an inundation of existing flood protection infrastructure.

BACKGROUND

NATURAL RIVER SYSTEM

Rivers are complex landscape features that are in a constant state of flux. Rivers are not an isolated element in the landscape but are a component of the interconnected water system across the earth. A river is never the same at any given point of time but is a snapshot of an ongoing changing process. They are continually changing form and changing the landscape around them. Rivers change form when their meandering process results in a change in pathway, they are continually fluctuation in water level vertically and laterally. They also carve at cut the landscape through sedimentation, transportation and deposition (Prominski. M).

Flooding occurs when a build-up of precipitation and runoff exceeds the capacity of the river channel (Rouse) and the water spreads outwards into the flood plain. This typically happens when water hits a flat plain after building up speed from running down the steep gradient of hills and mountains. Their flow slows down and the backlog of quick waters pushing from behind causing the body of water to increase to greater than the river channel flooding the surrounding floodplains.

Fig.1.1. Natural river processes.

BACKGROUND

DEVELOPMENT OF RIVERS AND PEOPLE

Fig.1.2. Transitional relationship of people and the river diagram.

Rivers and Urban Culture

Rivers were once the centre of urban culture however over time the relationship has significantly decreased. The river was seen as a resource and a method for transportation and the surrounding flat lands of the river's floodplain provided fertile land (Knight). For this reason, the river was exploited and the floodplains were built on. As settlements become more urbanised bringing expanses of infrastructure, technology and built infrastructure replaced the role of the river for people by making water and water services more practical and efficient for door-to-door access.

Introduction of Flood Protection

When the river presented the issue of flooding, rather than taking a landscape architecture approach to this issue of flooding an engineered structural approach was taken. This was through stopbanks, floodwalls, channelling the river and more (fig.1.2.). This confined the river movement to within the structural walls and created a physical barrier between the people and the river space. The urban river existed in the urban environment this no role in the life and function to the urban environment.

Shift In River Values

Urban growth in the built environment is seeing people valuing the natural environment more than ever and wanting to reconnect with nature. Waterways and landscape features have undergone conservation and protection and people are engaging with the recreational opportunities which allow an interaction with these spaces (Doi, Katano and Negishi).

BACKGROUND

FLOOD PROTECTION

Global Flood Protection

Globally, stopbanks, also known as dikes and levees, are one of the main forms of flood protection infrastructure. They are raised earth embankments designed to keep floodwaters inundating the urban environments within river floodplains (Knight). As the Netherlands sits below sea level, they are world leaders in their use of stopbanks for flood protection (fig.1.3.). Their approach sees that stopbanks are implement in multilayered systems that can be applied to different ecological and economic situations (fig.1.5.). They have different stopbank designs for lakes, rivers, beaches, alongside canals, as well as stopbanks which act as dams and storm surge barriers (fig.1.4.) (LOLA Landscape Architects).

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

Fig.1.3. (Right Top) Dutch water landscape.

Fig.1.4. (Right Bottom) Sea stopbank in the Netherlands.

Fig.1.5. (Left) Diagram examples of the multilayered Dutch stopbank systems.

Flood Protection In New Zealand

The stopbanks is also the typical form of flood protection implemented in New Zealand. Despite their global use however, they have many disadvantages. Not only does their implementation have severe consequences on the process of the river and on the social connection of the river and the people. The stopbanks is a stock-standard approach to the flooding problem which does not adapt to different environments despite the drastic differences proposed by every site. The structural integrity of these structures are decaying and becoming vulnerable to the pressures to current flood events (N. Lister, *Resilience Beyond Rhetoric in Urban Landscape Planning and Design*). The current approach to dealing with these hazards is to increase the height of stopbanks. This not only confines the river more, but it also increases the effects of the stopbanks as a barrier between the urban and river environments (fig.1.6.).

Need For Redesign

Despite the adaptation to site within the Dutch stopbank approach, they have come to realisation that these methods are still not enough to cope with the environmental change. They have moved from the approach of increasing the stopbank capacity and structural integrity to an environmental approach which gives allowance to the river to exercise natural flooding processes. This is through the 'Give Room to the River' project which identifies a series of strategic locations where stopbanks can be widen along with other measure to give the river more room over a large area to move and flood (Rijkswaterstaat). This approach is necessary to re-evaluate the role of stopbanks in other situations around the world.

Fig.1.6. Development of the stopbank with increasing urbanisation.

BACKGROUND

DISASTER HAZARD

Stopbank Disaster In New Orleans

The disaster of Hurricane Katrina on New Orleans (fig.1.8.) presents an example of the effects large storm events can have on urban environments due to the use of engineered protection methods. This example shows ecological processes continually overridden by structural systems (fig.1.7.). The implication of this is that although the effects of small floods may be lessened, large floods overflow the system causing disaster to the town "An increase in the threshold for catastrophe means that many small floods have been replaced by a number of large ones. The system may seem to fail less often, but the consequences are worse when it does" (Wolff).

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

Fig.1.7.(Left) Map of New Orleans infrastructure and effects.

Fig.1.8(Right) Hurricane Katrina flooding effects on New Orleans.

RESEARCH QUESTION

How can we design flood protection to support socially and ecologically engaging urban river spaces in New Zealand medium sized towns?

AIMS AND OBJECTIVES

- Allow the urban waterway to express natural flooding processes.
- Repair the transitional relationship between urban and river spaces.
- Create an integration of flood protection into a socially and ecologically engaging landscape.

SCOPE

New Zealand medium sized towns are the focus context for this research. They are small enough to not have had large engineering projects replace the role of the river but require some form of flood protection and therefore, have been built around stopbanks. They are large enough that urban growth has pushed developments close to the river edge making the role of the stopbank necessary to providing flood protection to the urban environments built within the rivers floodplain. Urban centres are growing and with failing stopbanks, the natural state of these landscape features are under threat if alternative flood protection methods are not explored.

The on-site analysis part of this study compares the river spaces of three of these situations in New Zealand being the Waiwhakailho River in New Plymouth, the Waikanae River in Kapiti and the Waipoua River in the Wairarapa. This investigation will influence the redesign of the transition space between urban and river environments which is tested in the context of the Waikanae River.

This study will provide a solution to flood prevention that is not a result of engineering but of landscape architecture. This provides a solution to the context within the parameters of an existing urban fabric and a solution for designing future developments that are integrated urban and river scapes.

METHODOLOGY

INTRODUCTION

PROBLEM

RESEARCH QUESTION

SITE INVESTIGATION

LITERATURE REVIEW

- Social
- Flood Management
- Ecology

PRECEDENT STUDIES

- River Aire Renaturation
- Room for the River at Waal
- Urban Stormwater Wetlands

TYPOLOGY DESIGN

- Urban streams
- Open corridors
- Urban wetlands
- Street rain gardens

ITERATIONS

- Concept One
- Concept Two
- Concept Three

DEVELOPED DESIGN

- Water Driven Recreational Spaces
- Water Centric Community Typologies

CONCLUSION AND REFLECTION

This thesis undertakes a typological study to form an understanding of the treatment of flood protection in urban river spaces. This involves analysing and comparing the river spaces of three rivers in New Zealand medium sized towns. The three river spaces are compared through identifying the reoccurring features of the river space and forming these into typologies. Assessing the quality of these typologies then informs the creation of new river space typologies which can be implemented in other similar situations of the medium sized town throughout New Zealand. An example of these can be implemented in different sites is tested on a case study site of the Waikanae River in Kapiti.

CONCLUSION

Urban development has seen a change in the relationship between the urban environment and the urban environment, however there has not been a change in the way the threshold between these spaces have been designed to reflect this. Now that existing flood protection infrastructure is degrading and a change in climate is putting a larger pressure on this, a new approach to flood protection and designing urban river spaces needs to be explored. This study will undertake an onsite practical investigation into the river spaces of urban rivers of New Zealand medium sized towns to inform future decisions about how to design for these river edges that repairs the relationship between the river and the developing urban environment.

[1.]

Fig. 1.9. Waikanae River southern wetlands. (Same image as chapter cover)

[2.]

RESEARCH TOPICS

POSITIONING THE RESEARCH WITHIN
DISCOURSE LITERATURE

INTRODUCTION

Current research in landscape architecture has established that the connection between the people and the river has been lost which present social, cultural and economic precedent to re-establish. There is also a recognition that current urban design practices are not sustainable and need to be ecologically orientated in order to be adaptable through a changing climate. The risk of flood to the urban environment is only increasing with climate change and presents a platform for the topics of ecology, flood management and social connection to the river to be integrated through a new perspective on flood protection measures (fig.2.1.).

This literature review explores research within landscape architecture on ecology for a response to climate change, flood management in the urban environment and the social relationship between the urban environment and the river in order to position the urban river scape in landscape architecture discourse.

Fig.2.1. Research positioning diagram.

Driving Question: How can ecology play a role in urban environments with a changing climatic conditions?

Key Texts: Resilience Beyond Rhetoric in Urban Landscape Planning and Design; Allowing Variance May Enlarge the Safe Operating Space for Exploited Ecosystems; Large Parks.

With climate change resulting in social, economic and environmental costs, there is a growing recognition our built environments are no longer adaptable to the changing environment. Design approaches to the urban environment need to integrate ecological change and vulnerability. The term of 'resilience' has emerged to address the recovery and management for natural disasters however, it has been argued by Nina- Marie Lister in Resilience Beyond Rhetoric in Urban Landscape Planning and Design that this idea is not enough for our urban and natural environments to coexist in harmony. Instead, she argues that resilience is misguided as it referred to the idea of bouncing back to a normal state. This perception that ecosystems must have a normal state is incorrect as there is no normal state for ecosystems. Events typically considered catastrophic are cyclic events which are part of the ecosystems process. It is normal for them to be a constant change and to develop into completely new systems (N. Lister, Resilience Beyond Rhetoric in Urban Landscape Planning and Design). This constant state of change and irregular lux needs to be the new normal.

Creating this environment is based on that foundation of allowing variance. This has been explored by Stephen Carpenter who explains how reducing variance has been the typical approach as it allows systems and services to be more reliable and predictable however this has adverse effects over the long term. "A decrease in short-term variance is accompanied by an increase in long-term variance. Lower variability in the short term raises the variability in the longer term." (S. Carpenter). This gives reason to allow variance in the small scale within our built environments in order to better deal with large scale events. This variance refers to the connection between urban environment systems and ecological process where ecosystems are present and developing within the built environment.

Approaches to design must consider long-term adaptation and the ability to "permit the emergence and evolution of self-organising" (N. Lister, Large Parks). As we can never fully understand the complexities of ecosystems, we

cannot fully predict the consequences of design. However, nature and ecology must coexist and we need to design our urban environments that allow for the variation, flux and uncertainty of the built environment to occur. Ecosystems are complex, unpredictable and are self- organising. For this reason, they cannot be fully designed but their processes must be incorporated into design to allow for their emergence and long term survival.

FLOOD MANAGEMENT

Driving Question: How can we implement site adapted flood management systems?

Key Texts: Water Centric Sustainable Communities, Don't Fence Me In, Water Sensitive Urban Design Engineering Procedures; Design in the Terrain of Water, Why aren't all Engineers Ecologists?; Introducing Alternative Project Frameworks Through Landscape Design, From The Mountains to The Sea; The Secret Life of New Zealand's Rivers and Wetlands

As humans we like to control our environment, this to date has influenced our approach to flood management in the urban environment where ecological processes have been engineered to fit into the structure of the built environment (Folke). The engineering agenda focuses on production efficiency, waste minimisation and is attuned to the inputs and outputs of the engineered system. Engineering methods have altered and 'improved' the landscape to make it more efficient for human use which is judged based on human wants and needs. Ecological implications have not in the past been part of the equation for engineering practices (Wurth). In order to allow our natural and built environments to coexist there must be a redefinition of the scope of engineering practices where there is consideration to the impacts on natural systems on both input and output sides.

Currently, rivers are understood as channels of water rather than a changing element within the watershed. The typical approach has been to modify a system that reduces variability and removes fluctuation. This approach reflects the issues which have arisen for applying engineering solutions to ecological issues. This allowed urban environments to exist next to rivers without any awareness of the natural forces occurring close by. However, this is not sustainable and no longer sufficient to deal with the changing climatic conditions. Controlling and suppressing natural systems, is paving the way for disaster (Folke). By treating the urban environment as wet landscapes, this allows the reinterpretation of the role of built environments and flooding. We need to produce management schemes which do not seek to provide a piece of infrastructure but a designed space that considers the environment and societal and cultural aspects. Wet landscapes create a new harmony between urban environments and natural environment where urban environments are not drained; rather they soak and live with the water (Mathur, Cuna and Hood).

The concept of wet landscapes has seen the emergence of water centric urban environments. This model of the urban environment manages water within the urban environment before it reaches the waterway to reduce overflow resulting in flooding during periods of high rainfall. They incorporate a range of systems which deal with water by recycling used water, harvesting rainwater, slowing down water flows, and reducing the discharge of pollutants into the water. This system is intertwined with the built environment to create an integrated natural and built environment within the watershed (Ahern, Brown and Novotny).

A part of this system is the integration of Water Sensitive Urban Design (WSUD) which allows flood control to be dispersed throughout the urban environment rather than relying on single structures at the river edge. WSUD are built on the combination of elements of sediment basins, bioretention swales, sand filters, constructed wetlands, swales or buffer systems and ponds. These elements collect rainwater and water runoff, begin to filter the water of pollutants and sediment then reduce the amount of water entering urban waterways through retention and slowing water flow to allow for infiltration. These elements can be adapted to different urban environments with different contexts and site spaces available. They increase the level of biodiversity into the urban environment and spread the distribution of water from the waterway throughout the watershed (Melbourne Water).

The systems of WSUD use the processes of wetlands. These are natural land features where water accumulates and plant and animal life is adapted to cope with an oversupply of water. Wetlands are a valuable natural system for flood protection. They are key for moderation of the hydrological cycle for their ability to store water and release it slowly to keep a constant flow of water and reduce flooding in heavy rainfall events (Bishop). They also support the wider ecosystem by containing plants which provide habitat for wildlife including invertebrates, birds and mammals (fig.2.2.). These plants also provide organic matter which helps to stabilise sediment and maintains the carbon source for microorganisms. The level of fertility of the wetland is governed by the nutrients in the water, rainwater has the least amount of nutrients though where water that has been in contact with rock or mineral soil and picked up sediment there is a higher level of nutrients. The three levels of fertility status are ombrotrophic which are rain fed making them low in nutrients; rheotrophic wetlands which are flow fed giving them more nutrients; and minerotrophic which are fed by water that has been in contact with substrate minerals making giving them the highest nutrient level (Johnson and Gerbeaux). Wetlands also have water filtration capabilities which makes them ideal for urban environments are they filter surface runoff water of metals and contaminants before it is discharged into waterways (Batty).

Fig.2.2. New Zealand wetland ecology.

Driving Question: How do we create a social relationship between river and urban environments?

Key Text: The Social Connectivity of Urban Rivers; Effects of Biodiversity, Habitat Structure and Water Quality on Recreational Use of Rivers.

People value natural landscape features for the cultural and recreational benefit they receive from it. This experience is influenced by a range of factors including the quality of biodiversity, the recreational opportunities and the connection people have to the natural environment. Historically the river was valued for its resource benefits of providing transportation routes, a water source and a location for washing (Doi, Katano and Negishi). This dictated the way the urban environment was built around the river which created a longitudinal connection between the river and the urban environment. The role of the river to society has now shifted from a transportation route and water resource to providing a recreational service. Now that the river has a different role in society, the way people value its quality has also changed and a new social connection needs to be established between the urban environment and the river space. This has been analysed by George Kondold who explains the idea of connectivity through the overlapping, with equal importance, longitudinal, lateral and vertical connection (fig.2.3.).

A longitudinal connection between the urban environment and the river is what is typically present in urban river situations due to the shape of the river, and how settlements have developed around them. This means that a longitudinal connection for the use of walking and cycling tracks along the river is already possible under existing urban fabric constraints. This has been made possible through the implementation of flood protection walls which have in turn caused a disconnection in the lateral flows from the urban environment to the river. Repairing this disconnection requires urban flows to be extended through into the river space at multiple locations. Due to flood walls, river spaces entrances are few and urban flows come to an end at the floodwalls. Lateral connectivity relies on the continuation of all of these flows to allow multiple access points dispersed along the length of the river.

A vertical connection between the urban environment and the river is vital due to the barrier or level drop created for flood protection which prevents people from accessing the river space (fig.2.4.). Creating a connection across a vertical

change on a human scales is achieved through providing different recreational opportunities at different heights across the transition space from urban to river. These differing recreational opportunities need to cross over horizontally in order to allow a vertical connection between recreational activity which is allowed by opening opportunities for specific activities at different levels across the transition space with the opportunity for some activities to exist at all heights across the transition space. These activities at specific location may be, but not limited to within the water channel, swimming and kayaking, these connect to activities which can occur along the edge of the water channel such as paddling, skipping stones and wader fishing. As the river edge transitions into river space, other recreational opportunities open for cycling, walking, bank fishing and picnicking. The connection between these recreational activities is then strengthened through the opportunity for recreation activities which can occur at any level across the transition space such as wildlife watching and quiet contemplation.

To ensure connectivity through all aspects, embankments should include frequent access points for where riverside activities can occur to establish vertical connectivity. These access points must all be connected longitudinally along the river as pathway and riverside walks. Lateral connectivity can be addressed through multilayer riverside parks (Kondold. G).

Where water quality is poor and physical access to the water is unattainable, visual access should still be maintained as this still provides open space benefits. Once people are engaged with their river they form a sense of custodian ship over the river. This means that people will want to maintain and protect it's quality, this strengthens people's relationship to the river and will also provide ecological benefits. If water quality is an issue then it will become a matter of public concern and necessary steps to improve it will be taken, once there is a landscape feature of aesthetical and environmental quality people will want to enjoy it's amenities and spend more time participating in the recreational opportunities on offer (Doi, Katano and Negishi).

Fig.2.3. (Top) Lateral, longitudinal and vertical flows along the river.

Fig.2.4. (Bottom) Vertical connectivity to overlapping recreational opportunities.

CONCLUSION

The current situation of water and the urban environment is a result of past practices which sought to deal with water in the urban environment by controlling it and shutting it out of the urban environment. Changes in the climate have revealed that these practices are now outdated and not sustainable. They have also removed the people from the experience of the river and segregated the river from the town. Urban environments must be reconnected with the river and with water. Exercising flood management through natural processes over hard infrastructure allows the natural environment to coexist with the built environment and to exercise natural fluctuation. This has begun to be explored through Water Sensitive Urban Design, however these practices need to be adapted to integrate a social experience of the water landscape in the built environment. This reduces the effects of disaster by establishing sustainability through a changing climate in the built environment. This extension of the river landscape in the urban environment reconnects people the natural river environment to create awareness of natural environment and climatic processes and re-establishes a relationship and custodianship between the people and the natural environment.

[2.]

Fig.2.5. Forest wetlands at El Rancho on Waikanae River. (Same image as chapter cover)

[3.]

PRECEDENT STUDIES

RIVER AIRE, SWITZERLAND

ROOM FOR THE RIVER AT WAAL, NETHERLANDS

URBAN WETLANDS, USA

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

RIVER AIRE RENATURATION
SWITZERLAND

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

Canalized in the 19th century, the Aire River underwent a restoration project due to flood risk to surrounding urban areas. Project designers Superpositions explored a new meaning of the term 'renaturation' in the project which was implemented over four construction phases from 2002 to 2015.

Rather than restoring that canal to its original state, Superpositions design turned the canal into a public river park. Orientated around a new use for recreation, the park incorporates the historic landscape elements of ditches, hedges, groves and marshes which are no longer present in the existing landscape. It manages flood waters by creating a new line of flow for the river adjacent to the preexisting canal (fig.3.1.) which allows the river to run its natural course by encouraging natural processes, fluctuation and ecologies. This "attempts to propose an alternate path, where the urgent ecological shifts are incorporated into a larger cultural change".

As well as river restoration, the project considers territory restoration as well. It integrates recreational areas which accompany urban development with the agricultural production of the surrounding land into which they termed a 'rural public space'. The project achieves a harmony between ecological processes and a recreational park by having two river channels, the 'natural' river and the 'recreational' river which flow side by side (fig.3.2.) (Descombes Rampini).

Fig.3.1.(Left) Aerial of the River Aire Renaturation.

Fig.3.2. a, b, c and d, (Right) Structural facilitation of people experiencing the River Aire.

THIS CONTENT IN UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IN UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IN UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IN UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

The 'recreational' river seeks to bring people the awareness of the cultural, natural, historical and contextual influences which intersect through the riverscape. The design demonstrates a linear park with no central focus or hierarchal elements which encourages the distribution of people and activity throughout the whole length of the park. This space reflects the past, current and future landscape into a contemporary design that acts as a link between the urban and rural environments (fig.3.3.).

This project features an ecological approach to managing the risk of flood which has typically been a engineered solution. It then uses hard infrastructure on a smaller, noninvasive scale to support human interaction and use of the riverscape. The river is free to move and flow as it pleases and human use of the river space although, secondary to the river movement, is enriched by the allowance and variability of the natural river channel.

Fig.3.3. Stages through time of the River Aire.

CRITICAL REFLECTION

The historical situation and transitions of time inform the spatial experience of the riverspace. The river features a naturalised constructed riverscape with a channel signifying the canalised river which once represented the river in the landscape. Structural interventions are only used to support public interaction with the river space rather than constrain or direct the river.

Engineering methods exercise a passive approach to the environment to allow movement and simulate growth. These methods are primarily for supporting the river waters to flood and fluctuate as it desires, with minimal impact on the surrounding agricultural land nearby. After this initial level of intervention, constructed intervention is no longer part of the process of the river.

After the original constructed intervention, nature is given a platform for adaptation and occupying the landscape. It is left to grow and adapt without additional intervention. The public interaction with the space does not rely on any specific ecological situation to occur nor does it intervene or alter the natural processes occurring. The area combined activity and nature which do not alter each other but are enriched by the interaction.

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

ROOM FOR THE RIVER AT WAAL
NETHERLANDS

One of the 30 projects in the Room for the River scheme in the Netherlands is Room for the River Waal at Nijmegen by H+N+S Landscape Architects implemented from 2012–2016. This project is located along the narrowest bend in the Waal river which sits between the old and new town of Nijmegen, the Netherlands oldest city (fig.3.4.). The project removes a past stopbank and constructs a bypass channel with a new island between the two channels. This new channel acts as the city's new flood defence (fig.3.5.) (Rijkswaterstaat).

A new urban river park, river side promenade and a connection between the old and new sides of the city has offset the loss of 50 homes and multiple businesses caused by the project. The urban river park features public facilities for hosting events and exhibitions on the islands, new recreational space, a riverside quay and opportunities for water sports.

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

*Fig.3.4. (Left) Waal off flow bypass
channel design.*

*Fig.3.5. (Right) Flood levels of the River
Waal at Nijmegen.*

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

Ecological processes form the framework of the design to engage people with the riverscape and encourage the education on river processes (fig.3.6.). It also allows the natural environment to change and construct the new environment in a natural process. They allow different experiences in the river park through different tides and water levels and seasons as some elements of the park are only exposed or accessible during certain climatic conditions. Natural processes of sedimentation and erosion are integrated into the design to encourage natural progression and change of the river scape (Rijkswaterstaat).

The project is an example of a proactive rather than reactive response to flood threats. It recognises that past practices of structural approaches to flood management which do not integrate natural processes are no longer suitable to the climatic conditions we are currently facing and will continue to in the future. It takes the risk of flooding and turns it into an opportunity to create a thriving public space that integrates the natural environment into the urban environment for a unique a valuable landscape.

CRITICAL REFLECTION

The flood protection scheme creates a new public space for a range of recreational activities and events. The different environmental conditions change the space accordingly through time and season giving different experiences at different times. The ecological situation enhances and shapes the recreation experiences making it unique to the site and time in space.

This form of flood protection allows natural flooding processes to fluctuate and move as it pleases. The design of the space and it's integration into the urban environment draws off natural process to create a space for people to interact with and be a part of the environmental situations occurring in their surroundings.

The design of the island provides the basis for ecological processes to take occupation and ownership of the space. It supports fluctuation and variation meaning that the ecological process are open to a constant state of change. the infrastructure which allows people to interact with the space and with nature enables people to engage with the different ecological states.

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

URBAN STORMWATER WETLANDS
UNITED STATES

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

This study into the application of urban stormwater wetlands is driven by the increasing effects of stormwater for flooding. It is concerned with the differing contextual environments which occur throughout the urban environment which make it difficult for a wetland framework to be adaptable to different sites.

Traditional stormwater infrastructure does not support natural systems or engage public interaction. This project takes this issue as an opportunity to re-work traditional stormwater practices and integrate biodiversity into the urban environment (fig.3.7.). It works with variation to build resilience and include public engagement through varying recreational opportunities (fig.3.8.). It uses landscape architecture to merge engineering, ecology and urban design to create a framework for designing urban wetlands applicable to differing urban environments (fig.3.11).

Fig.3.7. (Left) Recreational spaces created from urban stormwater wetland modules.

Fig.3.8. (Right) Water level variation throughout recreational spaces.

This study is based around the acknowledgment that stormwater is part of our urban environments and part of our future. Climate change is bringing more water at a higher intensity into the city making traditional stormwater infrastructure insufficient to current conditions. The design takes a modular approach to sculptural wetland forms (fig.3.9. and fig.3.10.) to be able to be applied to varying site scales, land uses, contexts and programs. The forms allow flexibility and variation which are fundamental for supporting an ecosystem and creating habitat.

The design focus on creating heterogeneity through water depths for shallow and dry zones, constantly wet and fluctuating water levels. The forms can be varied in size for different situations which can then be situated next to one another to extend and adapt into differing spaces (C, H and A).

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IS UNAVAILABLE

PLEASE VIEW PRINT VERSION TO
ACCESS

Fig.3.9. (Left) Stormwater wetland module.

Fig.3.10. (Right) Flow path testing of stormwater wetland modules.

Fig.3.11. (Below) Recreational activity within stormwater wetland.

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

CRITICAL REFLECTION

The variation in the design provides engaging opportunities for the public to interact with nature and ecology within their urban environment. By drawing attention to this space for public use, it eases the transition from urban to river spaces and creates a new hybrid of the two spaces.

This project recognises that stormwater infrastructure is no longer sufficient to cope with the amount of stormwater which is now flooding urban environments due to increasing paving of impervious surfaces and increased rainfall events. The design outcomes use natural processes that are more efficient at infiltrating and filtering stormwater than structural infrastructure and use the space between the natural river and the urban environment to manage these waters.

Ecological practices are the forefront of this project. Combining ecology with engineering to apply natural systems to the urban environment and maximise the efficiency and output of these systems. Wetland modules are replicated, scaled and adapted to different contexts to bring biodiversity and flooding resilience to the urban environment to increase stormwater management and reduce pressure on stormwater infrastructure.

CONCLUSION

Although these projects are all within contexts or larger urban environments than the New Zealand medium sized towns they are valuable examples of how to readdress riverspaces in urban environments and show how the perception of the relationship of rivers and urban environments is shifting globally. They give example of how to use ecological process to respond to flooding in an urban environment and how to use this ecological space to provide a public amenity and an environmentally driven recreational experience. The outcomes move away from structural infrastructure but creating flood protection by allowing natural processes to occur and engage people with the processes for better awareness and education of the natural environment.

[3.]

Fig. 3.13. Waimanu Lagoon, Waikanae.
(Same image as chapter cover)

[4 .]

CONTEXT

FLOOD MANAGEMENT ON RIVERS OF NEW
ZEALAND MEDIUM SIZED TOWNS

RIVERS IN NEW ZEALAND

Rivers and Culture

Maori culture holds a strong connection to waterways which they refer to as 'awa'. To the Maori, waterways carry spiritual significance as it is the living place of taniwha, they hold healing and cleansing power, it embodies their ancestors, above all it mauri- a life force. It is a medium for transport, a source of food, water resource and a place to find precious rocks such a pounamu. Western society holds a different regard for waterways which changed the relationship between the water and the people after European introduction to New Zealand (Knight).

Settlement on Rivers

Like developed countries around the world, settlement in New Zealand formed around waterways. Flat land and fertile floodplains meant that riversides were seen as a strategic place for European settlement to arise. However, rivers throughout New Zealand are short, steep and unpredictable in comparison to the rest of the world. Flood damages to the settlements were devastating and significantly more costly than first estimated. Due to the engineering trends of the time, flood protection methods in the form of stopbanks were implemented nationally. Between 1952-1957, 1,723km of stopbanks were constructed along river channels. By 1968, 69 major flood control schemes had been implemented across the country (Knight).

Flood Protection

Along with stopbanks, other flood control methods implemented included, drainage systems, dredging of river channels, and clearing of obstructing vegetation. River channels were also straightened with the intention that this would speed up the flow of rivers in times of flood. As towns grew, the rivers gave way to railways, roads and sewers and where towns turned into cities, the rivers were buried underground (Havrankova). It wasn't until later years when flood extents were significantly higher than first anticipated that the ecological effects of these flood protection methods began to be noticed.

Urban Growth

With towns increasingly growing due to urbanisation we are presented with a situation unique to medium sized towns (fig.4.1.) where rivers are still of mostly their natural state which have had stopbanks implemented to protect the existing town from its flood. However these towns are growing and the urban pressures on the river are increasing making the flood protection methods no longer capable of upholding their requirement level of protection to the now much larger urban population.

NEW ZEALAND MEDIUM SIZED
TOWNS
20,000-60,000 PEOPLE

Fig.4.1. New Zealand's medium sized towns placed along rivers across the whole country.

WAIWHAKAIHO RIVER

NEW PLYMOUTH

Lower Waiwhakaiho Catchment

One example of this situation is the Waiwhakaiho River in New Plymouth (fig.4.2.). The Waiwhakaiho River runs from Mt Taranaki through farmland then through the northern township of New Plymouth before it's exit into the Tasman Sea along the Coastal Walkway Foreshore (fig.4.3.) (LAWA). Up until the mid-nineties the urban area at the base of the Waiwhakaiho River was mostly used for industrial uses such as contractor yards, industrial manufacturing, stock-car track and gravel extraction and processing. These facilities would not suffer significant damage inflicted by a large flooding event.

Shift In Land Use

Urban growth of the New Plymouth area has extended into the flood plain of the lower area of the river and the land use of this industrial area has changed to a commercial and retail urban space for the new local residents. This required the implementation of the

Lower Waiwhakaiho Flood Control Scheme in 1996 which among other strategies saw the implementation of a stopbank between the river and the Valley Mega Centre shopping area to protect against a one in 50-year flood event (Taranaki Regional Council).

Shift In Flood Management

The change in land use saw a change in the flood event effects as well as a change in the relationship of the built environment and the river. However, unlike the response to the flood hazard, no design input was put into place regarding the new use of the river space. Instead, the stopbank which has since construction been increased to protect against a one in 100-year flood event, prevents any use of river space adjacent to the shopping centre and stops any connection along the river between the recreational area of the Coastal Walkway Foreshore at the river mouth and the walking tracks around the river at the upper end of the urban area.

Fig.4.2 (Left) Waiwhakaiho River within New Plymouth urban context.
Fig.4.3 (Right) Waiwhakaiho River within catchment in Taranaki.

WAIKANAE RIVER

KAPITI

Waikanae Catchment

The Waikanae River flows from the western foothills of the Tararua Ranges through Waikanae Town Centre to the estuary at Waikanae Beach (fig.4.5.). These features make up the beautiful and unique landscape of Waikanae which has made it a desirable place for people to live. The flat lands of the river flood plain were originally an area of wet ground comprised of a series of connected wetlands. As settlement grew and living near the river was desired, these wetlands were drained and the river underwent a series of alterations turning it into the path visible today (fig.4.6.).

Need for Flood Protection

Waikanae has seen rapid population growth in recent years with people seeking the benefits of the lifestyle provided. Most flood free areas are already developed meaning new developments are forced to marginal areas and flood protection infrastructure is more vital. The Waikanae River Flood Management Plan of 2013

recognises the significance of the river as an ecological feature and its vulnerability to flood protection schemes. The plan seeks to maintain the river feature in a corridor segment, which maintains the ecological quality of the space surrounding the river and allows people to engagement with recreational activities throughout the river within the urban environment however confines the river movement and ecology to fit within a tight set of parameters. Among other strategies, the management plan features five sections of stopbanks implemented at areas along the urban edge identified as the most vulnerable housing areas to flooding. The stopbanks are used as a final defence, only used where most necessary (Wellington Regional Council).

Fig.4.4 (Left) Waikanae River within Waikanae urban context.

Fig.4.5 (Right Top) Waikanae River within catchment in Kapiti.

Fig.4.6 (Right Bottom) Movement of Waikanae River following European settlement of Waikanae.

WAIPOUA RIVER

MASTERTON

Lower Waipoua Catchment

The Waipoua River runs from the southern foothills of the Tararua Ranges through the flat plains of Masterton in the Wairapa to meet the Ruamahunga River (fig. 4.8.) (LAWA). Recreational space and sports facilities have been predominantly placed along the river corridor margins within the Masterton urban area (fig.4.7.). Viewed from above, this gives the appearance that the river has spaces to spread and flood periodically throughout the urban stretch and that recreational activity and engagement with the river environment occur simultaneously.

River and Urban Disconnection

However, the stopbanks implemented for flood protection do not allow this when experienced on-ground. The nature of the river coming from a large catchment of steep hills then hitting an extensive flat area makes the risk of flooding to the urban environment a dangerous hazard. For this, large stretches of stopbanks are placed along the river edges and typically are placed between the recreational spaces and the river corridor. This creates a barrier

between the level of interaction of the two environments and means that use of recreation spaces within Masterton urban environment does not imply engagement with the river environment.

Increasing Pressures on Stopbanks

These stretches however, have been identified by the Greater Wellington Regional Council in 2015 to not be sufficient for providing protection of flooding to the Masterton urban fabric. They only protect against a one in 50 year flood when the river patterns and past stopbank inundations suggest that protection against a one in 100 year flood- at least, is necessary (Greater Wellington Regional council).

Fig.4.7. (Left) Waipoua River within Masterton urban context.

Fig.4.8. (Right) Waipoua River within catchment in Wairapa.

CONCLUSION

The three sites selected provide the research with similar contexts to compare and draw conclusions on the treatment of river spaces and flood protection in urban rivers of medium sized towns in New Zealand. The three towns all have a different relationship with the river to affect the river treatment. They are also part of larger scale flood management plans associated to the specific site which dictates the use of flood protection infrastructure. This means that although each site uses stopbanks for flood protection, they serve a different role in the flood management scheme in each site.

The initial research into medium sized towns with a relationship to a large river presented 12 situation across the country, as it is not practical nor would it have been necessary to undertake the study in all sites, the area of research was narrowed to three. The site selection is limited due to location as sites which would be able to be visited and visited more than once throughout the year of study were needed to be chosen. As the study looks into three different sites and there is a tight time frame for the research, sites where there was some previous knowledge or personal connection to the town were favoured as a basic understanding of the context of the river was already established and therefore did not need as much background research prior to starting site investigations. A longer time frame for this research could have afforded a more critical site selection process.

[4.]

Fig.4.9. Stream inlet on Waikane River
at El Rancho. (Same image as chapter
cover)

[5.]

RIVER SPACES

SITE INVESTIGATION OF RIVER SPACE

TYPES

WAIWHAKAIHO RIVER, NEW PLYMOUTH

WAIKANAE RIVER, KAPITI

WAIPOUA RIVER, MASTERTON

SITE CONDITIONS

SITE INVESTIGATION OF URBAN AND RIVER MARGIN

In order to understand the relationship of the urban environment to the river, the space within the urban to river margin was analysed in all three sites. This analysis consisted of mapping out the spatial make-up of these spaces in regards to the flood plains and flood protection. This has involved mapping out where there are floodplains, natural stopbanks (in the form of a topographical level shift) and where constructed stopbanks have been implemented and the combinations of these elements. These spaces have influenced a typological analysis forms an understanding of the use and treatment of these spaces. Comparative analysis of the typologies has explored the spatial experience and the effect that ecology and spatial makeup has on the recreational use of the river space.

WAIWHAKAIHO RIVER . NEW PLYMOUTH
1:20,000

Fig.5.1. On site mapping of river space
configurations of Waiwhakaiho River.

Fig.5.2.(Left) On site mapping of river space configurations of Waikanae River.
 Fig.5.3.(Right) On site mapping of river space configurations of Waipoua River.

WAIPOUA RIVER . MASTERTON

1:20,000

SPATIAL ARRANGEMENT

CONSTRUCTED STOPBANK

CONSTRUCTED STOPBANK + NATURAL STOPBANK

4 FLOODPLAIN-CONSTRUCTED STOPBANK

5 FLOODPLAIN-CONSTRUCTED STOPBANK-FLOODPLAIN

6 NATURAL STOPBANK-FLOODPLAIN-CONSTRUCTED STOPBANK-FLOODPLAIN

7 NATURAL STOPBANK-FLOODPLAIN-CONSTRUCTED STOPBANK-FLOODPLAIN-NATURAL STOPBANK

8 CONSTRUCTED STOPBANK

9 HALF CONSTRUCTED STOPBANK

Fig.5.4. Categorisation of river space configuration findings.

NATURAL STOPBANK

The combinations of urban to river spaces are categorised into four main river space sections. These were where there was a stopbank to meet the urban edge with a floodplain along the river side, a stopbank with a floodplain on either side, a stopbank with no floodplains on either side and there were situations where there was a stopbank which met the river and a floodplain on the urban side however, this only occurred with natural stopbanks and not constructed stopbanks as where these were implemented, if there was room for a floodplain it was always on the river side to allow for river fluctuation.

RIVER SPACES

COMBINATIONS

Stopbank set back from urban edge and river edge

Stopbank set back from urban edge to meet river edge

Stopbank meets urban edge and river edge

Stopbank set back from river edge to meet urban edge

RELATIONSHIPS

URBAN TO RIVER SPACE THRESHOLD URBAN SIDE FLOOD PLAIN STOPBANK RIVER SIDE FLOOD PLAIN WATER ACCESS

TRANSITIONS

Through comparing the relationships of spaces within the river space combinations (fig.5.5.), a series of spaces and transitions were defined to make up the typical model of the river space (fig.5.6.). These consisted of the water access (space 1), the river side flood plain (space 2), the stopbank (space 3), the urban side flood plain (space 4), the urban to river space threshold (space 5) and the urban fabric (space 6). These space were found to be present in a variety of combinations where all or some may be present at any point along the river. The spaces were then individually investigated through a typological study identifying all the spatial conditions which influenced the experience of being within these spaces. These typologies were then evaluated on their social, flood management and ecological quality in order to assess the urban and environmental interaction of existing river space typologies.

Fig.5.5. (Left) Process of forming river spaces from river space configurations.
Fig.5.6. (Right) River Space reference diagram.

1

RIVER ACCESS

The river access typology study investigates the different platforms which allow people to connect and interact with the water. The spaces discovered and analysed have been river access through raised stone bed typology, shallow stone bed typology, varied height stone bed typology, large rock groin typology, large rock bank typology and raised stone bed to large rock groin typology.

Fig.5.7. River Access location reference diagram.

RAISED STONE BED 1.1

SHALLOW STONE BED 1.2

LARGE ROCK BANK 1.5

RAISED STONE BED TO LARGE ROCK GROIN 1.6

CRITICAL REFLECTION

Where there is access to the water through raised stone beds, ecological quality is increased meaning not only is it the most easily accessible to people of varying abilities, but it allows an interactive connection with the water and with river ecology. The large rock typologies are more difficult to connect with the water however they create more opportunities for adventure and play, allowing people to connect with the river ecology and provide a unique connection to spaces. The strongest connection to the water is where the stone bed and large rock typologies are combined, allowing the ease of access to the water as well as the level of recreational opportunities.

Fig.5.8. Site analysis of River Access typologies.

RIVER SIDE FLOOD PLAIN

Different vegetation makeups and typical water levels contribute to the variation of spatial make up within the river side flood plain. When there is no typical water present the variation of vegetation creates the space typologies of open grass, open grass with singular trees, partial vegetation and full vegetation. When there is a fluctuating water level this presents the wetland typology and where there is a constant body of water present this forms the lake typology.

Fig.5.9. River Side Flood Plain location reference diagram.

OPEN GRASS

2.1

OPEN GRASS WITH SINGULAR TREES

2.2

WETLAND

2.5

LAKE

2.6

CRITICAL REFLECTION

The open grass typology brings people and community interaction across the stopbank into the floodplain through the opportunity of sporting events, this space however provides little ecological benefit to the space and does not support water expansion out of the river channel. As the level of vegetation increases, the ecological quality of the space also increases, the range of recreational activities decreases. Where recreation is possible, the increased vegetation creates barriers between people and the river preventing people in the river space to connect with the water. Where there is water present in the floodplain there is a greater ecological and flood management quality and it provides an interactive space for people to connect with water outside of the river channel. The lake creates a smooth transition from urban to river environments as the visual amenity means houses orient towards the lake. It also gives people a range of recreational opportunities where they can interact with the water and are in an exploratory mind set to continue into the river space.

Fig.5.10. Site analysis of River Side Flood Plain typologies.

3

STOPBANK

The typical stopbank form is in the mound form, however investigation of river spaces has established other constructed forms are also implemented with the same function. These are the staggered mound, gradual slope, retaining wall and the wall.

Fig.5.11. Stopbank location reference diagram.

MOUND 3.1

STAGGERED MOUND 3.2

WALL 3.5

CRITICAL REFLECTION

The stopbank analysis has shown that the ease of access and connection people have from the urban environment to the river decreases with the increase of level change and with the steepness of the transition. The gradual slope has an ease of transition due to one change in direction making the spaces either side visible from one on another. The difficulty in transition of the mound is increased over the staggered mound just as the difficulty of access from the retaining wall is increased with the wall.

Fig.5.12. Site analysis of Stopbank typologies.

4

URBAN SIDE FLOOD PLAIN

The urban side flood plain has different influences factors to the river side flood plain. These typologies differentiate due to different levels of vegetation and urban influence. Highly managed vegetation form the open grass space, semi managed vegetation forms the open grass with singular trees typology and constructed landscape feature forms the lake typology.

Fig.5.13. Urban Side Flood Plain location reference diagram.

OPEN GRASS

4.1

OPEN GRASS WITH SINGULAR TREES

4.2

LAKE
4.3

CRITICAL REFLECTION

All typologies present in the urban side flood plain were also present in the river side flood plain typologies however did not have the same effect on the transition between urban river spaces. Although they bring more people into the river space through increased recreational opportunities due to having a higher level of flood protection, they do not connect people with the river. This is because the stopbank acts as a barrier to the water framing the flood plain turning it into an urban park which has little connection to the adjacent river.

Fig.5.14. Site analysis of River Side Flood Plain typologies.

5 URBAN TO RIVER SPACE THRESHOLD

The urban to river space threshold investigates the spatial conditions which influence how people enter the river space from the urban environment. These conditions have an affect on how aware people are of the access to the river space and how easily it is accessed for people walking or if in a vehicle. The discovered transitions are the walkway from upper sidewalk typology, road through properties on either side typology, the walkway through properties on either side typology, off street car park with properties on either side typology, the off street car park in river space typology and the walkways through farmland typology.

*Fig.5.15. Urban to River Space Threshold
location reference diagram.*

WALKWAY FROM UPPER SIDEWALK

5.1

ROAD THROUGH PROPERTIES ON EITHER SIDE

5.2

OFF STREET CAR PARK IN RIVER SPACE

5.5

WALKWAY THROUGH FARMLAND

5.6

WALKWAY THROUGH PROPERTIES ON
EITHER SIDE **5.3**

OFF STREET CAR PARK WITH PROPERTIES
ON EITHER SIDE **5.4**

CRITICAL REFLECTION

Although walkway entrances within housing blocks increases the number of access points to the riverspace within built environments, their spatial conditions do not contribute to encouraging people to transition into the riverspace. Often there is little or not vegetation to give an indication or incentive for entering into the river space. Entranceways with car access increases the number of people who can enter the riverspace through that access way and open the entrance up to make the riverspace more visible, however they, do not create engaging spatial environments which contribute to the experience of the river space. The walkway through farmland creates an enjoyable experience within the riverspace before reaching the river and well as allowing the river and river ecology to extend out of the riverspace into the urban environment.

Fig.5.16. Site analysis of Urban to River
Space Threshold typologies.

6

URBAN FABRIC

The urban fabric investigation assesses how the urban road ways reflect a relationship of the river and urban environment. This was through assessing the role of present vegetation and river impression through pedestrian experience. The discovered spaces were the grass and path on both sides of road typology, grass and path on one side of road typology and grass on both sides of road typology.

Fig.5.17. Urban Fabric location reference diagram.

GRASS AND PATH ON BOTH SIDES OF ROAD

6.1

GRASS AND PATH ON ONE SIDE OF ROAD

6.2

GRASS ON BOTH SIDES OF ROAD

6.3

CRITICAL REFLECTION

Space for pedestrian access increases the community atmosphere and opportunity for interaction however these are reduced by a wide road which separates activity on either side of the road. Space between the road and private properties also gives the space for water filtering and infiltrating and to reflect adjacent river environment however footpaths remove the opportunity for this. It was also seen though that where there were not footpaths occupying this space, the area was still not utilised for these purposes.

Fig.5.18. Site analysis of Urban Fabric typologies.

CONCLUSION

The separation between the river and the urban environment was found to be due to the separation of spaces within this transition space. The spaces act as segregated elements which prevent a direct lateral flow from the urban fabric to the water's edge.

To make this analysis constant for all the sites for it to be a credible study, there were limitations which arose where some spaces could be argued did not fully match their categorisation. This occurred where there was a road next to a stop bank, which for the purpose of this study was considered as the line of the urban environment however it could be argued that this could be another typology in the urban side floodplain. Likewise, the edge of residential properties was considered the edge of the urban fabric however often these were densely vegetated spaces which do not present the typical characteristics of the urban environment yet were put in this consideration as although their ecological qualities were valuable to the river, they were not usable by the general public. These were limitations could not be avoided when dealing with the landscape however were defined with consideration to the most accurate categorisation to match the aims and objectives of the research.

The spaces of this analysis were initially mapped out in plan and section, these did not allow enough detail to map out the differences of the typologies of the space nor did they express a spatial experience of a person on the site. For this reason, an on site photograph chosen with the attributes noted in all areas of the same typology (these were highlighted through the annotation) to allow an understanding of the effects of this typology in not one site but all sites of that typology.

[5.]

*Fig.1.9. Waikanae River at Otaihanga.
(Same image as chapter cover)*

[6.]

RIVER SPACE APPLICATION

WAIKANAE RIVER, KAPITI

WAIKANAE SITE INVESTIGATION

Fig.6.1. Water presence in Waikanae urban area.

WIDER URBAN ANALYSIS

The following study places the river space typologies in a site context of the Waikane River to understand how they fit into site, into each other and into a full transect of both side of the river. To understand the effect of these on the site it has required an understanding of the wider site conditions through widening the scale and understanding the urban conditions which are effecting the treatment of the river space. This Wider Urban Analysis has been explored through the adjacent land use, the connection of recreational spaces within the urban environment and the accessibility of the river space.

WIDER URBAN ANALYSIS
RECREATIONAL ACCESSIBILITY

Fig.6.2. Recreational accessibility within Waikanae in relation to the Waikanae River.

The Waikanae River has frequent entranceways to the river occurring on both sides of the river. This connects people living near the river to entranceways and allows easy access to the river space. Entranceways with fewer connections to properties occur when a large property exists along an entrance way making smaller properties behind further than a 5 or 10 minute walk from an entrance way. However, most of these large properties which act along the river are set to be developed and will soon house a larger number of properties and occupants. Most recreational spaces are connected to the river meaning that when seeking an outdoor space for recreational activity, people of Waikanae will in most cases be brought to the river.

WIDER URBAN ANALYSIS
ACCESSIBILITY

Fig.6.3. Vehicle and foot access to Waikanae River.

Main road routes do not often have direct connection to the river space entrances. It often takes one or two road changes to get to the river entrances, particularly further up the river. This means that the river spaces are more accessible through walking and cycling giving the river a recreational quality to the residents, however this also privatises the river space to the local residents making it harder for people in vehicles who are not as familiar with the area to access the river space and to find entranceways to the river spaces further up the river.

WIDER URBAN ANALYSIS

LAND USE

Fig.6.4. Land use of Waikanae properties.

Land uses throughout Waikanae shows that there is a high proportion of residential occupation alongside the river which is only going to increase due to the large amounts of developing rural land. This land use comes into close proximity with the river space and with most recreational land being clustered into groups, the river space acts as the closest recreational area for most people living in the urban environment. This mapping exercise has shown that Waikanae presents five main different land use combinations of land use on either side of the river. These are Section 01: Residential and Industrial, Section 02: Residential and Rural, Section 03: Residential and Developing Rural, Section 04: Recreational and Developing Rural and Section 05: Residential and Residential. These sections are to be the context for placing the River Spaces further in this chapter.

RIVER SPACES ON SITE

SECTION 01

RESIDENTIAL + INDUSTRIAL

Residential side of the river comes in very close proximity with the river making flood plains minimal and large level change from natural flood plain creates a separation between urban environment and river. Industrial side of the river has less necessity for flood protection making a more integrated transition of river to urban environment however, with little connection to residential area or entranceways, this is not taken advantage of for recreational purposes. Without any river crossing structures, these two river sides are disconnected and are not experienced by people accessing the opposite river space.

Fig.6.5. (Left) Map of River Space typologies within Waikanae Section 01.

Fig.6.6.(Right) Transect 1 (Top) and 2 (Bottom) of River Space typologies within Waikanae Section 01.

RIVER SPACES ON SITE

SECTION 02

RESIDENTIAL + RURAL

Similar river space uses on either side of the river and with an opportunity for river crossing connects the river spaces. However large areas for sports fields on the rural side of the river lack in ecological enhancement of the river space and river space experience. This also gives little purpose to use of the river space outside of sports games making the recreational area a dead space for all other users and times of the week/year.

Fig.6.7. (Left) Map of River Space typologies within Waikanae Section 02.

Fig.6.8.(Right) Transect 1 (Top) and 2 (Bottom) of River Space typologies within Waikanae Section 02.

URBAN TO RIVER
CARPARK WITH
PROPERTIES ON
EITHER SIDE

RIVER SPACES ON SITE

SECTION 03

RESIDENTIAL + DEVELOPING RURAL

Wetlands within the river side flood plain of the developing rural side of the river create an ecologically diverse and dynamic transect with the combination of partial vegetation areas on the residential side of the river. However, with no river crossing structures and little access to the river space on the developing rural side, the combined river space section is not experienced as a whole by users as they are typically confined to a walking track for river space use on only one side of the river.

Fig.6.9. (Left) Map of River Space typologies within Waikanae Section 03.

Fig.6.10. (Right) Transect 1 (Top) and 2 (Bottom) of River Space typologies within Waikanae Section 03.

RIVER SPACES ON SITE

SECTION 04

RECREATIONAL + DEVELOPING RURAL

Recreational spaces of multiple uses with a variation in ecologies on either side of the river make the river space unique, attractive to a range of users and combines recreational use with environmental engagement. River crossing between these spaces links the river spaces across the transects and connects users coming from different locations.

Fig.6.11. (Left) Map of River Space typologies within Waikanae Section 04.
Fig.6.12. (Right) Transect 1 (Top) and 2 (Bottom) of River Space typologies within Waikanae Section 04.

RIVER SPACES ON SITE

SECTION 05

RESIDENTIAL + RESIDENTIAL

A wide river side flood plain with a water based structure increases the river presence further towards and into the urban environment and reduces the level of flood protection required making the implemented flood protection structures less of a barrier between the urban environment and river space. This is apparent on either side of the river making the transect a singular space, however the widening width of the water area in this transect reduces the accessibility throughout the transect.

Fig.6.13. (Left) Map of River Space typologies within Waikanae Section 05.
Fig.6.14. (Right) Transect 1 (Top) and 2 (Bottom) of River Space typologies within Waikanae Section 05.

6
URBAN FABRIC
RESIDENTIAL

6
URBAN FABRIC
RESIDENTIAL

6
URBAN FABRIC
RESIDENTIAL

CONCLUSION

Placing the River Space Typologies within site transects gives the typology study relevance through application to a physical site and enable a greater understanding of their relationship to one another by seeing the spatial arrangement, the proportion of the transect which they fill and which typologies are more or less frequent.

The Wider Urban Analysis could have been seen as an extension of the River Space 6: Urban Fabric in the river space study. However, this was placed within the application of River Spaces site study for reasons which were felt to better explain the research. The purpose of placing the typologies in site was to give them validation by seeing them in a real site and context. In order to understand how they related to the urban environment, a more in-depth understanding of the Waikanae urban environment was necessary. This required looking at the area at a different scale to the rest of the River Space typologies which would have made the Urban Fabric section not comparable to the other spaces had it been done this way. The Wider Urban Analysis, unlike the River Space Study, was only carried out in the Waikanae context. Although this research would have been further developed had the Wider Urban Analysis been carried out on all three sites but the scope and parameters of the study did not allow for this.

When applying the river spaces to a full transect, like the River Space Study, photograph was used to relate the drawings to the site. Drawing out an accurate section line through the site and separating the spaces up into their appropriate River Space was not enough to explain the site conditions and represent the site. By adding the third layer of the photographs, the way the varied river space transects fitted into a real life situation and differed from other site transects was able to be communicated.

[6.]

Fig.6.15. Waikanae River facing upstream at Edgewater Park. (Same image as chapter cover)

[7.]

TYPOLOGY DESIGN

FORMING NEW RIVER SPACE TYPOLOGIES

TPOLOGY ONE

Fig.7.1. (Left) Urban Stream typology sketch design.

Fig.7.2. (Right) Plant palette swatch with attracted bird species.

The Urban Stream runs through urban environments collecting runoff to reduce strain on stormwater infrastructure and on the river channel. It brings stormwater runoff to the surface to allow natural filtration, infiltration and sedimentation processes to before meeting the river. By allowing walkways alongside the river and a channel wide enough to allow water access during low water levels, people are able to engage with the stream ecology and interact with the natural processes occurring. As the stream carries smaller amounts of water than the river and slows the speed at which water runoff is entering the river, it reduces the level of flooding of the river and does not present the threat of flooding nearby urban environments. This allows less reliance on flood protection structures.

TPOLOGY TWO

Fig.7.3. (Left) Open Corridor typology sketch design.

Fig.7.4. (Right) Plant palette swatch with attracted bird species.

The Open Corridors are open spaces that run laterally through the urban environment towards the river. These spaces are a recreational and ecological connection from the living area to the river and collect water during flood events. This reduces pressures on both the river and the urban stream during rainfall. They create a greater awareness of the climatic conditions and water processes through the different level of access depending on water levels. Under normal conditions the corridors is a dry space that is a green backyard connecting the houses and the river, then as the rainfall events become heavier, the amount of water present restricts usage.

TYPOLOGIES THREE + FOUR

PERMANENT WETLAND

ALWAYS WET

OCCASIONAL WETLAND

SEMI WET

Fig.7.5. (Left Top) Permanent wetland typology sketch design.

Fig.7.6. (Left Bottom) Occasional Wetland typology sketch design.

Fig.7.7. (Right) Plant palette swatch with attracted bird species.

The wetland typologies create areas along the streams for the water to be held, filtered and released at a slow rate. This reduces the pressures on the river and increases the overall food reduction within the catchment. Increasing the wetlands within the development creates a greater awareness and interaction of the water catchment processes. Like the Urban Stream and Open Corridor, one form of wetland is permanent where there is more natural accumulation of water and the other acts as an over flow wetland to reduce pressures on the permanent wetland during rainfall events.

INNER BLOCK TYPOLOGIES

SECONDARY STREET- RAIN GARDEN

SOMETIMES

MAIN STREET- RAIN GARDEN

SEMI WET

OFF-FLOW CORRIDOR- RAIN GARDEN

SOMETIMES WET

Fig.7.8. (Left) Street rain garden sketch typology designs.

Fig.7.9. (Right) Street retention pond sketch typology design.

Fig.7.10. (Right) Plant palette swatch with attracted bird species.

Inner block typologies test ways of doubling transport routes and water movement routes. Through combining the water movement with people movement, the residents are more engaged and aware of the water distribution and processes occurring within their living environment. The ecological benefits of these iterations enhance the streetscape of the development while engaging the built environment with the river scape nearby. The ecology is suggestive of the river environment connecting the two realms while encouraging people to continue into the recreational areas to experience the full recreational potential of the ecology.

CONCLUSION

The concept typologies were designed in consideration to the river spaces analysed in the three sites rather than one specific location. They experiment with a spatial experience for users that also has a flood management function. They were designed with the intention that they could be manipulated into different contexts and scales to be applicable into different situations of medium sized town river edges. A further application of typologies to a site will assess the success of applying the typologies into different contexts and specific site conditions. The typologies have been designed as a series of isolated spaces, however the intention of their design is that they fit into site in combination to give diversity to the riverscape experience and achieve flood protection through a series of smaller interventions.

Although sectional drawings were a vital focus in designing the concept typologies this did not convey a spatial experience of the site. For this reason, perspective was incorporated into the designing phase through section perspective so that atmospheric conditions of the topographic design could be explored in conjunction with each other.

[7]

Fig.7.8: Waikanae River at Edgewater Park. (Same image as chapter cover)

[8.]

APPLIED DESIGN

TESTING OF DESIGN TYPOLOGIES IN SITE
WAIKANAE RIVER, KAPITI

IMPLEMENTATION
SITE

CASE STUDY SITE

Site Location

The location on the Waikanae River for the design iterations to be tested is within the rural area of the residential and rural transect discovered through the River Spaces on Site study (chapter 6). With the proximity to the developing rural area and the situation of the site sitting between the former State Highway One and the existing residential area this space will soon succumb to development pressures (fig.8.1.). This area between the developing and the existing rural areas gives a platform to experiment with a new form of riverside living to inform how development along river edges should be approached.

Site Features

The site features mostly flat topography on two levels. The lower level next to the river is currently being used as sports fields and the higher level by the railway and former State Highway One is being used for stock farming. The bottom of the site has an

existing stream with riparian planting and a walkway leading from the developing area to the river space. Between the two levels is a depression in the ground which collects over flow water linking it to the stream at the base of the site. A stopbank runs along the river space and the lower level, however this does not stop the sports fields from puddling and being a constantly damp surface. Connectivity between the walkways of the river space and the sports fields is also made difficult by the stopbank (fig.8.2).

Fig.8.1. (Left) Location of case study site on Waikanae River.

Fig.8.2. (Right) Site conditions of case study site.

ITERATION ONE

HIGH GROUND COMMUNITY

CIRCULATION

CRITICAL REFLECTION

The urban stream typology is implemented into the site along existing ground depressions which accumulate water during heavy rainfall. The implementation of these streams creates permanent water flow in these locations to reduce direct runoff into the river. The off flow channel for the river and the connection from the existing water body to the existing stream increases the water presence and ecology within the development areas however it still creates a separation of water spaces and living spaces on a smaller scale.

Fig.8.3. (Left) Site design with urban stream typology implementation.

Fig.8.4. (Right) Circulation analysis of site design.

ITERATION TWO

CORRIDOR SPLIT COMMUNITIES

OPEN CORRIDORS SPLIT
URBAN AREAS AND CREATE
LATERAL CONNECTION
THROUGH LIVING SPACES
TO RECREATIONAL AREAS

WETLANDS ARE
DISTRIBUTED THROUGHOUT
STREAMWAYS TO COLLECT
WATER COMING FROM
MULTIPLE SOURCES

CIRCULATION

CRITICAL REFLECTION

Implementing the open corridors within the living areas of the site laterally creates access and frequency of contact with the river environment. Where the main water channels run in the same direction as the river at wider spacings, the open corridors creates green linkages between the spacings. The collection of stormwater runoff is intercepted at an earlier point that when directly entering the urban streams, slowing down the flow and increasing the opportunity for infiltration and filtration. Although the second iterations creates a more integrated existence of water, ecology and people, the design is homogeneous throughout the site and creates no uniqueness and identity to the community.

Fig.8.5. (Left) Site design with open corridor typology implementation.

Fig.8.6. (Right) Circulation analysis of site design.

ITERATION THREE

WETLAND CENTRED COMMUNITIES

WETLANDS ARE DISPERSED TO LIE AT WATER PATH INTERSECTIONS WITH RANGE IN PERMANENT AND OCCASIONAL WETLANDS FOR GREATER VARIATION AND INCREASED WATER RETENTION CAPACITY

CIRCULATION

CRITICAL REFLECTION

Applying the wetlands along water channel intersections in an alternating pattern disperses the water retention capacity throughout the development. Using the wetlands as a central focus of the neighbourhoods within the development increases the awareness of the role of wetlands for flood management in the catchment. As each wetland has a relative neighbourhood associated to it, the neighbourhoods within the development have difference and a point of uniqueness throughout, not only creating heterogeneity within the social experience with the river space but also through the ecology.

Fig.8.7. (Left) Site design with permanent and occasional wetland typology implementation.

Fig.8.8. (Right) Circulation analysis of site design.

MASTERPLAN

OCCASIONAL WETLAND CENTRE
RESIDENTIAL TO DRY RECREATIONAL
OUTER

PERMANENT WETLAND CENTRE
RESIDENTIAL TO DRY RECREATIONAL
OUTER

PERMANENT WETLAND CENTRE
RESIDENTIAL TO STORMWATER
TREATMENT OUTER

01
REC. SPACE

02
REC. SPACE

03
REC. SPACE

STATE HIGHWAY

WAIKANAE RIVER

OCCASIONAL WETLAND CENTRE
RESIDENTIAL TO SEMI WET
RECREATIONAL OUTER

PERMANENT WETLAND CENTRE
RESIDENTIAL TO SEMI WET
RECREATIONAL OUTER

OCCASIONAL WETLAND CENTRE
RESIDENTIAL TO STORMWATER
TREATMENT OUTER

WAIKANAE RIVER . KAPITI
1:10,000

The masterplan is a schematic representation of how the sketch typologies can form a community of water centric neighbourhoods in a physical site. The design enhances flood management through the creation of the water plan prior to housing development plan where this will fit around the water paths rather the typically opposite approach. The Waikanae River has an off-flow channel to pass through the centre of the site and connect existing streams before re-entering the Waikanae River further downstream. The off-flow channel has a series of varied wetlands to increase ecological heterogeneity, enhance community engagement and increase flood management. The site results in four main areas of topographical variance. The highest level for housing development and the lower three for recreational areas for flood over flow. They are varied by the ecological situation created by their specific typical water state.

Fig.8.9. (Left) Developed design masterplan.

Fig.8.10. (Right) Model of design scheme over site topography.

COMMUNITY TYPOLOGIES

WATER CENTRIC COMMUNITIES

PERMANENT WETLAND CENTRE
RESIDENTIAL TO DRY RECREATIONAL
OUTER

OCCASIONAL WETLAND CENTRE
RESIDENTIAL TO DRY RECREATIONAL
OUTER

PERMANENT WETLAND CENTRE
RESIDENTIAL TO SEMI WET
RECREATIONAL OUTER

The concept plan has produced six unique neighbourhood communities with the combination of housing and a wetland which leads to one of three recreational spaces. Each recreational space leads to a permanent and an occasional wetland with their own neighbourhood development. Unique neighbourhoods give the development identity and encourage a community atmosphere through the urban environment. This strengthens peoples connection to the natural landscape and promotes a sense of custodianship over the landscape.

Fig.7.11. Wetland community typologies produced from masterplan.

IMPLEMENTATION

Implementing the concept design starts with deepening the existing channel between the two flat areas of the site and between the existing water body and stream. Creating an opening along the Waikanae River will create a steady flow long the stream which will act as an off flow stream for excess water in the Waikanae River. Creating spaces for wetland planting at stream and open corridor intersections will begin the wetland process to become permanent. Earthworks to lower the ground level of the lower end of the overflow flood plain with the cut ground to be placed on the upper half of the overflow flood plain and the opening of the lower end of the stopbank creates two levels of recreational space, one on higher ground for riparian and forest planting for more permanent recreational activities and the lower end to be a greater regular flood space to retain more floodwater. Lastly, the developments are implemented on the high ground centralised around the six wetlands with walkways and recreational opportunities allowing interaction between the living environments and the floodplain landscape.

Fig.8.11. Site adjustments for masterplan implementation.

01
HIGH GROUND RECREATIONAL SPACE
SOMETIMES WET

Fig.8.12. Recreational experience of High Ground Recreational Space.

Each planting variation provides new recreational opportunities which ecological engagement.

1 ECOLOGY + 3 SOCIAL

ECOLOGY TYPES

WATER LEVELS

PEOPLE USE

Fig.8.13. Experiential details of High Ground Recreational Space.

RECREATIONAL SPACE 01

The High Ground Recreational Space is focused primarily on ecology and the social relationship with the river. It is a last overflow space for flood water making it only sometimes wet. The space features forest and riparian planting which produces a range of recreational opportunities associated to the ecology. This makes the space a recreation hub for the community supporting a range of activities that encourage interaction with the natural environment. This includes forest trails, zip lines and adventure courses through dense forest, sports fields and market places within forest clearings, picnicking, nature play and playgrounds throughout dispersed forests and fishing, kayaking and paddle boarding through wetland and water bodies.

Fig.8.14. (Left) Recreational experience within High Ground Recreational Space.
Fig.8.15. (Inner Left) Location map of High Ground Recreational Space.

FLUCTUATING WETLAND RECREATIONAL SPACE
MOSTLY WET

Fig.8.16. Recreational experience of
Fluctuating Wetland Recreational Space.

3 SOCIAL + 2 FLOOD MANAGEMENT

ECOLOGY TYPES

WATER LEVELS

PEOPLE USE

Fig.8.17. Experiential details of Fluctuating Wetland Recreational Space.

RECREATIONAL SPACE 02

The Fluctuating Wetland Recreational Space is a large wetland area of varied surface levels to encourage variation in ecology, water flow, filtration and retention. This space is orientated around flood management and social interaction. The size of space gives it a large water retention capacity for during rainfall. This is achieved through creating multiple types of interaction with the varied wetland landscape. This is through a network of pathways which can be accessible through different water level conditions and play spaces which become flooded during flood events. The recreational space has a large flood management capacity which creates varied ecological spaces, these are then experienced differently resulting in a range of experiences with the changing water conditions.

Fig.8.18. (Left) Recreational experience within Fluctuating Wetland Recreational Space.

Fig.8.19. (Right) Location map of Fluctuating Wetland Recreational Space.

STORMWATER FILTRATION RECREATIONAL SPACE

03

ALWAYS WET

*Fig.8.20. Recreational experience of
Stormwater Filtration Recreational Space.*

ECOLOGY TYPES

WATER LEVELS

PEOPLE USE

Fig.8.21. Experiential details of Stormwater
Filtration Recreational Space.

RECREATIONAL SPACE 03

The Stormwater Filtration Recreational Space targets ecology and flood management. It sits on the South end of the site and collects the run off coming from the surrounding hills which accumulates on the former State Highway One. This water is retained, filtered and the flow is slowed before the body of water enters the site streams on its way to the river. This area uses natural water management processes to deal with the flood waters and create thriving ecological features of the landscape. Through the introduction of raised boardwalks and terraces the water filtration park can be utilised for recreational use without people coming into direct contact with the polluted water.

Fig.8.22. (Left) Recreational experience within Stormwater Filtration Recreational Space.

Fig.8.23. (Right) Location map of Stormwater Filtration Recreational Space.

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

The housing within the development is modelled off the urban plan design by Tredje Natur in Stockton. They feature medium density housing to create a tight community feel and offset the large amount of land devoted to recreational use (fig.8.24.). Through the reduction of a personal backyard from the typical development of the medium sized town, the outdoor space is devoted to a communal backyard. This means that land used as outdoor space can be utilised collectively for flood management, contributing to the local ecology and being a destination for people outside of the development to visit and enjoy (fig.8.25, fig.8.26.).

THIS CONTENT IS UNAVAILABLE
PLEASE VIEW PRINT VERSION TO
ACCESS

Fig.8.24. (Top) Precedent housing development plan by Tredje Natur.

Fig.8.25. (Middle) Spatial representation of inside housing development by Tredje Natur.

Fig.8.26. (Bottom) Second spatial representation of inside housing development by Tredje Natur.

SECONDARY STREET- RAIN GARDEN

TPOLOGY FIVE

MAIN STREET- RAIN GARDEN

TPOLOGY SIX

OFF-FLOW CORRIDOR- RAIN GARDEN

TPOLOGY SEVEN

RETENTION POND ROUNDABOUT

TPOLOGY EIGHT

1:2,500

Fig.8.27. Development housing plan

CONCLUSION

To further develop the design application, expanding the design extent further into the existing urban fabric would explore how this new concept for development along river edges relates and fits into the surrounding established urban environment. As the typologies were tested in conjunction with each other in a site context, the results and parameters to their site application was discovered. How these typologies could then be applied to an existing urban fabric and the experiential and flood prevention effects of these spaces in an existing urban fabric could be understood too.

Like the typology design, the preferred form of representation of the experience of the recreational spaces was through section perspective. This could communicate how the range of activities and experiences would fit into an overall experience of the space and how the recreational spaces related to the river and the urban environment. When designing at a larger scale for the full site iterations, the scale of site meant that sections did not express enough information nor did they explain how the design varied across intersecting axes. For these reasons a 3D approach by representing the site in axonometric was found to show the site plan in conjunction with the topographical changes. Applying the analysis overlay to the recreational spaces sections like the River Space in Site transects shows a comparison of the designed river spaces with the analysed existing river spaces. The absences of the river spaces categories under the section line shows how these spaces are no longer relevant in the new design as they create integrated river spaces the access, connection to exterior environments and flood management.

[8.]

Fig.8.28 . Waikanae River at Greenaway Road. (Same image as chapter cover)

[9.]

DISCUSSION

REFLECTION ON THE STUDY UNDERTAKEN

DISCUSSION

CONCLUSION

New Zealand has beautiful waterways within urban environments which are not able to be experienced due the current approach to flood protection. Stopbanks, as the investigated form of flood protection, create a separation of space within the flood plain, preventing people from engaging with the river and river space from the urban environment. They are harmful to the natural ecological processes of the river which is contributing to the rising hazard of flooding due to climate changes.

This research found that existing river spaces fail to be ecologically enhancing, naturally flood preventive and socially engaging. Spaces which lack in these areas prevent the flow of people from urban to river access. All spaces within the river urban margin need to support each other in this overall transition. The segregation between river space components is a major factor in the separation of the urban and river environments. The spaces need to be integrated through a spatial approach throughout the river space extents and into the urban fabric with flood protection distributed through a range of ecological elements.

DESIGN RESPONSE

Reduce flood hazard through distributed water management within the urban environment

The final design addresses the issue of flooding in the urban environment with an ecological approach through drawing from natural processes which considers all aspects of the watershed. For this reason, the design has not considered the river as a single constant element and floodwaters as another element which is only present periodically, instead it regards these elements as connected and part of an ongoing cyclic process of fluctuating water level in the watershed. This has been incorporated into the design of urban environments through allowance of water and water fluctuation where with designated areas that are allowed to flood and are enriched through this flooding. By allowing for more off-flow paths, and water retention zones, flood events become less hazardous to the urban environment and are a common occurrence rather than a catastrophic event.

Repair the disconnection between the urban environment and urban river

The disconnection between the urban environment and the water has been discovered to be due the separation of these two environments and separation of spaces within the transition space of these two environments. The design solution to this disconnection is through the creation of a social river space between the two environments. To ensure this space does not act in isolation to the two environments it intends to connect, the urban environment in the form of public access and interaction is extended into the river edges and the river space through the form of plant and water ecology is extended into the built environment. This creates a discrete transition between these environments so they form one interconnected urban river environment.

Reduce flood hazard through awareness and engagement

The design encourages fluctuating river processes to take place within the built environment. This means that people are more engaged and more aware of these processes. By being informed of the way water in the environment works, people gain the necessary knowledge to be better prepared and expectant of previously catastrophic events. Through combining changing natural conditions with recreational spaces people are able to experience their outdoor environment differently depending on different climatic and seasonal conditions. The natural environment is given the platform to grow, develop, and adapt and as a result, enriches the experience people have with the local natural water landscape.

METHOD REFLECTION

CONTEXT

The process undertaken has looked at the three examples within the context so that the differences between situations could be understood to better inform a design that was applicable to all situations. The designs were validated through their application and iteration when applied to one of the sites, however this would have been better improved by testing the practicality of the developed design through the other two sites. This would further improve the quality of design and of its application to site, however time did not permit this study to take place.

The limitation with the final design for implementation into other sites, is that it requires undeveloped space to be available. As the characteristics of the medium sized towns were that their development was pushing up next to the stopbank, the issues with the interaction of the urban fabric and the river are due to existing built conditions. This would be one setting in which the research would be valuable and could be developed further, however there was also reason for not pursuing this in the research.

As Waikanae presented a rural area along the river seeing development in time to come, other medium sized towns also have some spaces which are still being developed. Due to the context of the rural space existing in an interesting location of sitting between and existing urban riverside development and a recently undergone lifestyle development, the opportunity was taken to push a design with small spatial parameters where the link between these two urban fabrics could be explored. This link as to how this new type of design would fit into the existing was an area which the research intended to extend into however going into this area showed that these connections are very complex and would extend into a whole new area of study which this study did not have the capacity for.

SCALES

The initial river space investigation looked at the three spaces of the river side flood plain, the stopbank and the urban side flood plain as the main components of the river space however this was found to be too isolated from the urban environment. The process then included another space, the urban environment, to allow the investigation to understand the relationship of the river space to urban environment. Due to the difference in the types and size of these spaces, the urban environment analysis required a change in scale to be broader to understand the effect of the river to the wider environment fabric.

After reflecting on the results of the compiled analysis, it was found that a link between the urban environment and the river which reflects the personal experience on the ground was still missing from the analysis. This led to the additional two transition spaces of the transition from the urban environment to the river space and the transition from the river space to the river. This allowed the access points and entrances to have relevance to the investigation where this did not fit into either one of the spaces either side. This also allowed for the river space analysis to link and be connected to the river in which the investigation was looking into. These spaces were at a close personal scale which gave the analysis a rounded multi-scaled approach to take into consideration influences from a range of contextual factors.

Fig.9.1. Process diagram of forming River Spaces.

FORWARD

URBAN FABRICS

The design scope for this research focuses on repairing the transition space of existing urban fabric and the river a whole space due to the connectedness of the elements within. This research is built on the basis that it is not feasible, cost effective or structurally practical to remove existing stopbanks within these contexts. For this reason, incorporating these structures into a smooth transition from urban to river space presents a new design opportunity. In order to develop this research further would be through the continuation of the design development of the transition over and through existing stopbanks infrastructure at a closer scale than investigated in this work.

DEVELOPMENTS

To further this research, the next stage of consideration would be considering the urban design of towns with urban waterways. This research has investigated the space within the urban environment and the river with consideration to the edges of each of these spaces, however the urban planning and urban design also have a huge contributing factor to the connection of the urban environment to the river space. As discovered through the urban section of the rivers spaces investigation, this is through the housing orientation, road connectivity, property sizes and location of recreational spaces in relation to the river space. Continuing this study into the design phase looking at how to create a presence for the river and connection to the river through urban design would be the next phase in pushing this research further.

FLOODWATER CAPACITY

The capacity or level of protection of infrastructure is typically referred to as the protection against a 1 in so many years (10, 50, 100 or 400/500) which describes the flood the scheme will protect against and the annual chance of occurrence of the flood. These terms have not been used to describe the design outcomes throughout this study. This is because the site analysis and the design schemes have focused on creating spaces which incorporate social use and ecological engagement into spaces that increase flood protection. They are spaces which can be applied to different contexts, settings and in different scales. The level of flood protection they provide will depend on their site application and for a technical layer to be applied to their implementation. This would be a next step in further developing the developed design of this study to further validate and test the effectivity of the design schemes.

REPRESENTATION

The representation methods throughout the research sought to express spatial qualities from being within spaces in site. Which was through the form of site photograph, section perspective spatial expressions and axonometric diagramming. However, these heavily relied on annotation to assist with the photos to bring to attention to the viewer to connect site elements and their effects to the experience as well as linking individual site photos to a series of typologies and categories. Through testing of expressing site elements, it was discovered early on in the research that 3D drawings were necessary to inform a spatial experience and so this was continued in various forms depending on the scale and drawing intention, throughout the research.

Taking the exploration into the drawings forms of 3D representation could have also helped to develop the areas of design which were left unexplored. This is through the use of digital 3D modelling of the site and design which would not only give a clearer representation of the changes to site that form the design but also could be connected to water flow simulation data to accurately test the flood effects within the site. Testing the design through this software could have added another level of design iterations to the research to further uncover technical information about the application of the design typologies.

Although the form of representation was considered to be important to the research throughout, it was considered in terms of how to best communicate and reflect the design ideas. It was not until after the research had concluded and the design outcomes were being reflected on that it was realised that the representation methods could have held more of a design experimental role in the research which could have further develop both areas of research for a more refined outcome.

C, Balderas Guzman, Nepf. H and Berge. A. "design guidelines for urban stormwater wetlands." Report. MIT, 2018.

Descombes Rampini, A. Renaturation of the Aire River. 30 June 2016. 8 August 2018. <<http://www.superpositions.ch/>>.

Doi, Hideyuki, et al. "Effects of Biodiversity, Habitat Structure and Water Quality on Recreational Use of Rivers." *Ecosphere* 4.8 (2013): 1-11.

Folke, Carl. Don't Fence Me In. n.d. 11 April 2018. <<https://www.stockholmresilience.org/research/research-news/2015-10-07-dont-fence-me-in.html>>.

Greater Wellington Regional council. Collaborative Approach to Flood Protection in Masterton. 19 June 2015. Announcement . 5 February 2019. <<http://www.gw.govt.nz/collaborative-approach-to-flood-protection-in-masterton>>.

Havrankova, Tereza. "The Potential of River in Urban Spaces." *European Scientific Journal* 2 (2014): 414.

J, Ahern, Brown B and Novotny V. Water Centric Sustainable Communities; Planning, Retrofitting, and Building the Next Urban Environment. Hobokwn, 2010.

Johnson, P and P Gerbeaux. Wetland Types in New Zealand. Wellington: Department of Conservation, 2004.

Knight, C. New Zealand's Rivers; An Environmental History. Christchurch: Canterbury University Press, 2016.

Kondold. G, Pinto. P. "The Social Connectivity of Urban Rivers." *Geomorphology* (2016): 182-196. Document.

L, Batty. "Wetland Plants- More Than Just a Pretty Face?" *Land Contamination & Reclamation* 11.2 (2003): 173-180.

Larkham, P, K Moore and A Nikologianni. "Introducing Alternative Project Frameworks Through Landscape Design." IFLA World Congress 2018. 2018Singapore. 583-593.

LAWA. Waipoua River at Colombo Road Bridge. n.d. Web Page. 5 February 2019. <<https://www.lawa.org.nz/explore-data/wellington-region/river-quality/ruamahanga/waipoua-river-at-colombo-rd-bridge/>>.

Lister, Nina-Marie E. "Large Parks." Czerniak. J, Hargreaves. G. Large Parks. New York: Princeton Architectural Press, 2007. 35-58.

Lister, Nina-Marie E. "Resilience Beyond Rhetoric in Urban Landscape Planning and Design." *Nature and Cities: The Ecological Imperative in Urban Design and Planning*. Lincoln Institute of Land Policy, 2006. 303-325.

LOLA Landscape Architects. Dutch Dikes. Rotterdam: nai010, 2014.

Mathur, Anuradha, Dilip Da Cuna and Walter Hood. Design in the terrain of water. Applied Research + Design Publishing, 2014.

Melbourne Water. WSUD Engineering Procedures; Stormwater. Collingwood: CSIRO Publishing, 2005.

N, Bishop. From The Mountains to The Sea; The Secret Life of New Zealand's Rivers and Wetlands. Auckland: Reed Books, 1994.

BIBLIOGRAPHY

National Research Council. Dam and Levee Safety and Community Resilience: A Vision for Future Practice. Washington DC: The National Academies Press, 2012.

Prominski. M, Stimberg. D, Stokman. A, Voermanek. H, Zeller. S. River Space Design. German National Library, 2012.

R, Kaur. Milk and Honey. Kansas City: Andrews McMeel Publishing, 2017.

Rangitaiki Scheme Review Panel. Rangitaiki River Scheme Review- April 2017 Flood Event. River Scheme Review. Bay of Plenty, 2017.

Rijkswaterstaat. Room for the River for a safer and more attractive river landscape. n.d. 24 January 2019. <<https://www.ruimtevoorderrivier.nl/english/>>.

Rouse, H. Flood Risk Management Research in New Zealand: Where and are we, and where are we going? GNS Science Report. NIWA. Christchurch, 2012.

S. Carpenter, W. Brock, C. Folke, E. van Nes, M. Scheffer. "Allowing Variance My Enlarge the Safe Operating Space for Exploited Ecosystems." PNAS (2015): 14384-14389.

Sills, George. "Levee Design and Emergency Response." Fire Engineering; Tulsa 159.5 (2006): 63-64.

Stats. NZ. Wetland Extent. 19 April 2018. Website. 12 February 2019. <http://archive.stats.govt.nz/browse_for_stats/environment/environmental-reporting-series/environmental-indicators/Home/Fresh%20water/wetland-extent/wetland-extent-archived-19-04-2018.aspx>.

Taranaki Regional Council. Lower Waiwhakaiho Flood Scheme Asset Management Plan. Asset Management Plan . New Plymouth: Taranaki Regional Council, 2014. Report.

Waiwhakaiho River. n.d. Web page. 31 January 2019. <<https://www.lawa.org.nz/explore-data/taranaki-region/river-quality/waiwhakaiho-river/>>.

Wellington Regional Council. Waikanae Floodplain Management Plan. Managment Plan. Wellington: Publishing Solutions, 2003.

Wolff, Jane. "Cultural Landscapes and Dynamic Ecologies: Lessons from New Orleans." Lister, Nina-Marie and Chris Reed. Projective Ecologies. Harvard University Graduate School of Design , 2014. 184-203.

Wurth, Albert. "Why Aren't All Engineers Ecologists?" Schulze, Peter. Engineering Within Ecological Constraints. Washington: National Academy Press, 1996. 129-138.

All figures not attributed are authors own

Figure 1.3. Dutch water landscape.

Reference: Sellenraad, Dick. Aeroview, the Netherlands. 2013. The New York Times. Web. <<https://www.nytimes.com/2013/02/17/arts/design/flood-control-in-the-netherlands-now-allows-sea-water-in.html>> 24 January 2019

Figure 1.4. Sea stopbank in the Netherlands.

Reference: The Netherlands and Water. 2012. I Am Expat. Web. <<http://kraft1atomo.blogspot.com/2012/03/netherlands-water.html?view=classic>> 24 January 2019.

Figure 1.5. Diagram examples of the multilayered Dutch stopbank systems.

Reference: LOLA. Dutch Dikes Group Sea Dike. 2014. NAI010 Uitgeners. Dutch Dikes. Book. 24 January 2019.

Figure 1.8 Hurricane Katrina flooding effects on New Orleans.

Reference: Hurricane Flooding Pictures. 2005. Web. < <http://thegolfclub.info/related/hurricane-flooding-pictures.html>> 30 July 2018

Figure 3.1. Ariel of the River Aire Renaturation.

Reference: Chironi, Fabio. Views from the Sky. Group Superpositions. Web. <<http://superpositions.ch/extras/vol-en-drone.html>> 1 August 2018

Figure 3.2. a, b, c and d, Structural facilitation of people experiencing the River Aire.

Reference: Superpositions. Uses. Group Superpositions. Web. <<http://superpositions.ch/extras/photos-des-usagers.html>> 1 August 2018

Figure 3.3. Stages through time of the River Aire.

Reference: Berthet, Jacques. Pictures of the Initial State. Group Superpositions. Web. <<http://superpositions.ch/extras/photos-de-letat-initial.html>> 1 August 2018

Figure 3.4. Waal off flow bypass channel design.

Reference: N+H+S Landscape Architects. Design Plan. 2012. N+H+S Landscape Architects. < <http://www.hnsland.nl/en/projects/room-river-nijmegen>> Web. 1 August 2018.

Figure 3.5. Flood levels of the River Waal at Nijmegen.

Reference: N+H+S Landscape Architects. Water Level days/year. 2012. N+H+S Landscape Architects. Web. < <http://www.hnsland.nl/en/projects/room-river-nijmegen>> Web. 1 August 2018.

Figure 3.6. a, b, c, and d, Waal River site.

Reference a, b and d: N+H+S Landscape Architects. The Quay. 2012. N+H+S Landscape Architects. Web. < <http://www.hnsland.nl/en/projects/room-river-nijmegen>> Web. 1 August 2018.

Reference c: NEXT Architects. Citadelbrug. 2012. N+H+S Landscape Architects. Web. < <http://www.hnsland.nl/en/projects/room-river-nijmegen>> Web. 1 August 2018.

Figure 3.7. Recreational spaces created from urban stormwater wetland modules.

Reference: Susskind, Jonah. Diagrammatic Plan. 2018. Design Guidelines for Urban Stormwater Wetlands. Report. 4 September 2018.

LIST OF FIGURES

Figure 3.8. Water level variation throughout recreational spaces.

Reference: Balderas Guzman, Celina. Matrix of Programming Opportunities. 2018. Design Guidelines for Urban Stormwater Wetlands. Report. 4 September 2018.

Figure 3.9. Stormwater wetland module.

Reference: Swingle, Tyler. Wetland Islands. 2018. Design Guidelines for Urban Stormwater Wetlands. Report. 4 September 2018.

Figure 3.10. Flow path testing of stormwater wetland modules.

Reference: Swingle, Tyler. Diagram of Circulation Patterns in Plan View. 2018. Design Guidelines for Urban Stormwater Wetlands. Report. 4 September 2018.

Figure 3.11. Recreational activity within stormwater wetland.

Reference: Susskind, Jonah. Rendering of Houston Wetland Channel. 2018. Design Guidelines for Urban Stormwater Wetlands. Report. 4 September 2018.

Figure 8.24. Precedent housing development plan by Tredje Natur.

Reference: Tredje Natur. Urban Planen5. 2016 Tredje Natur. Web. < <https://www.tredjenatur.dk/portfolio/urbanplanen-etape-2/>> 27 November 2018.

Figure 8.25. Spatial representation of inside housing development by Tredje Natur.

Reference: Tredje Natur. Urban Planen Low. 2016 Tredje Natur. Web. < <https://www.tredjenatur.dk/portfolio/urbanplanen-etape-2/>> 27 November 2018.

Figure 8.26. Second spatial representation of inside housing development by Tredje Natur.

Reference: Tredje Natur. Urban Planen 10. 2016 Tredje Natur. < <https://www.tredjenatur.dk/portfolio/urbanplanen-etape-2/>> Web. 27 November 2018.